LOWER FOX RIVER BASELINE MONITORING PLAN

June 23, 2006

EPA Region 5 Records Ctr.
361405

Prepared for:

Fort James Operating Company, Inc.
NCR Corporation

For Submittal to:

Wisconsin Department of Natural Resources
U.S. Environmental Protection Agency

Prepared by:

Shaw® Shaw Environmental, Inc.

Shaw Environmental & Infrastructure, Inc.

and

ANCHOR ENVIRONMENTAL, L.L.C.

Anchor Environmental, L.L.C.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGIONS 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
SR-6J

July 24, 2006

Mr. George L. Hicks
Regional Director, Ports, Harbors and Waterways
Shaw Environmental and Infrastructure, Inc.
444 North Wells Street, Suite 602
Chicago, IL 60610

Dear Mr.Hicks,

Pursuant to the Administrative Order on Consent relating to the Lower Fox River and Green Bay Site (Docket No. V-W-04-C-781), the *Lower Fox River Baseline Monitoring Plan (Including Sampling and Analysis Plan/Quality Assurance Project Plan and Health and Safety Plan)* submitted on behalf of Respondents Fort James Operating Company, Inc., and NCR Corporation, dated June 23, 2006, is hereby approved.

It should be noted that, consistent with our ongoing collaborative process, during implementation of this Baseline Monitoring Plan and QAPP or upon review of its results, if it is determined that modifications are necessary, these will be documented for this sampling round and incorporated into the final Long-term Monitoring Plan and QAPP.

If you have any questions, or wish to discuss this further, please contact me at (312) 353-4213. Thank you.

Sincerely yours,

James J. Hahnenberg, EPA Project Coordinator
Superfund Division

cc: Richard Murawski, Office of Regional Counsel
Greg Hill, WDNR
Richard Moser, Georgia Pacific Corporation
Roger McCready, NCR Corporation
Clay Patmont, Anchor Environmental, L.L.C.

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LOWER FOX RIVER BASELINE MONITORING PLAN
(Including Sampling and Analysis Plan/Quality Assurance Project Plan and Health and Safety Plan)

Prepared by:

Shaw Environmental & Infrastructure, Inc. and Anchor Environmental, LLC

Approved by:

James J. Hahnenberg 7/24/06

USEPA Project Coordinator — Date
James Hahnenberg

WDNR Project Coordinator — Date
Gregory Hill

for W. Layne 7/24/06

USEPA QA Reviewer — Date
Warren Layne

Respondent Project Coordinator — Date
George L. Hicks

Respondent Project Manager — Date
Todd Thornburg

Severn Trent Laboratories, Inc. — Date
John D. Reynolds

Pace Analytical — Date
Tod Noltemeyer

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Acronyms and Abbreviations

Anchor	Anchor Environmental, L.L.C.
AOC	Administrative Order on Consent
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BOD_5	biochemical oxygen demand
CERLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	contract laboratory program
cm	centimeter
COC	chain-of-custody
CPT	cone penetration testing
CQAP	Construction Quality Assurance Plan
CST	column settling test
CU	consolidated-undrained
CV	coefficient of variation
DOC	dissolved organic carbon
DGPS	differential global positioning system
DQO	data quality objective
DRET	dredging elutriate test
EDD	electronic data deliverables
EIMS	environmental information management system
FRG	Fox River Group
FCR	field change request
Fort James	Fort James Operating Company, Inc.
FTL	field team leader
GIS	geographic information system
HSP	health and safety plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
high-res	high-resolution
I-DW	investigation-derived waste
LCS	laboratory control sample
LIMS	laboratory information management system

Acronyms and Abbreviations (continued)

LOD	level of detection
LOQ	level of quantitation
LTMP	Long Term Monitoring Plan
MDL	method detection limit
MET	modified elutriate test
mg/L	milligrams per liter
MDRD	Minimum Detectable Relative Difference
MS	matrix spike
MSD	matrix spike duplicate
NAD	North American Datum
NAVD	North American Vertical Datum
NCP	National Contingency Plan
NCR	NCR Corporation
OMMP	Operations, Maintenance, and Monitoring Plan
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCB	polychlorinated biphenyl
PCLT	pancake column leach test
PM	project manager
PPE	personal protective equipment
ppm	part per million
QA	quality assurance
QAM	quality assurance manager
QAP	quality assurance plan
QAPP	quality assurance project plan
QC	quality control
QL A	Quality Level A
QL B	Quality Level B
QL C	Quality Level C
QL D	Quality Level D
RAL	remedial action level

Acronyms and Abbreviations (continued)

RAO	Remedial Action Objective
RD	Remedial Design
RG	Remedial Goals
ROD	Record of Decision
RPD	relative percent difference
SAP	sampling and analysis plan
RM	river mile
SDG	sample delivery group
Shaw	Shaw Environmental and Infrastructure, Inc.
SIC	seepage-induced consolidation
SOP	standard operating procedure
SOW	statement of work
SPT	standard penetration testing
STL	Severn Trent Laboratories, Inc.
SUE	subsurface utility engineering
SWAC	surface-weighted average concentration
TBA	to be determined
TOC	total organic carbon
TSCA	Toxic Substances Control Act
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources
WSLH	Wisconsin State Lab of Hygiene

1.0 Project Management and Objectives

1.1 Introduction

The Lower Fox River extends 39 miles from the outlet of Lake Winnebago over a series of locks and dams to the mouth of the river where it discharges into Green Bay (Figure 1-1). The Lower Fox River is the most industrialized river in Wisconsin; since the early 1900s, water quality has been degraded by expanding industries and communities discharging sewage and industrial wastes into the river. Polychlorinated biphenyls (PCBs) were discovered in the Lower Fox River in the 1970s. Due to their persistence in the environment, PCBs remain the focus of current remedial design efforts.

This Baseline Monitoring Plan (BMP) describes the sampling and analytical tasks necessary to characterize water and fish tissue quality in the Lower Fox River and Green Bay (the Site) prior to initiation of full-scale sediment remediation. Data collected under this effort are intended to serve as a baseline to monitor future progress toward achieving agency-established Remedial Action Objectives (RAOs) for the Site. A coordinated baseline monitoring program will be implemented throughout the entire Site, inclusive of Operable Units (OUs) 1 through 5, although remedial design and remedial action are being addressed separately by two groups of Respondents in different parts of the Site.

The requirements for remedial design (RD) in OU 2-5 are set forth in the Administrative Order on Consent (AOC) and associated Statement of Work for OU 2-5 executed in March 2004 by Fort James Operating Company, Inc. and NCR Corporation (collectively the "OU 2-5 Respondents") in cooperation with the Wisconsin Department of Natural Resources and the U.S. Environmental Protection Agency (collectively the "Response Agencies"). Remedial design and remedial action in OU 1 are being addressed under separate agreements between the Response Agencies and the WTM1 Company and P.H. Glatfelter Co. (collectively the "OU 1 Respondents").

Dredging of approximately 80,000 cubic yards (cy) of sediments containing roughly 240 kilograms (kg) of PCBs occurred within the upper reaches of OU 1 in 2005, and additional dredging will be performed in 2006. A Phase I removal action within the upstream reach of OU 4, targeting removal of approximately 140,000 cy of sediments containing roughly 6,000 kg of PCBs, is scheduled to occur between May and October 2007. Further staged remedial actions throughout the Site (i.e., generally proceeding from upstream areas of OU 1 to the mouth of the Lower Fox River at the OU 4/OU 5 boundary) will likely occur over the next 10 to 15 years.

1.2 Project Organization

This section describes the Project Management Plan for baseline monitoring activities, including:

- Project organization, responsibilities, and authorities
- Communications

Lines of communication during project activities will follow the project team structure presented in the organization chart on Figure 1-2.

The preparation and implementation of this Baseline Monitoring Plan is being jointly managed by Shaw Environmental and Infrastructure, Inc. (Shaw) and Anchor Environmental, LLC (Anchor), on behalf of Fort James Operating Company and NCR. Project team responsibilities and authorities are outlined below.

Fort James and NCR have jointly entered into the Lower Fox River OUs 2-5 Administrative Order on Consent (AOC) and as such are responsible for the preparation of the Lower Fox River OUs 2-5 Remedial Design (RD) documents. In addition, Fort James and NCR have agreed to prepare this Baseline Monitoring Plan to ensure it is closely coordinated with other RD activities, in particular, the Long-Term Monitoring Plan which will be submitted as part of the 60 Percent Design documents.

Responsibilities of key Shaw/Anchor personnel and subcontractors are summarized below.

1.2.1 Shaw/Anchor Team

1.2.1.1 Project Coordinator

George L. Hicks Office: 312-499-3509 Cell: 812-946-1669

Mr. Hicks' duties include:

- Administration and management of Remedial Design (RD) activities, including schedule and budget control
- Authorization and coordination of subcontractors
- Authority to stop work based on quality control issues, health and safety issues, or other deficiencies that may compromise the integrity of the Baseline Monitoring Program
- Facilitate coordination of document production with the Shaw/Anchor Team, laboratories, and other sub-contracted personnel

- Communication with USEPA and WDNR on an ongoing basis regarding project status, problems encountered and recommended solutions, deviations from scope of work, and other related issues
- Prepare and submit progress reports

1.2.1.2 Technical Director

Clay Patmont Office: 206-903-3324 Cell: 206-300-1543

Mr. Patmont's duties include:

- Management of scientific and engineering aspects of remedial design
- Strategic advisor for design and implementation of the baseline monitoring program
- Provide overall direction and management of field and laboratory activities according to this Baseline Monitoring Plan
- Coordination of key technical issues with Respondent and Response Agency Teams

1.2.1.3 Baseline Monitoring Project Manager

Todd Thornburg, Ph.D. Office: 503-670-1108 x18 Cell: 503-819-0277

Dr. Thornburg's duties include:

- Co-Chair (Respondent Lead), Long-Term Monitoring Work Group
- Coordination and trouble-shooting of field activities, including recommendations for scope modifications as needed based on field conditions
- Review and assessment of corrective action procedures in consultation with Project Coordinator and Technical Director
- Coordination of water and fish tissue data analysis
- Managing preparation of the Baseline Monitoring Plan and Reports

1.2.1.4 Field Quality Assurance Manager

Ben Hung Office: 503-670-1108 x21

Mr. Hung's duties include:

- Auditing of field activities to ensure compliance with BMP requirements

- Review of all documentation of field activities and modifications to ensure completeness and compliance with BMP requirements
- Reporting of deficiencies in field procedures or documentation to Project Manager to initiate development of corrective action procedures

1.2.1.5 Analytical Quality Assurance Manager

Eddie Weaver Office: 865-560-5274

Mr. Weaver's duties include:

- Direct the review of quality assurance plans and procedures
- Schedule and coordinate the analytical laboratories and data validators
- Oversee the tracking of samples and data from the time of field collection until results are entered into a database
- Review laboratory data for compliance with Baseline Monitoring Plan requirements

1.2.1.6 Baseline Monitoring Field Supervisors

Water Sampling Supervisor: *Scott Janssen (Foth and van Dyke)* Office: (920) 497-2500

Fish Sampling Supervisor: *Walter Klock (Shaw)* Office: 716-871-2066

Lead Fish Biologist: *TBD (Anchor)* Office: 000-000-0000

The duties of the Field Supervisors include:

- On-site coordination and direction of field activities and staff
- Coordination of field and laboratory schedules
- Ensure that field activities are conducted in accordance with this Baseline Monitoring Plan and HSP
- Communicate field conditions and progress, problems encountered and recommended scope modifications, if needed, to the project team
- Oversee sampling subcontractors

The duties of the Lead Fish Biologist include:

- Review fish catch and select specimens for chemical analysis and archiving

- Group fish into compositing classes based on sampling location and size
- Oversee field processing of fish tissue samples

1.2.1.7 Corporate Health and Safety Manager

Clifford Florczak Office: 630-771-9205

- Remote supervision of field activities to ensure adherence to the HSP
- Final authority on HSP issues and approval of significant modifications to HSP, if needed, based on changed field conditions

1.2.1.8 Other Key Personnel

- *John Wolfe, Ph.D.*, LTI (Sampling Design, Data Analysis); Office: 734-332-1200
- *Sarah Signiski*, Shaw (GIS Manager); Office: 913-317-3589

1.2.2 Subconsultants/Subcontractors

Key sub-consultants and sub-contractors to the Shaw/Anchor team are listed below.

1.2.2.1 Analytical Laboratory Project Managers

Tod Noltemeyer, Pace Analytical; Office: 608-232-3300 ext. 302

John D. Reynolds, Severn Trent Laboratories, Inc.; Office: 865-291-3000

The duties of the analytical laboratory project managers include:

- Oversee laboratory QA/QC requirements for the project
- Provide technical guidance to Shaw/Anchor team
- Review laboratory data for compliance with BMP requirements

1.2.2.2 Laboratory Quality Assurance Managers

Julie Trivedi, Pace Analytical; Office: 920-469-2436

Dr. Christopher Rigell, Severn Trent Laboratories; Office: 865-291-3000

The duties of the laboratory quality assurance managers include:

- Evaluate compliance with laboratory standards of practice and ensure that systems are in place to provide QA/QC as defined in this Baseline Monitoring Plan
- Initiate and oversee audits of corrective action procedures
- Perform laboratory data quality reviews

- Maintain laboratory documentation

1.2.2.3 Independent Data Quality Validator

Marcia Kuehl Office: 920-469-9113

- Independent third-party validation of at least 10 percent of analytical data
- Evaluate compliance with laboratory QA/QC criteria as defined in this Baseline Monitoring Plan
- Qualification of analytical data as needed to identify noncompliance with QA/QC criteria, and acceptability of data to fulfill project objectives

1.2.3 Oversight Agencies – General Responsibilities

USEPA and WDNR and their consultants will observe, review, offer technical assistance, and comment throughout the Baseline Monitoring program, and USEPA and WDNR have sole approval authority over any modifications to the program. Other federal agencies have provided expertise and input to the BMP, including US Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), and US Fish and Wildlife Service (USFWS). The latter agencies have clarified that their participation does not imply agreement or endorsement of any aspects of the plan. Roles and responsibilities of WDNR and USEPA personnel, as well as the technical consultants hired to assist the agencies in their review, are identified in Sections 1.2.4 and 1.2.5, respectively.

1.2.4 Wisconsin Department of Natural Resources (WDNR) Team

1.2.4.1 Project Coordinator

Gregory Hill Office: 608-267-9352

- Review all project deliverables, plans, and project strategies
- Ensure Baseline Monitoring Plan meets the requirements of the ROD, and assist Respondent Team and WDNR staff in interpreting the intent of the ROD
- Final review and approval of the Baseline Monitoring Plan
- Ongoing communication with Respondent Team Project Coordinator (Hicks), Technical Director (Patmont), and Project Manager (Thornburg)

1.2.4.2 Project Manager

Steve Jaeger Office: 608-267-7657

- Co-Chair (Agency Lead), Long-Term Monitoring Work Group

- Assist with review of the Baseline Monitoring Plan
- Coordination of technical resources for WDNR and its consultants, and application of these resources to help support the design and implementation of the Baseline Monitoring Plan
- Scheduling and management of WDNR reviews and approvals
- Assist WDNR Project Coordinator with project administrative duties
- Review progress reports detailing work accomplished

1.2.4.3 Quality Assurance Manager

Donalea Dinsmore Office: 608-266-1552

- Review Baseline Monitoring Plan for technical accuracy and completeness
- Provide technical assistance to the WDNR Project Manager and Project Coordinator

1.2.4.4 Other Key Personnel

Other key personnel:

- Jim Killian, WDNR; Office: 608-264-6123
- Rick Fox and Jennifer Kahler, Natural Resource Technology (Oversight Team Contractor); Office: (262) 523-9000
- John Kern, Kern Statistical Services (Oversight Team Contractor); Office: 320-230-5785
- Kevin Kapuscinski, WDNR (Fish Biology and Sampling Methods); Office: 920-662-5480
- Candy Schrank, WDNR (Fish Consumption Advisory Program); Office: 608-267-7614
- Gary Kincaid, WDNR (Green Bay Project Manager); Office: 920-448-5136

1.2.5 U.S. Environmental Protection Agency (EPA) Team

Responsibilities and authorities for the EPA are outlined below.

1.2.5.1 Remedial Project Manager

Jim Hahnenberg Office: 312-353-4213

- Review all project deliverables, plans, and project strategies

- Ensure Baseline Monitoring Plan meets the requirements of the ROD, and assist Respondent Team and Agency staff in interpreting the intent of the ROD
- Final review and approval of the Baseline Monitoring Plan
- Ongoing communication with Respondent Team Project Coordinator (Hicks), Technical Director (Patmont), and Project Manager (Thornburg)

1.2.5.2 Quality Assurance Manager

Warren Layne Office: 312-886-7336

- Review Baseline Monitoring Plan for technical accuracy and completeness
- Provide technical assistance to the EPA Project Coordinator

1.2.5.3 Other Key USEPA and Federal Agency Personnel

- Steve Westenbroek and Peter Hughes, USGS; 608-821-3888 and 608-821-3833 respectively
- James Chapman, USEPA; 312-886-7195
- Ken Stromborg and Collette Charbonneau, USFWS; 920-866-1733 and 920-866-1726, respectively
- Todd Goeks and Jay Field, NOAA; 312-886-7527 and 206-526-6404, respectively.

1.3 Communication Plan

1.3.1 Monthly Progress Reports

As required by the AOC, the Respondent Team's Project Coordinator will provide written monthly progress reports to the Response Agencies by the tenth day of every month. These progress reports will describe the status of baseline monitoring activities.

1.3.2 Semimonthly Meetings

As required by the AOC, the Project Coordinators will hold progress report meetings or telephone conferences twice a month unless it is deemed unnecessary by the Response Agencies. Briefings on the status of baseline monitoring activities and preliminary results, as available, will be provided during the meetings.

1.3.3 Long-Term Monitoring Work Group

In an effort to develop mutually acceptable and implementable baseline and long-term monitoring programs that are consistent with the intent of the ROD, representatives from the Respondent Team and the Response Agencies have formed the Long-Term Monitoring Work

Group. The Long-Term Monitoring Work Group has held various meetings and conference calls beginning in October 2004 to discuss monitoring objectives, field and analytical methods, and data evaluation tools and techniques. These discussions have been instrumental in developing the scope of work for this Baseline Monitoring Plan. Draft notes from these meetings will be maintained in the Response Agency project files, although the notes have not been approved by all parties involved. The Long-Term Monitoring Work Group will continue to meet on a mutually agreeable schedule as needed. It is anticipated that future meetings will be held to discuss the following:

- Water and fish tissue analytical results as they become available
- Adaptive management of field sampling, laboratory analytical and data validation procedures
- Development of the scope of the Long-Term Monitoring Plan, to be submitted as part of the 60 Percent Design documents

1.3.4 Electronic Data Transmittal

Technical documents, reports, data, comments, schedules, meeting notices and general project communications related to baseline monitoring activities will be distributed electronically to the following:

- James Hahnenberg, EPA – hahnenberg.james@epamail.epa.gov
- Gregory Hill, WDNR – hillg@dnr.state.wi.us
- Steve Jaeger, WDNR – steve.jaeger@dnr.state.wi.us
- James Killian, WDNR – james.killian@dnr.state.wi.us
- Gary Kincaid, WDNR – gary.kincaid@dnr.state.wa.us
- Boldt Technical Services, Oversight Contractor – lfr.oversightteam.boldt.com

Documents that are too large to send via email may be posted on a shared access website. In such cases, an e-mail notification will be sent to the same addresses with information on how to access those documents.

Electronic copies (CD-ROM) of laboratory analytical data packages (pdf format) will be provided to the agency oversight team upon receipt from the laboratory.

1.3.5 Hard Copy Data Transmittal

For documents requiring hard copy distribution, one copy will be sent to each of the following Response Agency personnel:

- James Hahnenberg, EPA Project Coordinator, United States Environmental Protection Agency, 77 West Jackson Blvd. (SR-6J) Chicago, Illinois 60604-3590

- Gregory Hill, WDNR Project Coordinator, Wisconsin Department of Natural Resources, 101 S. Webster St., Madison, WI 53703
- Steve Jaeger, WDNR Project Manager, Wisconsin Department of Natural Resources, 101 S. Webster St., Madison, WI 53703
- James Killian, WDNR Project Manager, Wisconsin Department of Natural Resources, 101 S. Webster St., Madison, WI 53703
- Gary Kincaid, Wisconsin Department of Natural Resources, 801 E. Walnut St., Green Bay, WI 54301
- Richard Johnson, Oversight Team Manager, Boldt Technical Services, 2525 N Roemer Rd., Appleton, WI 54912
- Richard G. Fox, Oversight Team Baseline Monitoring Lead, Natural Resource Technology, 23713 W Paul Road, Suite D, Pewaukee, WI 53072
- Todd Goeks, NOAA, SR-6J, 77 West Jackson Blvd, Chicago, IL 60604
- Ken Stromborg, USFWS, 2661 Scott Tower Dr., New Franken, WI 54229
- Steve Westenbroek, USGS, Wisconsin District Office, 8205 Research Way, Middleton, WI 53562

1.3.6 Notification Procedures

Requirements for progress reports and communications with WDNR and USEPA are detailed in the AOC. Monthly progress reports are to be submitted to the WDNR and USEPA Project Coordinators (see Section 1.3.1). Conference calls or meetings are to take place between the WDNR, USEPA, Oversight Contractor (TBD), G-P, NCR, Shaw Project Coordinator, and Anchor Technical Director twice a month (see Section 1.3.2). At least 15 days of notice shall be given to the WDNR and USEPA Project Coordinators prior to beginning sampling.

1.3.7 Modifications to the Baseline Monitoring Plan

The anticipated project design is presented in this Baseline Monitoring Plan. If necessary, recommended modifications to the project design will be provided to USEPA and WDNR for review and approval via revisions to this Baseline Monitoring Plan or as an Addendum to the Baseline Monitoring Plan. Modifications that will require USEPA and WDNR approval include the following:

- Major changes/revisions to the project design
- Major changes/revisions to the sampling or analytical methods
- Changes to project personnel

Such modifications may be required as a result of unexpected field conditions or obstructions, inclement weather, or changes in the project design that may result from ongoing discussions of the Long-Term Monitoring Work Group. Changes to project personnel may occur as a result of unforeseen conditions.

In addition, the media and monitoring parameters described in this BMP are premised on anticipated amendments to the ROD, as discussed in the Long-Term Monitoring Work Group and currently in process. Depending on the scope of the final ROD Amendment, modifications to this BMP could potentially be required.

1.4 Problem Definition

1.4.1 Problem Statement

Data collected during the remedial investigation/feasibility study and related investigations were used to define Remedial Action Objectives (RAOs), Remediation Goals (RGs), and Cleanup Levels (CULs) for the Site (see EPA 2005). The RAOs, RGs, and CULs for the Lower Fox River are set forth in the Records of Decision (ROD) for OUs 1-2 and OUs 2-5 signed by the Response Agencies in December 2002 and June 2003, respectively.

As with other CERCLA sites, the ROD described the overall goals and objectives, and selected a specific remedy that the Response Agencies believe will achieve the goals and objectives. Specifically, the RODs require that the remedies for the Site be designed to achieve CULs (i.e., addressing sediments above 1 ppm or, if that is not achieved, a surface weighted average concentration of 0.26 and 0.25 ppm in OU 3 and OU 4, respectively). The RODs have concluded that achieving the CULs will result in achieving the RGs (target fish tissue concentrations) and RAOs (human and ecological risk reduction and surface water PCB load reductions to Green Bay). This translates into two types of remedy success measures: (1) remedy effectiveness success (whether the CULs are met); and (2) risk reduction success (whether achievement of the CULs leads to the desired risk reduction). A monitoring program to evaluate remedy effectiveness success (primarily sediment verification sampling) will be developed as part of the Construction Quality Assurance Plan (CQAP; see Section 1.4.4.2).

The overall objective of this Baseline Monitoring Plan and the forthcoming Long-Term Monitoring Plan (LTMP) is to develop a monitoring program to evaluate risk reduction success. As set forth in the AOC, the draft LTMP will be prepared as part of the Intermediate (60 Percent) Design submittal, which will be informed by both the results of the baseline monitoring program and ongoing, more detailed remedial design. The results of the LTMP efforts, in turn, will be used to inform the five-year, post-remediation review process for the Lower Fox River and may also assist the Response Agencies in designing future RODs at

other similar contaminated sediment sites. Further discussion of risk reduction monitoring elements will be continued in the Long-Term Monitoring Work Group (see Section 1.3.3) to inform preparation of the forthcoming LTMP.

This BMP was developed independent of the sediment cleanup remedy. Therefore, the baseline data collected in accordance with this Plan will remain valid for both dredging and capping remedial action areas.

1.4.2 Baseline Monitoring Objectives

Specific objectives of the Baseline Monitoring Plan include the following:

1.4.2.1 Establish Pre-Remediation Conditions

Baseline (pre-remediation) water and fish tissue quality conditions in the Lower Fox River and Green Bay will be characterized to provide a point of comparison for long-term (post-remediation) monitoring data. The baseline data (per the requirements of this Baseline Monitoring Plan) and long-term monitoring data (per the requirements of the Long-Term Monitoring Plan, to be submitted with 60% Design documents) will provide data sets to allow the Response Agencies to determine whether or to what degree the implemented remedy meets risk reduction success criteria. To the extent possible, consistent field and analytical techniques and procedures will be used in baseline and long-term monitoring programs to control statistical variability.

1.4.2.2 Confirm Statistical Assumptions

Although historical data will not be used to evaluate the achievement of RAOs in the Lower Fox River, because of comparability issues, historical water and fish tissue monitoring data were nevertheless used to help design the Baseline Monitoring Plan, as described in Section 1.5. In particular, the statistical characteristics of these historical data were used to estimate the required number of samples and monitoring frequencies needed for the Baseline Monitoring Plan, and the resultant statistical power these samples will provide for detecting concentration reductions and recovery trends. The statistical characteristics of the baseline monitoring data will be evaluated to confirm the accuracy of the statistical assumptions and the adequacy of the sample numbers and monitoring frequencies.

1.4.2.3 Refine Field and Laboratory Procedures

The field and laboratory procedures proposed herein will be evaluated during initial phases of the Baseline Monitoring Program, and modified as necessary to ensure that monitoring objectives are achieved (see below). Examples of monitoring elements that will be reviewed during the conduct of the Baseline Monitoring Plan include the selection of appropriate fish species, and the sensitivity of high-resolution PCB congener analysis. Ongoing review and

adaptive management, if needed, of field and laboratory procedures will be coordinated through the Long-Term Monitoring Work Group.

1.4.3 Long-term Monitoring Objectives

Long-term monitoring data will be collected to evaluate progress toward achieving the RAOs of reduced risk to humans and the environment, as presented in the RODs (WDNR/EPA 2002, 2003). The long-term monitoring objectives include:

1.4.3.1 Monitor Reductions in Water and Fish Tissue Concentrations

Verify that sediment remedial actions in the Lower Fox River result in substantive reductions in water column and fish tissue PCB concentrations. The RODs identified water and fish tissue as key exposure media through which bioaccumulation may occur.

1.4.3.2 Monitor Progress toward Achieving Human Health Risk Goals

Verify progress toward achieving human health risk goals through analysis of recovery trends in water and fish tissue monitoring data. As described in the RODs, one of the goals of remedial action is removal of fish consumption advisories for recreational and high-intake fish consumers. The results of the long-term monitoring program will be submitted to WDNR's Fish Consumption Advisory Program for their consideration in determining if and when modification or removal of advisories is warranted.

1.4.3.3 Monitor Progress toward Achieving Ecological Risk Goals

Verify progress toward achieving ecological risk goals through analysis of recovery trends in water and fish tissue monitoring data. In addition to reducing human health risks, another goal of remedial action is achievement of safe ecological thresholds for fish-eating birds and mammals. The results of the long-term monitoring program will be considered using the risk assessment framework described in the RODs, and in consultation with WDNR and EPA risk assessors, to determine if and when ecological thresholds are achieved.

1.4.3.4 Monitor Reductions in PCB Loadings to Green Bay

Verify that sediment remedial actions in the Lower Fox River result in substantive reductions of PCB loadings to Green Bay. Decreased loadings from the Lower Fox River will help facilitate natural recovery processes in Green Bay.

1.4.4 Relationship to Other Monitoring Activities

The AOC and RD Work Plan for OUs 2-5 provide for baseline monitoring to characterize environmental conditions in the Lower Fox River and Green Bay before the onset of full-scale sediment remediation. As specified in the AOC and RD Work Plan for OU 2-5, three related monitoring plans will be developed as part of the Intermediate (60 Percent) Design documents, as described below. These related plans will be prepared following sequential

approval by the Response Agencies of the OU 2-5 Basis of Design Report and Preliminary (30 Percent) Design documents, respectively.

The RD Work Plan for OU 2-5 currently targets submittal of the Intermediate Design documents to the Response Agencies in early 2007, depending on the progress of earlier RD activities. The following monitoring plans will be included in the Intermediate Design documents:

1.4.4.1 Long-term Monitoring Plan (LTMP)

The LTMP will describe the water and fish tissue monitoring program in the years following the remedial action, to verify that the remedial action was effective at reducing risk to humans, mammals, birds, fish, and invertebrates. This Baseline Monitoring Plan is intended to be a support document to the LTMP, in that baseline data collected as described herein will characterize existing (pre-remediation) conditions for key water and fish tissue measurement endpoints and will provide the initial point of comparison for determining the magnitude and extent of decreasing PCB concentrations over the long term. To the extent possible, the methods and procedures used in the baseline sampling program should be identical to those used in the long-term monitoring program.

1.4.4.2 Construction Quality Assurance Plan (CQAP)

Water column monitoring during construction activities, including dredging, contingent capping, and dredged material disposal activities will be described in the CQAP. These monitoring activities will be designed to ensure construction best management practices are being properly implemented and to prevent construction activities from unduly impacting the river or bay. One of the objectives of the CQAP is to achieve RAO 5, as specified in both RODs: "Minimize the downstream movement of PCBs during implementation of the remedy."

Also in the CQAP, a sediment verification sampling program will be designed to confirm the attainment of remedial action levels in sediments. If remedial action levels are not met at the completion of construction, a range of contingency response actions may be appropriate for consideration. The range of possible response actions and the decision criteria used to guide their selection will be presented in the CQAP.

1.4.4.3 Operations, Maintenance, and Monitoring Plan (OMMP)

If certain elements of the remedial action require long-term maintenance and monitoring, such activities would be covered under the OMMP. The OMMP would include, for example, maintenance and monitoring of capped areas to ensure the cap remains physically stable (i.e., does not erode) and chemically protective. Similar to the CQAP, the OMMP will include a discussion of potential contingency response actions in the event that post-construction monitoring data reveal that containment actions (e.g., engineered caps) have not met remedial ac-

tion criteria. The range of possible post-construction response actions and the decision criteria used to guide their selection will be presented in the OMMP.

1.4.5 Modifications to ROD Monitoring

The scope of the Baseline Monitoring Plan has been modified from the scope that was originally conceived at the time the RODs were written (WDNR/EPA 2002, 2003). These proposed modifications have been prompted by new scientific information and ongoing discussions of new and existing information within the Long-Term Monitoring Work Group. The new information considered in determining appropriate modifications to the Baseline Monitoring Plan includes:

- Comprehensive pre-remedial design sediment and water sampling undertaken in 2004 and 2005 by the Respondents (Shaw/Anchor 2004)
- The recent publication of EPA's *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, which provides relevant guidance for designing site-specific long-term monitoring plans (including baseline monitoring components) to ensure the effectiveness of the remedial action for controlling site risk (EPA 2005)
- Ongoing research by various agencies and organizations regarding the current state of environmental conditions in the Lower Fox River and Green Bay, and the health of potentially impacted receptors (e.g., Schrank and Horns 2004, Dykstra et al. 2004, Sea Engineering 2004 & 2005, WDNR fish consumption monitoring data, Schrank, 2006)

To a large degree, the new information and associated modifications appropriately focus investigative resources on water and fish tissue, these being critical components of all major bioaccumulation risk pathways. Water is often the medium of transport which relates PCB concentrations in sediments to food-web exposures. Fish are the medium of exposure for bioaccumulation risk in higher-level organisms, including humans, mammals, and birds, as well as the fish themselves. This more focused monitoring approach allows for a more thorough characterization of: 1) fish species, sizes, and habitats, including species considered most relevant to humans and wildlife; 2) fish of various ages, from young-of-year to adult; and 3) additional contingent species to improve the adaptiveness and flexibility of the long-term monitoring program.

The scope of work described in this Baseline Monitoring Plan differs from the scope of work as originally presented in RODs in several ways. These differences are listed below, along with the rationale for modification.

- *Zebra Mussels.* Tissue residue levels of PCBs in mussels have not been found to be a reliable indicator of risk to invertebrates. The sediment quality values for protection of invertebrates that were developed and used in the Risk Assessment are not based on tissue residue levels. Zebra mussels themselves are not a human food source. To the extent consumption of invertebrates contributes to bioaccumulation of PCBs in fish, this pathway will be measured directly in key human health and ecological fish species.

  A comprehensive water monitoring program will be conducted in place of zebra mussel monitoring (see below). At the time the ROD was prepared, it was thought that zebra mussels might be a good integrator of water column concentrations over time, and that they might serve to concentrate PCBs. However, by using high-resolution PCB analytical techniques in water with a robust sampling frequency, mussel tissue monitoring is not needed as a medium for concentrating PCBs. Further, a disadvantage of zebra mussel sampling is that locations would be limited to nearshore structures and rocky substrates. Direct sampling of the water column will provide more representative coverage of river reaches and flow cross-sections, and better characterization of water quality in the vicinity of fine-grained sediments that may generate higher PCB loads.

- *Reduced Mercury Analysis in Fish Tissue.* PCBs have contributed to the listing of fish consumption advisories for fifteen different fish species in the Lower Fox River and southern Green Bay. Mercury has contributed to the listing of only two of these species—smallmouth bass and walleye. For the general population, mercury advisories are in effect only for large older fish (i.e., greater than 18 inches) which carry a high historical contaminant burden and are therefore less responsive to improvements in river and bay quality. For higher-level ecological receptors (fish, birds, mammals), mercury exposures are consistently below the Lowest Observed Adverse Effects Levels (LOAELs), and PCB hazard quotients are typically an order of magnitude higher than those for mercury (Retec 2002c). In consideration of these data, PCBs are the highest priority for baseline and long-term monitoring. A more limited sampling program for mercury will be conducted in OU 2 to confirm the effectiveness of natural recovery processes in this area.

- *Population Studies.* Population studies of eagles and cormorants were originally proposed for monitoring in the OU 1-2 ROD. However, it was also recognized in both RODs that much uncertainty is introduced in the assessment of population level endpoints due to a number of confounding environmental factors, separate and apart from contaminant exposures, that can affect the absence or abundance of receptors at the Site. These confounding factors include immigration and emigration, food availability, habitat suitability and availability, species competition, predation, and weather (WDNR/EPA 2002, 2003). It was for these reasons that population level surveys were not included in the ecological Risk Assessment, and are not planned herein. The beneficial effects of the remedial action on reducing PCB residues in birds and mammals will be assessed by monitoring PCB concentrations in the tissue of fish that make up their diet, rather than monitoring

general population parameters which are responsive to various environmental stressors.

Population monitoring is routinely conducted by state and federal agencies as part of more comprehensive local and regional studies comprising other parts of Wisconsin, the Great Lakes, and the nation (e.g., Dykstra et al. 2004, USDA 1997; Eckstein et al., 2002). It is only in this larger context that population data can be properly interpreted, especially considering the effects of non-point sources of pollution such as chlorinated pesticides (in particular, DDT and its degradation products) in agricultural runoff. It is also noteworthy that both cormorant and eagle populations in the Lake Michigan region have roughly tripled during the 1990s, and PCBs have not been shown to have a measurable effect on the productivity of either species (Dykstra et al. 2004, Custer et al. 2001).

- *Bird and Waterfowl Sampling.* Bird sampling was originally indicated as a component of monitored natural recovery in OUs 2 and 5 (WDNR/EPA 2002, 2003). The primary ecological receptors of concern are fish-eating birds, because field data indicate that insectivorous birds (e.g., tree swallows) are not impaired on the Lower Fox River (Retec 2002c). OU 2 does not provide suitable habitat for either cormorants or terns, but hosts several eagle nests, including one of the oldest and most productive nests on the Lower Fox River (at Kaukauna). OU 5 (Green Bay) supports larger populations of fish-eating birds.

  A number of factors complicate the interpretation of bird tissue PCB data compared to a more primary medium such as river water or fish tissue which is in more intimate contact with the sediments. Complicating factors include diet (percent and types of fish), feeding range, and parent-to-embryo transfer of PCBs. In addition, potential bird sampling sites in Green Bay are limited (e.g. Cat Island, Hat Island) and are not coincident with the highest sediment PCB concentrations which are found in the eastern part of the bay. The fish sampling approach discussed later is this Baseline Monitoring Plan has been designed to better target this area of potential concern in Green Bay.

  Finally, consumption of waterfowl by hunters is a comparatively lower risk exposure pathway, compared to that associated with fish consumption. The risk to waterfowl hunters is estimated to be about ten to one hundred times lower than the risk to anglers (Retec 2002c). Therefore, it is expected that monitoring contaminant reductions in water and fish tissue to the extent necessary to protect anglers will implicitly protect waterfowl hunters in OUs 2 and 5.

1.5 Background Information

In developing this Baseline Monitoring Plan, existing data on water quality and fish tissue quality were compiled and summarized to characterize recent environmental conditions at the Site. Data summaries of recent water quality and fish tissue monitoring data are presented in Tables 1-1 and 1-2, respectively. These statistics were used to support the design of a statistically based sampling program, and to estimate sample sizes for baseline and future long-term

monitoring events (see Section 1.7.7.1). It should be noted, however, that historical water quality and fish tissue data were not intended for use in long-term monitoring decisions because significantly different field and/or analytical methods may have been used to collect historical data compared to the methods proposed in this Plan, and the comparability of the various studies has not been established.

1.5.1 Site Description

The Lower Fox River is divided into five operable units (Figure 1-3):

- OU 1 is also known as Little Lake Butte des Morts. The Neenah and Menasha Dams control the pool elevation of Lake Winnebago and the discharge to the upstream end of OU 1 at river mile (RM) 39. Remedial design of OU 1 is being addressed under a separate SOW and Consent Order from that of OUs 2-5.
- OU 2 extends from the Appleton Locks at RM 31.9 to the Little Rapids Dam at RM 13.1. This unit contains the majority of locks and dams in the Lower Fox River system and the greatest elevation drop and gradient. Sediments have a very patchy distribution in this reach with extensive intervening bedrock exposures. Monitored natural recovery (MNR) is the selected remedy for OU 2, except for Deposit DD just upstream of Little Rapids Dam which is planned for active remediation.
- OU 3 extends from the Little Rapids Dam to the De Pere Dam at RM 7.1. Soft sediment covers most of this unit.
- OU 4 extends from the De Pere Dam to the river mouth at Green Bay. This unit contains a federal navigation channel. The federal channel is currently maintained by the USACE downstream of the Fort James Turning Basin, but the section above the turning basin is unmaintained. The area around OU 4 is highly urbanized, including the City of Green Bay metropolitan area.
- OU 5 begins at the river mouth, and includes the entirety of Green Bay. Except for a relatively small PCB deposit on the river-mouth delta, MNR is the selected remedy for OU 5. Because of its size, OU 5 is divided into three zones (Zone II, III, and IV).

1.5.2 Lower Fox River Database

A large set of environmental information has been compiled for the Lower Fox River by various agencies, respondent parties, and other institutions. The database used for this project is the FoxView database (version 7; LTI 2004), which includes the Fox River Database, previously compiled by WDNR (EcoChem and ThermoRetec 2000), as well as additional information collected by the U.S. Geological Survey (USGS), the Fox River Group (FRG), and others.

The various FRG studies (Exponent 1999; BBL, 1999, 2002; LTI, 2002; see below) contain recent and valid scientific data in the Lower Fox River and were implemented in accordance with Quality Assurance Project Plans. However, the FRG Plans and resultant data did not go through the WDNR or USEPA approval processes. These data have been determined suitable for use in the design of the baseline monitoring program. However, these data were not intended for use in long-term monitoring decisions.

Data summaries for recent (i.e., collected over the last ten years) water and tissue data are presented in Tables 1-1 and 1-2, respectively. In addition, the Green Bay Mass Balance Study (Bierman et al. 1992), provides important information about historical environmental quality of the river and bay. However, these data were not included in the summary statistics because they could complicate the statistics by introducing long-term (i.e., decade scale) time trends.

The characterization of recent water quality conditions was based on the following studies:

- 1994-1995 Lake Michigan Mass Balance Study (USEPA 2002a, 2004b)
- 1998 FRG Sediment, Surface Water, and Biota Surveys (Exponent 1999, BBL 1999, 2002)
- 2000-2001 FRG Surface Water Survey (LTI, 2002)

The characterization of recent fish tissue quality was based on the following studies:

- 1994-1995 Lake Michigan Mass Balance Study (USEPA 2002a, 2004b)
- 1996 USFW NRDA Biota Survey (Stratus, 1999)
- 1996-1998 WDNR Fish Tissue Surveys (Retec, 2002a, 2002b)
- 1998 FRG Sediment, Surface Water, and Biota Surveys (Exponent, 1999, BBL, 1999 and 2002)
- 2000-2001 FRG Surface Water Survey (LTI, 2002)

1.5.3 Site Water Quality

This section discusses the geographical distribution of PCBs in the water column of the Lower Fox River and Green Bay, the distribution between particulate and dissolved PCBs, and seasonal patterns of water column concentrations and PCB loadings.

1.5.3.1 Water Quality Summary Statistics

The mean, standard deviation, and coefficient of variation of total suspended solids, and dissolved, particulate, and total PCB concentrations are summarized in Table 1-1. Mean TSS concentrations in the Lower Fox River range from approximately 16 to 48 mg/L, with an overall mean of 31 mg/L, generally increasing downstream to the highest concentrations in OU 3 and OU 4. Mean total PCB concentrations also increase downstream, ranging from less

than 5 ng/L (or parts per trillion, ppt) in Lake Winnebago (Neenah and Menasha Channel) to 19 - 38 ng/L in OU 4. On average, the particulate fraction accounts for about two-thirds of the total water column PCB concentration, and the dissolved fraction accounts for the remainder. The coefficient of variation for existing total PCB concentrations, which was used to estimate sample sizes for the baseline monitoring program, is approximately 0.6 (60 percent).

1.5.3.2 Distribution of Water Column PCB Concentrations

Downstream trends in water column PCB concentrations in the Lower Fox River were characterized during a 2000-2001 monitoring program by the Fox River Group (Figure 1-3; (LTI 2002). Base flow and high flow river conditions were characterized. Base flow events were sampled semi-monthly in 2000-2001, independent of flow. High flow events, which included sampling over rising and falling limbs of runoff hydrographs, were sampled between April 7 and May 30, 2001. Flow rates during base flow sampling events ranged from 1,700 to 6,500 cfs, whereas flow rates during high flow sampling events ranged from 2,930 to 13,300 cfs.

Figure 1-3 shows significant downstream increases in PCB concentrations in OU 1 and OU 4, and to a lesser degree in OU 3, during both base flow (BF) and high flow (HF) events. Water column PCB concentrations are relatively constant across OU 2, consistent with the fact that there are only a few small PCB sediment deposits in OU 2 and large areas of bedrock exposure.

In the 2000-2001 FRG study, background concentrations of PCBs in Lake Winnebago were not detectable at a detection limit of 3 ppt. In previous studies (i.e., GBMBS), Lake Winnebago concentrations were also below the limits of detection. A more definitive quantitation of PCB concentrations in Lake Winnebago was obtained in October 2004 during the remedial design sampling program using high-resolution gas chromatography/mass spectrometry (EPA Method 1668A). In two duplicate samples, total PCBs ranged from about 0.29 to 0.44 ng/L and dissolved PCBs were about 0.1 ng/L, although only 5 to 7 PCB congeners peaks were detected during that sampling.

Data collected during the 2000-2001 FRG study suggest that there is little difference in total PCB concentrations between base flow (BF) and high flow (HF) events (see Figure 1-3; LTI 2002). The effects of seasonality and temperature appear to exert a more pronounced influence on PCB concentrations, compared to flow conditions (see Section 1.5.3.3 below).

1.5.3.3 Seasonal Trends in PCB Concentrations

Three investigations are available which provide water quality monitoring data over the course of a year, allowing an assessment of seasonality: 1) the 1989-1990 Green Bay Mass

Balance Study (GBMBS); 2) the 1994-1995 Lake Michigan Mass Balance Study (LMMBS); and 3) the 2000-2001 Fox River Group (FRG) study. Seasonal trends in PCB concentrations observed at the mouth of the Fox River in these three investigations are shown on Figure 1-4. Data are expressed in terms of mean monthly PCB concentrations; depending on the sampling frequency, these mean values represent either a single sampling event or an average of several sampling events during the month.

Figure 1-4 shows a pronounced seasonality in PCB concentrations in the Lower Fox River. The highest concentrations typically occur during the warm weather months from May through October, and the lowest concentrations occur during the winter months of December through March, with April and November being transition months. Concentrations during winter (3 to 10 ppt) are about an order of magnitude less than concentrations during the warmer months (30 to 100 ppt). Temperature appears to be one of the key factors controlling the seasonality of water column PCB concentrations (LTI 2002), either through direct action (i.e. PCB solubility) or through more indirect mechanisms (i.e., by affecting biological productivity, bioturbation, methane production, total and dissolved organic carbon, etc.), or both.

1.5.3.4 Seasonal Trends in PCB Loads

Estimated mean monthly PCB loads (concentration times flow in mass/day) at the mouth of the Lower Fox River are shown on Figure 1-5. Consistent with the annual cycles of surface water PCB concentrations, there is a similar seasonality to PCB loads. Between 86 and 96 percent of the annual load (92 percent on average) is estimated to occur between April and November, whereas only 4 to 12 percent of the annual load (8 percent on average) occurs between December and March. The seasonal variations in PCB concentration have a pronounced effect on the PCB load. This is augmented by generally lower TSS concentrations during the winter months which further decrease the particulate load. During the 1989 Green Bay Mass Balance Study, for example, TSS concentrations in January and February were usually at or below 5 mg/L, whereas TSS concentrations between April and November were typically between 20 and 50 mg/L, spiking to even higher values during high flow events; December and March were transitional months (Bierman et al., 1992; LTI, 2002).

1.5.4 Fish Tissue Quality

This section discusses tissue PCB concentrations in various fish species, in whole fish and in fillets, and the geographical distribution of PCBs in fish tissue throughout the Lower Fox River and Green Bay.

1.5.4.1 Fish Tissue Summary Statistics

The mean, standard deviation, and coefficient of variation of existing PCB concentrations in various fish species are summarized in Table 1-2. Mean PCB concentrations in fish tissue

currently range from less than 0.1 to 8.4 mg/kg, generally increasing downstream to the highest concentrations in OU 4 and inner Green Bay (OU 5, Zone 2). The coefficient of variation for fish tissue PCB concentrations, which is used to estimate sample sizes for the baseline monitoring program, varies depending on the fish species but averages about 0.5 to 0.6.

1.5.4.2 Fish Consumption Advisories

In the Lower Fox River and southern Green Bay, fish consumption advisories are in effect for nineteen species. All species are listed for PCBs. The species restricted by consumption advisories are summarized in Table 1-3.

1.5.4.3 PCB Concentration by Species

Average existing PCB concentrations in fish tissue for various species in the Lower Fox River are summarized in Figure 1-6, with the data segregated based on preparation method as whole fish or fillet. Because fillets were not always reported as skin-on or skin-off, all reported fillets for a particular species were combined for averaging purposes. Data used to develop Figure 1-6 were obtained from various studies over the last ten years, as cited in Section 1.5.2.

Carp, white bass, catfish, walleye, and white sucker tend to have the highest PCB concentrations in fillets, whereas walleye, carp, gizzard shad, white sucker, and northern pike tend to have the highest PCB concentrations in whole fish.

Fish tissue PCB concentrations are influenced by the method of preparation, in particular, whether the sample was prepared from a whole fish or from a fillet. Within a particular species, existing data indicate concentrations in whole fish are about two to five times higher, on average, than concentrations in fillets.

1.5.4.4 Spatial Distribution of PCBs in Fish Tissue

The spatial distribution of fish tissue PCB concentrations are summarized in Figure 1-7. Five species with relatively widespread occurrence in the Lower Fox River and Green Bay were evaluated—carp, walleye, northern pike, smallmouth bass, and yellow perch—using both whole fish and filleted preparations.

For most of the fish species, there is currently a general downstream increase in PCB concentrations in the Lower Fox River, reaching maximum values in OU 4 or inner Green Bay (OU 5-Zone II). Some of the highest concentrations have been associated with carp and walleye. One exception to this general spatial pattern has been the elevated average PCB concentration for walleye (as whole fish) in central Green Bay (OU 5-Zone III). This anomaly may be explained by a size bias in the samples (i.e., larger and older fish may have been collected

from the open waters of the bay), or by the wide-ranging migration patterns of walleye (i.e., possible seasonal feeding in OU 4). Because this data set is not well controlled for size, age, season, or lipid content, the plots should be used only to characterize general spatial distributions.

1.5.5 Conceptual Site Model

It was recognized in the RODs that bioaccumulation of PCBs in fish tissue and subsequent ingestion by higher-level organisms (humans, mammals, birds, and the fish themselves) is the primary risk pathway of concern in the Lower Fox River and Green Bay. A conceptual site model has been developed to better understand the relationship between sediments, water, fish, and fish-eating animals, including humans. The conceptual site model will be used to help interpret baseline and long-term monitoring data for water and tissue.

1.5.5.1 Predicted Reduction in SWAC due to Cleanup Action

The RODs estimated that sediment remedial action in the Lower Fox River will result in an approximate 90 percent reduction of the SWAC for PCBs (WDNR and USEPA, 2002, 2003). Remediating the in-water sources of PCBs in sediments is expected to result in substantive reductions in PCB water column concentrations, PCB loadings to Green Bay, PCB concentrations in young-of-year fish, and eventually, PCB concentrations in adult fish. There will likely be a lag period of at least several years before improvements in the tissue quality of adult organisms (i.e., fish of harvestable size) will be evident.

1.5.5.2 Predicted Reduction in Water Concentrations

As reported in the RODs and RI/FS, model projections for the Lower Fox River indicate order-of-magnitude improvements in both water column PCB concentrations and PCB loads resulting from the remedial action. Model predictions referenced in the RODs suggest that over the long term (i.e., roughly 30 years), post-remedial action PCB concentrations in the Lower Fox River will decline by about 50 percent every 5 years, on average, compared to pre-remedial baseline values. These changes are predicted based on the combined effects of the remedy and subsequent long-term natural recovery processes.

1.5.5.3 PCB Concentrations vs. PCB Loads

The PCB load to Green Bay (mass/time) is the product of PCB water column concentration (mass/volume) times river flow (volume/time). Because the PCB load may be confounded with inter-annual variation in flow, PCB concentration is expected to provide a more accurate indicator of trends in water quality. However, differences in PCB concentration may also be confounded by the effects of inter-annual variation in flow conditions and temperature, so multiple regression techniques will be available for use in estimating trends in PCB concentration adjusted for the effects of flow and temperature (see Appendix J).

1.5.5.4 Seasonal Effects on Water Quality

Water temperature exerts a seasonal influence on PCB concentrations in the Lower Fox River, with the highest PCB concentrations and loads occurring in the warm weather months between April and November. In contrast, only 4 to 12 percent of the annual PCB load (8 percent on average) is discharged during the cold weather months between December and March (Velleux and Endicott 1994, USEPA 2002a and 2004b, and LTI 2002). Flow and suspended solids concentrations (TSS) also influence PCB concentrations, but to a lesser extent than temperature.

1.5.5.5 Bioaccumulation Exposure Pathways

As determined in the Baseline Risk Assessment (Retec 2002), the primary exposure pathway for humans and wildlife to become exposed to PCBs in the Lower Fox River is through consumption of PCB-contaminated fish. Therefore, the focus of this Baseline Monitoring Plan is to monitor risk reduction to humans and wildlife (including fishermen as well as fish-eating mammals and birds) by monitoring PCB concentrations in an appropriate selection of fish species, sizes, ages, and preparation methods which are relevant to these receptors.

1.6 Project/Task Description

The key objective of this phase of the project is to use the results of the Baseline Monitoring Program to establish current conditions as well as seasonal and spatial variations in PCB contamination in water and fish. Results from the Baseline Monitoring Program will be used as the basis to assess trends in water and fish contamination with similar data collected during the Long-Term Monitoring Program.

1.6.1 Standards and Criteria

1.6.1.1 Remedial Action Levels

The remedial action level (RAL) for the Lower Fox River is:

- Remediation of sediments with PCB concentrations above 1 ppm

If post-dredge residual PCB concentrations remain above 1 ppm following the remedial action, the contingent RAL becomes:

- Attainment of a surface-weighted average concentrations (SWAC) in sediments of 0.26 and 0.25 ppm in OU 3 and OU 4, respectively

Through achievement of the RALs, the remedial action is expected to result in improved sediment quality conditions in the Lower Fox River. In response, it is expected that first water and then fish tissue PCB concentrations will decline. Measuring the rate and magnitude of

this decline in water and fish tissue, over a representative set of stations, seasons, and species, is a key objective of the Baseline and Long-Term Monitoring Plans.

1.6.1.2 Human Health Target Tissue Goals

As stated in the Lower Fox River RODs, the human health remedial action objective is removal of fish consumption advisories for recreational and high-intake fish consumers. Beyond this narrative standard, the RODs did not provide numerical target tissue concentrations for protection of human health. It is anticipated that the Wisconsin Fish Consumption Advisory Program will ultimately determine if and when modification or removal of fish advisories is warranted. The Long-Term Monitoring Work Group, in consultation with the State Program, will work toward developing target tissue goals for protection of human health that are consistent with the numerical criteria and analytical methods used in the State Program.

1.6.1.3 Ecological Target Tissue Goals

As stated in the Lower Fox River RODs, the ecological remedial action objective is achievement of safe ecological thresholds for fish-eating birds and mammals, which are among the most sensitive of ecological receptors to PCB contamination. Beyond this narrative standard, the Lower Fox River RODs did not provide numerical target tissue concentrations for protection of ecological resources. It is anticipated that safe ecological thresholds will be determined based on a review of the Ecological Risk Assessment for the Lower Fox River, and appropriate updates. The Long-Term Monitoring Work Group will work toward developing target tissue goals for protection of ecological resources that are consistent with the methods used in the Ecological Risk Assessment for the Lower Fox River.

1.6.2 Overview of Baseline Monitoring Activities

Water and fish tissue are the media of interest for baseline monitoring. Both media will be monitored at a number of stations from Lake Winnebago to Green Bay. The water monitoring plan includes systematic monthly sampling of 10 stations over the course of an entire year. The fish tissue monitoring plan includes sampling of 5 different species at 9 different stations, in replicates of 15 to 25 samples of each adult species at each station.

1.6.2.1 Water Quality Plan

In general, water monitoring stations are sited near the downstream boundaries of the OUs such that the net PCB contribution from each OU, and the effectiveness of the remedy in each OU, can be evaluated. In addition, multiple water quality monitoring stations are sited in OU 2 and OU 5 to provide increased coverage in monitored natural recovery areas. The monitoring locations are consistent, to the extent possible, with stations occupied during past and ongoing monitoring programs. For example, water quality monitoring in OU 4 will be coincident with the USGS and LMMBS monitoring station at the Oil Depot gage.

1.6.2.2 Fish Tissue Plan

Fish monitoring stations include an upstream reference site (Lake Winnebago), six stations in the Lower Fox River, and two stations in Green Bay (9 stations total). One sampling station is assigned to each OU, except OU 2 which has three sampling stations and OU 5 which has two sampling stations because of the greater length and breadth of these reaches and more diverse habitat types. It is expected that different fish species will be collected from different parts of the OUs because of varying habitat preferences, feeding and migration patterns. Sampling locations are presented in Section 2.2.2 based on input from WDNR fish biologists; however, exact locations may be adjusted in response to the local field conditions at the time of sampling.

1.6.3 Special Equipment and Personnel Requirements

1.6.3.1 Equipment Requirements

Specialty equipment required for water quality monitoring activities includes:

- Sampling boat with echo sounder
- Water quality monitoring probe (temperature and turbidity)
- Sampling pump (peristaltic) and accessories
- Discrete water column sampler (Niskin bottle or equivalent)
- Differential Global Positioning System (DGPS)
- Personal protective equipment (per HSP)

Specialty equipment required for fish sampling activities includes:

- Sampling boat with echo sounder
- Support boat
- Electrofishing equipment
- Fyke net; mini-fyke net
- Other fish collection equipment as needed (e.g., trawls, set lines)
- Global Positioning System (GPS)
- Personal protective equipment (per HSP)

1.6.3.2 Personnel Requirements

Field Supervisors will be experienced in conducting water and/or fish sampling activities at hazardous waste sites as necessary to implement the tasks required in this Plan in accordance with the field and laboratory quality assurance requirements of this Plan. Field personnel will be trained in the safe and proper use of the above-listed equipment. All field personnel will have completed 40-hour HAZWOPER training with up-to-date, annual 8-hour refresher training, as specified in the Health and Safety Plan (HSP).

1.6.4 Baseline Monitoring Schedule

Water sampling will be performed on a monthly basis from August 2006 through July 2007 (12 sampling events total). Fish tissue samples will be collected between August 15 and September 15, 2006. The Baseline Monitoring Report will be submitted four (4) months after collection of last water sample. The Long-Term Monitoring Work Group will be convened in December 2006, and periodically thereafter, to review and discuss the results and analysis of water column and fish tissue sampling data.

This schedule is subject to change based on timely agency approval of the Baseline Monitoring Plan, weather delays, and other factors that are out of the Respondents' control.

The key tasks and milestones in the schedule of baseline monitoring activities are presented in Figure 1-8.

1.6.5 Preliminary Long-Term Monitoring Schedule

A preliminary conceptual schedule of remediation and long-term monitoring activities is presented in Figure 1-9. This schedule is of a conceptual nature only, given the current schedule uncertainty for completion of engineering design and sediment remediation. The preliminary schedule provided in Figure 1-9 is based on relative dates in which Year 0 corresponds to the start of the remedial action in OUs 2-5. Absolute dates cannot be accurately predicted at this time.

The key concepts of the long-term monitoring schedule include the following:

- Sediment remediation in OUs 2-5 will take approximately ten years to complete. Remediation will be completed in OUs 1, 2, and 3 first, and the majority of the ten year construction period will be spent working in OU 4.
- Once the remediation of OU 3 has been completed, post-construction monitoring will begin in OU 3 and all upriver areas (i.e. Lake Winnebago, OU 1, OU 2A, OU 2B, OU 2C, and OU 3). The monitoring in OU 4 and Green Bay will lag by five years because of ongoing in-water construction activities.
- Post-construction monitoring will begin at the completion of remediation and will initially be scheduled on five-year intervals. The monitoring should occur one year prior to the scheduled CERCLA five-year reviews to inform the review process and selection of an appropriate path forward for the monitoring program. The path forward could include: (1) continued monitoring at five-year intervals; (2) continued monitoring at less frequent intervals, e.g. ten-year intervals; (3) continued monitoring at a reduced level of effort, e.g., monitoring of fish only and discontinuation of water monitoring; and (4) termination of monitoring because RAOs have been achieved.

1.7 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements that define the objectives of the project, identify the most appropriate types of data and data collection procedures, and specify acceptable error limits for decision making. The DQOs for this project were developed in accordance with USEPA Guidance for Data Quality Objectives Process, EPA QA/G-4 (USEPA, 2000b) and USEPA Region 5 Instructions on the Preparation of the Superfund Division Quality Assurance Project Plan, Revision 0 (USEPA, 2000a). Once approved, any proposed additions or changes to methods and procedures of this Baseline Monitoring Plan will be documented in a Sampling Plan Addendum and submitted to WDNR and USEPA for review and approval.

The DQO Process for Baseline Monitoring is presented below.

1.7.1 Step 1: State the Problem

The overall objective of this Baseline Monitoring Plan is to characterize baseline (pre-remediation) water and fish tissue quality conditions in the Lower Fox River and Green Bay to provide a point of comparison for long-term (post-remediation) monitoring data. The combined baseline and long-term monitoring data will provide the Response Agencies with information to determine whether the implemented remedy meets remedial action objectives (RAOs) and risk reduction success criteria.

As stated in the ROD (WDNR/EPA 2002, 2003), the RAOs for this project which are relevant to Baseline and Long-Term Monitoring include the following:

- Reduction of water column PCB concentrations
- Removal of human health fish consumption advisories
- Achievement of safe ecological thresholds for fish-eating birds and mammals, as well as other ecological receptors
- Reduction of Lower Fox River PCB loadings to Green Bay

These objectives are expected to be met through completion of the sediment remedial action (design of which is currently underway) and achievement of sediment remedial action levels as specified in the RODs.

1.7.2 Step 2: Identify the Decisions

Baseline data will be collected to support long-term monitoring objectives and to evaluate progress toward achieving remediation goals. The baseline and long-term monitoring programs are structured to answer the following questions:

- Were the assumptions and data used to design the BMP appropriate and representative of actual baseline conditions? (i.e., are the number and location of baseline samples adequate for long-term decision making?)
- Are water and fish tissue PCB concentrations declining in response to sediment remedial actions and follow-on natural recovery processes?
- Are fish tissue mercury concentrations declining in OU 2?
- To what extent is the observed variability in PCB concentrations over space and time controlled by ancillary variables (e.g. temperature and turbidity for water; size and lipid content for fish)?
- Are Lower Fox River PCB loadings to Green Bay declining in response to sediment remedial actions and follow-on natural recovery processes?
- Are water and fish tissue concentrations in the Lower Fox River similar to those in the upstream reference area (i.e., Lake Winnebago)?
- Can fish consumption advisories be lifted within ROD-specified time periods?
- Will safe ecological thresholds be achieved within ROD-specified time periods?

The first question will be assessed during the baseline monitoring program, whereas a complete assessment of the other questions must await the collection of long-term monitoring data. It is expected that these questions, and more specifically the statistical hypotheses listed below, will be tested and addressed on an OU-by-OU basis, with the possible exception of OU 2 and OU 5, where decisions may be broken into sub-parts based on the substantially greater length, breadth, and complexity of those operable units.

Ultimately, the achievement of human health and ecological remediation goals will be based on fish tissue concentrations. However, as discussed in the RODs, water represents the principal medium through which fish are exposed to PCBs, and will therefore be used as an indicator of bioaccumulation, and potentially a more sensitive indicator that responds more quickly to the effects of the remedial action.

Long-Term Statistical Hypotheses. The primary long-term decision that will be informed by the baseline and long-term monitoring programs is whether the sediment remedial action has resulted in measurable reductions in water and fish tissue concentrations in the Lower Fox

River and Green Bay. These hypothesis statements are presently developed at a preliminary and conceptual level, as needed to support the design of baseline monitoring activities:

- *Null Hypothesis G-1.* Water and fish tissue PCB (and mercury) concentrations measured in the post-remediation period are not significantly different than baseline concentrations
- *Alternative Hypothesis G-1.* Water and fish tissue concentrations measured in the post-remediation period are lower than baseline concentrations

and

- *Null Hypothesis G-2.* Water and fish tissue PCB (and mercury) concentrations in the post-remediation period are static and unchanging over time
- *Alternative Hypothesis G-2.* Water and fish tissue concentrations are decreasing over time as a result of the sediment remedial action

Sufficient data will be collected in the water and fish tissue sampling programs to be able to test these hypotheses with an appropriate level of statistical confidence and power. More detailed hypothesis statements related to long-term monitoring decisions will be discussed and developed in the LTMP Work Group and presented in the Long-Term Monitoring Plan as part of the 60 Percent Design submittal.

Baseline Statistical Hypotheses. Two specific baseline monitoring hypotheses will be tested to ensure the data collected during the baseline program will provide sufficient statistical power to make long-term decisions with an appropriate level of confidence. The first hypothesis statement is related to the statistical distribution of water and fish data, and the suitability of using parametric testing procedures for data analysis:

- *Null Hypothesis B-1.* Water and fish tissue data are in conformance with standard normal and/or lognormal statistical distributions
- *Alternative Hypothesis B-1.* Water and fish tissue data do not conform to standard normal or lognormal distributions

The second hypothesis statement is related to confirming that the sample sizes collected during the baseline program are adequate to inform long-term decisions:

- *Null Hypothesis B-2.* The coefficient of variation (CV) of baseline water and/or fish tissue data is comparable to or less than the CV of the historical data which was used to design the baseline monitoring plan; therefore, the data will provide an appropriate level of statistical power for making long-term decisions.

- *Alternative Hypothesis B-2.* The coefficient of variation (CV) of baseline water and/or fish tissue data is higher than the CV of the historical data which was used to design the baseline monitoring plan; therefore, the statistical power of the data may be compromised.

1.7.3 Step 3: Identify Inputs to the Decision

Existing data on water quality and fish tissue quality were compiled and summarized to characterize recent environmental conditions at the Site (see Section 1.7.3.1 below). These data have been used to support the design of a statistically based sampling program, to estimate sample sizes for baseline and future long-term monitoring events, and to refine the conceptual model for the recovery of water and fish contamination in the years following completion of the sediment remedial action.

1.7.3.1 Existing Data

A large set of environmental information has been compiled for the Lower Fox River by various agencies, respondent parties, and other investigators. The database used for this project is the FoxView database (version 7; LTI 2004), which includes the Fox River Database, previously compiled by WDNR (EcoChem and ThermoRetec 2000), as well as additional information collected by the U.S. Geological Survey (USGS), the Fox River Group (FRG), and others. These data have been determined suitable for use in the design of the baseline and long-term monitoring programs, as summarized in Section 1.5.2. However, these data were not intended for use in long-term monitoring decisions.

1.7.3.2 Existing Monitoring Guidance

Federal and State guidance documents were consulted in preparing the Baseline Monitoring Plan, including the following:

- EPA, 2000 Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1: Fish Sampling and Analysis
- Great Lakes Sport Fish Advisory Task Force 1993, Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory
- EPA 2005, Contaminated Sediment Remediation Guidance for Hazardous Waste Sites

1.7.3.3 Summary Statistics for PCBs in Water

Summary statistics for PCB concentrations in water are presented in Table 1-4. Statistics include the mean total PCB concentration, the unitless coefficient of variation (CV), and statistical distribution test results (normal, lognormal, or other). The CV is a measure of sampling variability and was used to estimate sample sizes for baseline and long-term monitoring (see Section 1.7.7.1).

Water column data have a bi-modal distribution, with overall higher concentrations during the warm weather months of May through October, and generally much lower concentrations during the winter months of December through March. These data are therefore amenable to seasonal stratification. Compared to year-round statistics, warm weather months are well described by a normal distribution (normally distributed in 5 out of 6 sampling events), and have a lower CV (0.37 compared to 0.52 year-round). For the purpose of designing the water quality monitoring schedule, warm weather months have been defined to include the transitional months of April and November (see Section 2.1.3).

1.7.3.4 Summary Statistics for PCBs in Fish Tissue

Summary statistics for PCB concentrations in fish tissue are summarized in Table 1-5. Statistics include the mean total PCB concentration, the unitless CV, and statistical distribution test results (normal, lognormal, or other). Fish tissue CV values range from 0.39 to 0.72 depending on species, operable unit, and preparation method (i.e., fillet versus whole fish). Statistical distribution tests were calculated by Retec (2002c) for walleye, carp, and gizzard shad. In a majority of cases in which statistical distribution testing was conducted (9 out of 13 data sets), fish tissue data were found to be in conformance with a normal distribution.

1.7.3.5 Key Inputs to Monitoring Plan Design

Several key assumptions and considerations, as discussed during LTMP Work Group meetings, have helped to guide the design of this Baseline Monitoring Plan. Overarching programmatic considerations include the following:

- Expanded Baseline Monitoring Activities. The baseline monitoring activities are designed to be broader and more extensive than long-term monitoring activities to allow for future contingencies and provide flexibility to accommodate changing river conditions in the decades ahead, such as changes in fish species availability. For example, an expanded list of fish species will be sampled during baseline monitoring, including primary as well as secondary contingency species, whereas during long-term monitoring, secondary species will only be sampled if the primary species are not available.

- State-of-the-Art Analytical Methods. State-of-the-art laboratory analytical methods have been selected to carry the program forward in the decades following the sediment remedial action, and specifically, to anticipate future data needs and analytical capabilities. For example, PCBs in water will be analyzed using high-resolution gas chromatography/mass spectrometry (HRGC/MS) which provides the lowest detection limits commercially achievable at the present time.

- Control of Confounding Variables. The assessment of river recovery, as measured by decreasing water and fish contaminant concentrations, may be confounded by random

or systematic changes in other controlling variables. For example, PCB concentrations in water are affected by river flow, temperature, and turbidity, and PCB concentrations in fish are affected by fish type, age, length, and fat content. As a result, field sampling and data analysis techniques will be utilized in the Baseline and Long-Term Monitoring Programs to control for the effects of confounding variables to the extent possible, thus providing a more accurate assessment of river recovery rates and magnitudes.

- Limited Sampling for Mercury. PCBs are the primary focus of baseline monitoring activities; however, a more limited fish sampling program for mercury will also be performed. The decision to perform limited mercury sampling was based on the following considerations. The human health and ecological risks associated with mercury in the Lower Fox River are significantly lower than those for PCBs (Rectec, 2002c; see also Section 1.4.5). Recent studies of mercury speciation in the Lower Fox River indicate a large proportion of the mercury is present in a form that is not readily available to aquatic organisms (Hurley et al., 1998). Finally, the distribution of mercury in Lower Fox River sediments is indicative of complex and multiple sources, including atmospheric fallout, municipal effluent, and stormwater runoff (Retec, 2002a); such sources will complicate assessments of the effectiveness of the sediment remedial action.

- General Strategy for Sampling Locations. Post-remediation management decisions will be made on the basis of operable units. Therefore, at least one fish and one water sampling station will be allocated to each operable unit on the Lower Fox River. Areas of monitored natural recovery, specifically in OU 2 and OU 5, will receive more detailed monitoring, and therefore multiple fish and water stations have been assigned to these two areas. The rationale for selection of baseline monitoring water and fish sampling locations is summarized in Table 1-6.

Other assumptions and considerations that were instrumental in developing the details of the field monitoring plans for water and fish include the following:

- Sampling Locations in OU 1, OU 3, OU 4, and Lake Winnebago. Within these reaches of the Lower Fox River system, fish swim freely and without obstruction. Therefore, one fish sampling station is assigned to represent each one of these reaches. Similarly, one water station is assigned to the downstream boundaries of these reaches (see Table 1-6).

- Sampling Locations in OU 2. Several dams are located within OU 2 which obstruct fish migration and isolate aquatic communities. The length of OU 2 is also signifi-

cant—its length is comparable to the combined lengths of OU 1, OU 3, and OU 4 together. OU 2 contains variable habitats, flow regimes, depositional environments, land use and accessibility. Therefore three fish and three water stations are assigned to OU 2 to characterize the wide range of environments in this operable unit (see Table 1-6).

- Sampling Locations in OU 5. The length and breadth of Green Bay provides a wide range of environmental conditions, from the inner shoals near the Fox River mouth to the increasingly deeper and open-water reaches approaching Lake Michigan. Along the length of the bay, gradients in sediment, water, and fish tissue concentrations have developed. Therefore, three water stations and two fish stations are assigned to OU 5 to characterize the spatial gradients in the bay (see Table 1-6).

- Timing of Fish Sampling. Fish sampling will occur in late summer (August 15 – September 15) for a number of reasons: (1) fish lipid content, which tends to concentrate PCBs, is typically highest in late summer and early fall after heavy spring and summer feeding, and therefore fish are expected to carry some of their highest PCB burdens during that time of year; (2) recreational fishing is popular at that time of year; (3) fish spawning periods are avoided; and (4) the state conducts many of its fish sampling programs and fish population surveys during that time, allowing for coordinated field activities and data collection.

- Timing of Water Sampling. Water samples will be collected monthly throughout the year to characterize seasonal changes in PCB concentrations. Samples will be collected systematically according to evenly spaced calendar dates to provide an unbiased and representative sample of the water year. "Storm chasing" will not be practiced because such targeted sampling tends to bias annual statistics and it is difficult to ensure reproducibility of storm conditions from one monitoring year to the next.

- Human Health Fish Species. Two human health fish species (walleye and catfish) were selected based on: (1) importance and popularity of the recreational fishery; (2) representation of different habitat preferences (i.e., walleye prefer swift currents and coarse substrates, whereas catfish prefer quiescent, muddy bays); (3) ease and reliability of harvesting; and (4) broad availability throughout the Lower Fox River and Green Bay.

- Consistency with State Fish Advisory Program. The Wisconsin fish advisory program analyzes individual skin-on walleye and skin-off catfish fillets to assess human health risks associated with eating fish. The Baseline Monitoring Program utilizes

comparable procedures to monitor these index fish species for human health. In addition, the human health index species will be sampled over a range of legal and harvestable sizes.

- Ecological Fish Species. Three ecological fish species (carp, drum, and gizzard shad) were selected based on: (1) representativeness as prey for higher-order predators (i.e., fish-eating birds and mammals, as well as predatory fish); (2) representation of different habitat preferences, but with an emphasis on bottom dwellers which are more intimately associated with PCBs in sediments; (3) ease and reliability of harvesting; and (4) broad availability throughout the Lower Fox River and Green Bay. Gizzard shad are small, young forage fish that are being monitored in part because they do not carry a legacy PCB burden; these fish are expected to respond more quickly to improving water quality conditions in the Lower Fox River.

- Fish Compositing Design. Ecological fish species will be composited for analysis because bioaccumulation is caused by the cumulative effects of long-term average dietary exposures. Compositing will be performed using strict fish-length windows (typically 2-inch windows) to control for the effects of size and age on PCB concentration. To preserve site fidelity, grouping of fish into composite samples will be kept within individual operable units, or sub-units in the case of OU 2 and OU 5, and will not cross operable unit or sub-unit boundaries.

- Comparability of Background Stations. Procedures used for sampling background water and fish in Lake Winnebago will be the same as those used throughout the Lower Fox River and Green Bay to ensure comparability of data and accurate statistical comparisons.

- Location Control. Accurate sample location control is essential for ensuring quality data and reproducibility between field sampling events. More accurate and precise control is needed in the water monitoring program to locate monitoring stations and depths along the cross-section of flow. A reduced level of accuracy is appropriate for the fish monitoring program because fish are transient and migratory. Water stations will be located to within a target accuracy of two meters; fish stations will be located to within a target accuracy of ten meters.

Additional details of the water and fish monitoring plans are provided in Sections 2.1 and 2.2, respectively.

Other data inputs were considered in developing appropriate modifications to the BMP design compared to the monitoring plan as it was originally envisioned at the time the RODs

were prepared (e.g., design of a more comprehensive fish sampling program in lieu of sampling other less direct and potentially more confounded media). A description of the differences in the monitoring elements of this Plan compared to the RODs, and the rationale for these recommended changes, are described in Section 1.4.5.

1.7.4 Step 4: Define the Boundaries of the Study

The study area is bounded spatially and temporally by the terms of the ROD.

1.7.4.1 Geographic Boundaries

The study area for the baseline monitoring encompasses the following areas:

- Upstream Reference Site – Lake Winnebago
- Remedial Action Areas – OU 1 through OU 4
- Downstream Receiving Water Body – OU 5

1.7.4.2 Temporal Boundaries for Baseline Monitoring

- Water Monitoring – August 2006 through July 2007
- Fish Tissue Monitoring – August 2006 through September 2006

1.7.4.3 Temporal Boundaries for Long-Term Monitoring

According to the ROD, long-term monitoring will be conducted after remediation is completed until the RAOs are achieved. The time frame estimated by the Response Agencies for achievement of the RAOs is:

- Recreational Anglers: 10 years
- High-Intake Anglers: 30 years
- Fish-eating Birds and Mammals: 30 years

Monitoring may be terminated early if RAOs are achieved sooner than expected.

1.7.5 Step 5: Develop Decision Rules

Baseline and long-term monitoring will be conducted in accordance with the following decision rules:

1. If it can be shown with statistical significance that the Null Hypothesis is false (see Section 1.7.2), then a reduction in water column and/or fish tissue PCB (or mercury) concentrations will have been demonstrated. It is assumed that any observed reduction in water or fish tissue PCB (or mercury) concentrations, when controlled for changes in other potentially confounding variables (e.g., river flow and temperature, fish fat content), and absent any long-term trends in these variables, is primarily the result of the sediment remedial action.

2. If RAOs are achieved (i.e., fish tissue concentrations have recovered to the extent that fish consumption advisories may be lifted and ecological resources are safely protected), then the effectiveness of the remedy will be confirmed and the monitoring program will be terminated. Showing that monitored site concentrations are statistically comparable to background concentrations, as established in Lake Winnebago upstream of the Lower Fox River remediation areas, will be an alternate means of demonstrating remedy effectiveness; the details of the statistical methods used to evaluate background comparisons will be developed during 60 Percent Design.

3. If water and fish tissue concentrations are declining at a rate that indicates RAOs will be achieved within the ROD-predicted time frames, then monitoring will continue until such time as the RAOs have been achieved. If concentrations are declining at a rate that equals or exceeds expectations, revisions to the monitoring program (i.e., decreased sampling intensity) may be considered. Such revisions would be discussed in the Long-Term Monitoring Work Group.

4. If water or fish tissue concentrations are not declining, or are declining at a rate that indicates RAOs will not be achieved within the ROD-predicted time frames, then project assumptions will be reassessed (i.e., are the ROD-predicted recovery rates realistic and achievable in light of the knowledge gained during the monitoring program?). If project goals and assumptions remain valid, the data will be evaluated to determine the likely cause(s) of the delayed recovery, and whether revisions to the monitoring program (i.e., increased sampling intensity, improved characterization of ambient background conditions, etc.) should be considered. Such revisions will be discussed in the Long-Term Monitoring Work Group.

Information collected during the Baseline Monitoring Program and the forthcoming Long-Term Monitoring Program is anticipated to be adequate to make informed decisions regarding the effectiveness of natural recovery, and to determine if additional actions may be needed in areas where natural recovery is the selected remedy. Such evaluations would be performed during the CERCLA five-year reviews. More detailed decision rules associated with exit criteria will be developed as part of the 60 Percent Design.

Baseline and long-term monitoring decisions will be made at the scale of individual operable units. OU 2 and OU 5 contain multiple fish and water stations and will therefore generate data at a sub-unit level; if appropriate, the use of smaller scale decision units in these areas (i.e., sub-units) will be discussed in the Work Group. The scale of the decision units will influence data assessment and corrective action (e.g., if follow-up sampling is warranted in a second year of monitoring, it may be focused on particular OUs with higher variability and lower statistical power), data analysis (i.e., determination of concentration reduction rates and trends in the post-remediation period will be evaluated on an OU-by-OU basis), and fulfillment of long-term monitoring goals through the achievement of exit criteria and eventual termination of monitoring (i.e., some OUs may fulfill exit criteria and be removed from the

monitoring program sooner than others). Field protocols must also be designed to generate data at a scale commensurate with the scale of the decision units; for example, fish compositing groups will not cross OU or sub-OU boundaries.

1.7.6 Step 6: Specify Limits on Decision Errors

The baseline and long-term monitoring program is designed to meet the following levels of statistical confidence, power, and sensitivity:

1.7.6.1 Minimum Detectable Relative Difference (MDRD)

The specified MDRD between two consecutive monitoring rounds is 50 percent. The monitoring program should be able to detect with statistical significance a 50 percent reduction in water or fish tissue concentrations.

In response to the anticipated 90 percent reduction in average surface sediment PCB concentrations following completion of the remedial action, combined with ongoing natural recovery processes in the river and bay, order-of-magnitude reductions in water and fish tissue concentrations are expected to occur. One order-of-magnitude reduction is approximately equal to three 50-percent reductions. Therefore, an MDRD of 50 percent provides an appropriate level of sensitivity for monitoring the concentration reductions which are expected to result from the remedial action.

1.7.6.2 Statistical Confidence and Power

Reductions in water and fish tissue concentrations will be determined at the following levels of statistical significance:

- Alpha = 0.1 (90% confidence)
- Beta = 0.2 (80% power)

1.7.7 Step 7: Optimize the Design

To achieve the data quality objectives specified above, a sufficient number of water and fish tissue samples should be collected and analyzed using field and laboratory methods which provide adequate sensitivity for detection and quantitation of PCBs.

1.7.7.1 Number of Samples

The number of samples required for each monitoring round may be estimated based on the desired MDRD and level of statistical confidence and power (see Section 1.7.6.2), and an estimate of the variability of the data as measured by the coefficient of variation, or CV (Tables 1-4 and 1-5).

The power analysis follows EPA (1998, section 9.3.3):

$$N = (Z_{\alpha} + Z_{2\beta})^2 (CV/MDRD)^2$$

where [N] = number of samples, [Z_{α} and $Z_{2\beta}$] are Z statistics at the specified alpha and beta levels, [CV] is the coefficient of variation of water or fish tissue data, and [MDRD] is the minimum detectable relative difference (see Section 1.7.6.1).

The estimated sample size as a function of CV for either water or fish tissue data is provided on Figure 1-10. For comparison purposes, a range of confidence levels (alpha = 0.2, 0.1, and 0.05) is provided; however, sample size estimates are based on an alpha value of 0.1. The estimated sample sizes are based on an assumed normal distribution; as shown in Tables 1-4 and 1-5, both fish tissue data and seasonally stratified water data are reasonably described by a normal distribution.

Number of Water Samples. The CV for PCB water column data ranges from 0.37 for seasonally stratified data to 0.52 for unstratified data (Table 1-4). As shown in Table 1-7 and on Figure 1-10, these CV values correspond to estimated sample sizes of between 3 to 6 samples for each monitoring year. Therefore, monthly water column sampling should provide more than adequate confidence and power to detect a 50 percent reduction in concentration. In fact, higher levels of confidence and/or power will likely be achieved, compared to the target values listed in Section 1.7.6.2. In addition to this method of comparing mean values between successive sampling rounds, multiple regression techniques show potential for increasing the statistical power of the analysis and reducing the effects of confounding variables (LTI 2005, Appendix J). For example, based on past performance of multiple regression models for the Lower Fox River (LTI 2002), concentration reductions of 29 percent would likely be statistically significant using a monthly sampling frequency.

Number of Fish Samples. The weighted-average CV values for PCB concentrations in target fish species that were historically analyzed on an individual basis are summarized below (see also Table 1-5):

- Walleye (fillet) ~ 0.72
- Carp (whole) ~ 0.68
- White Bass (fillet) ~ 0.62
- White Sucker (whole) ~ 0.39
- Channel Catfish (skin-off fillet) ~ Insufficient Data
- Drum (whole) ~ Insufficient Data

These CV values, ranging from 0.39 to 0.72, correspond to estimated sample sizes of about 3 to 10 individual fish to achieve the desired sensitivity and statistical power. For human health species (walleye, channel catfish, and possibly bass) 15 individual fish will be analyzed at

each monitoring station. For ecological species (carp, drum, and possibly white sucker), 25 fish will be analyzed at each station (as 5 composites of 5 fish each). These numbers exceed the estimated sample size requirements; therefore, higher levels of sensitivity and/or statistical power will likely be achieved.

The CV of mercury concentrations in individual walleye fillets in OU 2 is 0.44 based on historical data (Table 1-5). Therefore, it appears mercury concentrations show comparable if not lower variability compared to PCB concentrations, and the specified number of walleye samples should be sufficient to evaluate remediation goals for mercury as well as PCBs.

In contrast to these species, gizzard shad have historically been analyzed as composite samples. The average CV for gizzard shad is 0.40, which corresponds to an estimated sample size of three composite samples (Table 1-6). Five composite samples are planned at each monitoring station. Therefore, higher levels of sensitivity and/or statistical power will likely be achieved.

Effect of Increasing Monitoring Period. The preceding statistical power calculations are based on a two-sample comparison of means between the baseline monitoring data and the first round of post-remediation monitoring data. Statistical confidence and trend discrimination (i.e., ability to detect smaller MDRD) may tend to increase with each successive monitoring round due to increasing sample size, a longer time period of record, and progressively larger concentration reductions in the river and bay, as the effects of the sediment remedial action are increasingly realized in declining water and fish tissue concentrations. However, the variance of the pooled data may also increase as the time period of record grows. As a result, two-sample comparsions will likely be supplemented with regression-based approaches after the first few rounds of post-construction data are collected (see Section 4.2.3.4).

Other Controlling Variables. The preceding statistical power calculations do not consider the effects of other controlling variables, such as the effects of temperature, flow, or suspended solids concentrations on water column PCB concentrations, or the effects of lipid content or fish size/length on fish tissue PCB concentrations. These effects are captured in the "random" variability of the existing data; however, they may be predictable to some degree using multivariate statistical techniques such as multiple regression.

Multiple regression methods will be used to evaluate the strength of the association between PCB concentrations and other controlling variables to determine if simple PCB time trend analysis may be confounded by trends in other variables. If so, then PCB trends will be estimated after controlling for covariation with controlling variables. It is expected that trend analysis of tissue concentrations will control for variation in lipid content and fish length, and trend analysis of surface water concentrations will control for variation in flow and tempera-

ture. If associations with other controlling variables are identified through multiple regression analyses these will also be incorporated into multiple variable models to adjust spatial and temporal comparisons. These procedures are described further in Appendix J (LTI, 2005).

1.7.7.2 Analytical Sensitivity

To achieve the data quality objectives for this project, the selected analytical method(s) should be sensitive enough to:

- Reasonably quantify upstream "background" concentrations in Lake Winnebago
- Reasonably quantify future PCB concentrations based on anticipated order-of-magnitude reductions
- Reasonably quantify seasonally low PCB concentrations during winter months

Water is the more difficult medium to evaluate analytical sensitivity because PCBs are extremely hydrophobic (i.e., they tend to concentrate in the fatty tissue of fish but are poorly soluble in water). The method adopted for baseline and long-term water monitoring is high-resolution gas chromatography/mass spectrometry (high-res GC/MS) PCB congener analysis using EPA Method 1668A with method detection limits (aka levels of detection) for individual congeners ranging from approximately 0.0005 to 0.003 ng/L, and reporting limits (aka levels of quantitation) ranging from 0.02 to 0.03 ng/L (see Table 2-8). The PCB congener reporting limits have been enhanced by: (1) installation of improved electronics for the mass spectrometer at the analytical laboratory; and (2) extraction of double sample volumes (two liters per sample). As a result, these reporting limits represent the "state of the art" for commercially available PCB quantitation.

Review of Existing Congener Data. Existing PCB congener data in the Lower Fox River are summarized in Appendix I. The majority of the PCB congener data have been analyzed using a GC-ECD method developed by the Wisconsin State Lab of Hygiene (WSLH method). The WSLH method is similar to SW-846 Method 8082 with the additional resolution of coeluting congeners through the use of two-dimensional chromatography. The WSLH method is not directly comparable to the high-res GC/MS method proposed for use in the baseline monitoring program due to fundamental differences in sample collection procedures (i.e., the WSLH method requires collection and field processing of large-volume, 40- to 80-liter samples), sample preparation methods, calibration protocols, analytical methods, and reporting. Therefore, existing WSLH congener data were used to help guide the design of the baseline monitoring program, but were not intended for use in long-term monitoring decisions.

More recently, duplicate samples from Lake Winnebago were analyzed for PCB congeners using the proposed high-res GC/MS method during RD sampling activities in October 2004. Lake Winnebago is the "background" location for this project, being upstream of the Lower Fox River remediation areas, and is likely to exhibit some of the lowest total PCB concentrations in the monitoring program. In the October 2004 sample, 5 congeners peaks were detected at a total PCB concentration of 0.29 ng/L, and in the duplicate sample, 7 congeners peaks were detected at a total PCB concentration of 0.44 ng/L. The detection of 5 to 7 congeners peaks in these samples is less than optimal, because some portion of the total PCB mass may be present at concentrations below the congener detection limits. An evaluation of the minimum number of detected congeners needed to achieve a reliable total PCB quantitation (currently estimated at 20 to 30 congeners) will be performed in the Long-Term Monitoring Work Group when the first few rounds of baseline monitoring data are available for review (see also Section 4.2.1.2).

Minimum Number of Detected Congeners. Water column PCB data will be expressed in terms of total PCBs, calculated as the sum of all detected congeners using zero values for undetected congeners below the method detection limit (MDL), and using estimated values between the MDL and the reporting limit (RL). Analysis of the congener composition of technical grade Aroclor 1242 (Rushneck, et al., 2004) as well as more contaminated PCB samples from the Lower Fox River, indicate approximately 90 percent of the total PCB mass is distributed among the top 20 to 30 of the most prevalent congeners out of 209 possible congeners. Therefore, the goal for this study is to detect and quantify 20 to 30 congeners in each sample, with coeluting congeners counting as a single detection, at concentrations above the MDL, and preferably above the RL. Detections of fewer numbers of congeners may tend to bias results low because some fraction of the PCB mass would be undetected or "censored". In addition, highly contaminated samples should be diluted such that 20 to 30 congeners continue to be detected in the diluted sample (see Section 4.2.1 for further discussion).

Analytical Sensitivity in Water. Existing congener data from Lake Winnebago using EPA Method 1668A indicates a large fraction of the PCB mass is likely to be captured if total PCB concentrations are at or above about 1 ng/L. In addition, further improvements in analytical sensitivity (relative to those employed during the October 2004 sampling) are expected because larger sample volumes and more sensitive electronics will be employed during the Baseline Monitoring Program. Average warm-weather PCB concentrations in the Lower Fox River range from about 7 ng/L in OU 1 to 57 ng/L in OU 4. Cold-weather concentrations during the winter months are typically a few ng/L, and concentrations in Lake Winnebago may be below 1 ng/L. Based on this preliminary analysis, Method 1668A is likely to provide adequate sensitivity during the Baseline Monitoring Program. During future post-construction monitoring events, order-of-magnitude reductions are predicted to occur

throughout much of the river. However, if PCB concentrations continue to decline in the future in Lake Winnebago and in the winter months in the Lower Fox River, regional background and cold-weather recovery trends will be more difficult to resolve. Fortunately, the winter months contribute a very small percentage of the total annual PCB load (see Section 1.5.3.4).

Analytical Sensitivity in Fish Tissue. Average PCB concentrations in fish tissue from the Lower Fox River and Green Bay range from about 0.25 to 8 mg/kg, depending on the particular species and river reach. Average mercury concentrations in fish tissue range from about 0.1 to 1 mg/kg. The reporting limits for PCBs and mercury are 0.05 mg/kg and 0.01 mg/kg, respectively (see Table 2-7). Therefore, the analytical methods are sufficiently sensitive for monitoring long-term trends in fish tissue.

1.8 Documentation and Records

Complete and accurate records of sample collection, sample analysis, quality assurance, data corrections, and data analysis will be maintained. Integrity of this information must be maintained throughout all data transfers and manipulations. Procedures used to generate, transform, and validate data are critical for effective data management. A summary of the data management procedures is provided below.

1.8.1 Data Tracking

When samples are processed and the appropriate sample identification is given, the sample tracking process will be initiated. Every sample will be tracked individually from its collection through receipt of the analytical results and final validation. The date collected, laboratory receipt, data receipt, status of data validation, and status of database entry for each sample will be tracked and recorded in a sample tracking database.

1.8.2 Electronic Data Management

Technical data, including field observations, laboratory analytical results, and analytical data validation, lend themselves to storage in a relational database structure in order to make the data suitable for query. SHAW will manage this data using EQuIS®, a third-party database application that is becoming a standard for the management of environmental data (see www.earthsoft.com). Historical analytical data stored in the Fox River Database, the current data warehouse for Fox River and Green Bay analytical data, will be available in EQuIS® format. In addition, requiring that data be provided in an EQuIS® compatible format will facilitate importing future data (see http://www.epa.gov/region5superfund/edman/download/EDD%20V1_05.pdf).

The database administrator will be responsible for uploading sample collection data into the EQuIS® database. Data received from analytical labs in EDD format, received as EQuIS® -compatible text files from laboratories, will be checked for completeness by comparing them to the sample collection form before appending them directly into the EQuIS® database, where the records will be flagged as "Unvalidated." At this point, the analytical data will be available for search and download by users of the EIMS who have been granted permission to see unvalidated data. Data will be promptly exported and transmitted to a data validator, where the appropriate quality checks will be completed, including a comparison of the electronic data against the hard copy reports received from the laboratory. Finally, the database administrator will upload updated results, including validation qualifiers received from the data validators, and will make these results available to the general EIMS user community.

In addition to analytical data, the EQuIS® database will be used to organize field observation data, including field parameter results. These data will be transcribed by field personnel into electronic files, where they will be uploaded into EQuIS® with the assistance of the database administrator. These data will then be available for data evaluation through EQuIS® exports.

1.8.3 Hard Copy Data Management

Measurements made during field data collection activities will be recorded in field logbooks and field forms. Field data will be reduced and summarized, and will be stored along with the field logbooks.

All raw analytical laboratory data are stored as the original hard copy. Hard copy information includes COC forms, analytical bench sheets, instrument printouts and chromatograms, certificates of analyses, and QA/QC report summaries.

1.8.4 Evidence File

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities. Shaw is the custodian of the evidence file and maintains the contents of the evidence files for the project, including all relevant records, reports, logs, field notebooks, pictures, contractor reports, and data reviews in a secured, limited access area under the custody of Shaw.

All records will be kept by Shaw until project completion and project closeout. As necessary, records may be transferred to an offsite records storage facility. The records storage facility must provide secure, access-controlled storage of records. Records of raw analytical laboratory data, QA data, and reports will be kept by the subcontract laboratory for a minimum of 10 years after completion of remedial action construction.

Section XXIV (Record Preservation) of the AOC governs record preservation on this project and states the following:

> *"Respondents shall preserve all records and documents which relate to implementation of the RD at Operable Units 2, 3, 4, and/or 5 for a minimum of ten (10) years following completion of Remedial Action construction. Respondents shall acquire and retain copies of all documents that relate to Remedial Design for Operable Units 2, 3, 4, and/or 5 and are in the possession of its employees, agents, accountants, contractors, or attorneys. After this 10-year period, Respondents shall notify the Response Agencies at least ninety (90) days before the documents are scheduled to be destroyed. If EPA or WDNR request that the documents be saved, Respondents shall, at no cost to the Response Agencies, give the Response Agencies the documents or copies of the documents."*

2.0 Data Generation and Acquisition

2.1 Water Quality Monitoring Plan

2.1.1 Number of Water Samples

At all water quality monitoring stations, monthly water samples will be collected for a period of one year (12 samples at each of 10 stations). Sampling may not always be possible at all stations due to unforeseen field conditions, in particular, ice cover or other severe weather restrictions during the winter months. Therefore, the "completeness" objective for the water quality sampling program will be a minimum of 7 out of 8 possible sampling events at each station during the warm weather months (April through November) and a minimum of 2 out of 4 possible sampling events at each station during the cold weather months (December through March).

2.1.2 Water Quality Monitoring Stations

In general, water monitoring stations are sited near the downstream boundaries of the OUs such that the net PCB contribution from each OU, and the effectiveness of the remedy in each OU, can be evaluated. In addition, multiple water quality monitoring stations are sited in OU 2 and OU 5 to provide more detailed coverage in monitored natural recovery areas.

Water column samples will be collected and analyzed at 1 upstream reference location in Lake Winnebago, 6 stations along the Lower Fox River (OUs 1-4), and 3 stations in Green Bay (OU 5), for a total of 10 stations.

These stations are located on Figures 2-2 through 2-9, and listed below (see also Figure 2-1 for an index map):

- *Lake Winnebago (upstream reference station).* Just above Neenah and Menasha Channels (Figure 2-2)
- *OU-1.* Downstream of LLBDM and above the first Appleton Dam (Figure 2-3)
- *OU-2.* Three sampling stations:
  - *OU-2A.* Reach between Lock 4 and Cedars Lock (Figure 2-4)
  - *OU-2B.* Reach between Lock 5 and Rapide Croche Lock (Figure 2-5)
  - *OU-2C.* Above Little Rapids Dam (Figure 2-6)
- *OU-3.* Above DePere Dam (Figure 2-7)
- *OU-4.* Near the USGS stream gage (Oil Depot gage); approximately 1,300 meters upstream from the mouth, and beyond the influence of upstream migration of bay water under seiche conditions (Figure 2-8).

- *OU-5 (Green Bay).* Three sampling stations (Figure 2-9):
  - *OU-5A.* Zone II/Zone III Boundary
  - *OU-5B.* Zone III South
  - *OU-5C.* Zone III North

Three stations have been specified for both OU 2 and OU 5 (Green Bay). Monitored natural recovery (MNR) is the selected remedy for these areas. The decision criteria for the selection of water sampling stations in OU-2 are as follows:

- *OU-2A.* To provide information in a reach of OU 2 having a steeper gradient and faster water velocities, as well as to provide information on natural recovery processes due to Deposit N removal
- *OU-2B.* To provide information in a reach of OU 2 with gentler gradients and slower water velocities (i.e., more likely to be depositional)
- *OU-2C.* To provide information on natural recovery processes due to removal of Deposit DD, and data regarding the PCB mass loading from OU 2 to OU 3

The water sampling stations in OU 5 were sited to characterize the concentration gradient in Green Bay between the mouth of the Lower Fox River and Lake Michigan.

2.1.3 Water Quality Monitoring Schedule

Sampling will be performed on a monthly basis from August 2006 through July 2007 (12 sampling events total). Sampling will be "systematic" in design, to provide representative and unbiased coverage. Specific runoff events will not be targeted but a random and representative range of flows is expected to be captured during the course of the monitoring program. Water sampling will be scheduled during the first two weeks of each month and will be performed within a seven day period, weather and field conditions permitting.

The "warm weather" monitoring months are defined to include August to November 2006, and April to July 2007 (8 months total); the completeness goal for warm weather months is to collect valid monitoring data in at least 7 out of 8 monitoring events. The "cold weather" monitoring months are defined to include December 2006 to March 2007 (4 months total); the completeness goal for cold weather months is to collect valid monitoring data in at least 2 out of 4 monitoring events.

2.1.4 Water Quality Sample Identification

Water quality samples will be coded as follows (see also Table 2-1):

AAAA-YY-MMDD

where "AAAA" is a 3 to 4 letter code that identifies the operable unit (OU1) or subunit (OU2B); "YY" is the two-digit year (e.g., -05 for 2005, -10 for 2010, etc.); and "MMDD" is the month and day of the sample collection. For example, "OU4-05-0912" is a water sample from the OU 4 station collected on September 12, 2005. This sample identification scheme is designed to sort alphabetically in time and space.

Duplicates and other quality control samples will be coded in the initial letter string (e.g. OU1D or OU2BD) in order to preserve the time stamp at the end of the name.

Each of the water quality samples is composited from six separate aliquots from different distances and depths along the channel transect, as described below (Section 2.1.5.1). Each aliquot will be labeled with a consecutive letter (A, B, C, D, E, and F) progressing from top to bottom and west to east, in the following format:

AAAA-YY-MMDD-**B**

The six aliquots will be submitted separately to the analytical laboratory for compositing.

2.1.5 Water Quality Sampling Procedures

Water quality sampling procedures are described below. Further details may be found in the accompanying SOP – Water Sample Collection (see Appendix C).

2.1.5.1 Location Control

Water quality monitoring stations will be located to within a target accuracy of 2 meters using a differential global positioning system (DGPS) calibrated to known shoreline benchmarks before and after each sampling transect. Project-specific location control requirements, calibration protocols, and quality indicators are described in the SOP *Location Control – Water Quality Monitoring* (see Appendix C).

2.1.5.2 USGS "Quarter Point" Sampling

Area-weighted composite samples will be collected on specified river transects to obtain representative samples of river discharge concentrations averaged over the cross-section of flow. Water quality sampling transects are located to the extent possible in relatively straight reaches with simple, U-shaped cross-sections, avoiding areas with shallow benches or protrusions that could cause eddies, wind waves, or other hydraulic complications. It is assumed that the flow in these sections of river is relatively uniform and well mixed. In a uniform, well-mixed cross-section, an area-weighted sampling design provides a reasonable approximation of a flow-weighted design.

Representative river transects will be sampled in general accordance with USGS procedures, similar to the sampling approach used in the Lake Michigan Mass Balance Study (USGS and Eisenreich 1993, USGS, 1998). The channel cross-sections are divided into 3 equal areas based on bathymetric data, as shown on the cross-sectional diagrams in Appendix H. Water sampling stations will be positioned at the midpoint of each of the three flow areas; the coordinates of these stations are listed in Table 2-2. Discrete water samples will be collected at 0.2 and 0.8 times the depth of the water column (i.e., 2 depths x 3 stations = 6 total subsamples). Sampling locations will be measured with a DGPS and recorded on the field sampling logs. Water depths will be determined using either a lead line or an echo sounder.

One key difference between the currently proposed sampling method and previous USGS investigations in the Lower Fox River is that previous USGS studies collected continuous large-volume samples at quarter-point locations, and in the process generated large-volume composite samples directly in the field, whereas the current method involves collection of discrete water samples at quarter-point locations and depths with subsequent compositing of these samples in the analytical laboratory. One liter bottles will be collected at each of the 6 subsampling locations/depths in a given transect. The 6 subsamples will be composited in the laboratory to represent the area-weighted PCB concentration. Samples will be collected using either a peristaltic pump or a Niskin bottle (or equivalent), depending on water depth and site conditions.

2.1.5.3 Field Parameters

The following field parameters will be measured at each of the "quarter-point" locations on each sampling transect:

- Temperature
- Turbidity

These field parameters will be monitored in continuous casts from water surface to river bed to assess water column stratification and spatial variability.

2.1.5.4 Green Bay Stratification

In OU 5 (Green Bay) surface water and deep-water layers will be composited separately to better characterize lake stratification. Water samples collected at each of the OU 5 stations (OU 5A, OU 5B, and OU 5C) will be analyzed as two 3-point composite samples (i.e., one surface-water sample and one deep-water sample composited over the three sampling locations in each cross section) rather than one 6-point composite sample as will be done in the river. The surface sampling depths will be positioned midway between the water surface and the thermocline, as determined from concurrent temperature surveys (see Section 2.1.5.2). The bottom sampling depths will be positioned midway between the thermocline and the bot-

tom of the water column. The thermocline is defined as a layer of varying depth having a sharp temperature gradient. In the absence of stratification, a surface-water sample will be collected from one meter below the surface, and a deep water sample will be collected from the mid-point of the water column.

2.2 Fish Tissue Monitoring Plan

2.2.1 Number of Fish Samples

The following number of fish samples will be collected at each sampling station (i.e., in each OU, or part of an OU):

- *Walleye and Channel Catfish (human health index species).* 15 individual fish.
- *Carp and Drum (ecological index species).* 25 individual fish, to be composited into 5 groups of 5 fish each.
- *Gizzard Shad (young forage fish).* 125 individual fish, to be composited into 5 groups of 25 fish each.

Reasonable efforts will be made to obtain these numbers of target species, according to the field decision criteria outlined in Section 3.5.2. However, if sufficient numbers of fish cannot be collected at certain sampling stations, the following minimum numbers of fish will be collected to satisfy project completeness goals, and still provide a reasonable level of statistical power (see Section 1.7.7.1):

- *Walleye and Channel Catfish (human health index species).* Minimum 8 individual fish.
- *Carp and Drum (ecological index species).* Minimum 5 individual fish, to be analyzed separately (no compositing).
- *Gizzard Shad (young forage fish).* Minimum 50 individual fish, to be composited into 5 groups of 10 fish each.

2.2.2 Fish Tissue Monitoring Stations

Fish monitoring stations include an upstream reference site (Lake Winnebago), six stations in the Lower Fox River, and two stations in Green Bay (9 stations total). One sampling station is assigned to each OU, except OU 2 which has three sampling stations and OU 5 which has two stations. Two electrofishing areas and two fyke netting areas have been designated for each station. Collection efforts will initially focus on these predetermined target areas; however, fishing locations may be added, expanded, or otherwise modified in the field based on species availability, habitat, river or bay conditions, seasonal migration patterns, or other

field conditions. Because of these variables, different species will likely be collected from different parts of the OUs.

Fish tissue monitoring stations are located on Figures 2-2 through 2-9, and listed below (see also Figure 2-1 for an index map and Appendix H for fishing "hot-spot" details):

- *Lake Winnebago* (upstream reference station) (Figure 2-2).
- *OU-1.* Little Lake Butte de Morts (Figure 2-3).
- *OU-2.* Three sampling reaches:
  - *OU-2A.* Reach between Lock 4 and Cedars Lock (Figure 2-4).
  - *OU-2B.* Reach between Lock 5 and Rapide Croche Lock (Figure 2-5).
  - *OU-2C.* Above Little Rapids Dam (Figure 2-6).
- *OU-3.* Reach above DePere Dam (Figure 2-7).
- *OU-4.* Reach from DePere Dam to at least 1,000 meters upstream from the mouth, beyond the influence of bay water (Figure 2-8).
- *OU-5.* Two sampling reaches (Figure 2-9):
  - *OU-2A.* Shallow, inner portion of Green Bay, near Lower Fox River mouth
  - *OU-2B.* PCB depositional area along eastern shore of Green Bay

2.2.3 Fish Monitoring Schedule

Fish tissue samples will be collected in late summer/early fall, between August 15 and September 15, 2006. Every fish sampling event will be target this same seasonal sampling window (i.e., August and September) during both baseline and long-term monitoring events to control for seasonal variability in the monitoring data.

2.2.4 Target Fish Species and Size Ranges

Target fish species were selected based on a number of criteria:

- Presence of fish consumption advisories
- Popular recreational fishery
- Key species evaluated in Human Health or Ecological Risk Assessments (Retec 2002c)
- Common food source for upper-level animals (i.e., fish-eating mammals, birds)
- Presence of elevated PCB concentrations in recent monitoring data (see Table 1-2; Figure 1-6)

Target fish species are summarized in Table 2-3. A total of five species will be analyzed as part of the baseline monitoring program, including three primary species and two secondary

species. It is anticipated that three species will be sufficient for monitoring during the post-remediation period. During this initial baseline program, however, two secondary or "backup" species will also be collected and analyzed to provide greater flexibility during the long-term monitoring program, i.e., in case one of the primary species is not obtainable in one or more operable units in the future.

The three primary species include:

- Walleye (human health index)
- Carp (ecological index)
- Gizzard Shad (early indication of river recovery)

The two secondary species include:

- Channel Catfish (human health index)
- Drum (ecological index)

Finally, alternate species are recommended which can be used to substitute for one of the five primary/secondary species if all five species are not obtainable at all stations during the base-line monitoring program. The following alternate species will be retained (and archived but not analyzed) if collected incidentally during the baseline monitoring effort:

- White Bass or Smallmouth Bass (human health index)
- White Sucker (ecological index)
- Emerald Shiner (early indication of river recovery)

Fish species should remain consistent, to the extent possible, between baseline and long-term monitoring events. After the baseline fish tissue data are collected, the LTMP Work Group will review the field and analytical data to determine the most appropriate species to carry forward into the long-term monitoring program.

2.2.5 Fish Tissue Sample Identification

With the exception of gizzard shad, each individual fish will be given a unique sample ID, as follows (see also Table 2-4):

LLLL-YY-SP-122

where [LLLL] is the location code describing the operable unit or subunit (OU1, OU2A, OU2B, etc.), [YY] is the two-digit year (i.e., 05 is 2005), [SP] is the species identification code (WA = walleye, CC = channel catfish, CA = carp, DR = drum, and GS = gizzard shad), [1] is a sequentially numbered fishing location/method in a given operable unit (i.e., each

fishing location and method will be assigned a sequential number so that each individual fish can be traced back to its location and method of collection), and [22] is a sequential number assigned to each individual fish. For example, OU4-05-WA-203 is the third walleye collected from the second deployment of fishing gear in OU 4 during the 2005 monitoring event.

Composite sample ID's will follow a similar convention as the ID's assigned to individual fish, except the last digits will be changed to represent a composite sample:

LLLL-YY-SP-C#

where C# represents composite samples C1 through C5.

Duplicates and other quality control samples will be coded in the initial letter string (e.g., OU1D or OU2BD).

2.2.6 Fish Sampling and Preparation Methods

Fish sampling procedures are described below. Further details may be found in the accompanying SOPs for fish tissue preparation and compositing (see Appendix E).

2.2.6.1 Location Control

The beginning, end, and turning points of fishing transects will be located to within a target accuracy of 10 meters using a global positioning system (GPS) as well as references to shoreline landmarks. Project-specific location control requirements for fish sampling activities are described in the SOP *Location Control – Electroshocking Vessel* (see Appendix C).

2.2.6.2 Fish Sampling Methods

Fish collection will be performed using various methods, as summarized in Table 2-5 (e.g., electrofishing, fyke and mini-fyke nets, trawling, set lines). Preliminary electrofishing runs and fyke net deployment locations have been located on the sampling plan maps; however, the most productive fishing techniques will be determined in the field based on field conditions at the time of sampling.

The coordinates, time, and water depth of the starting point, ending point, and turning points of each electrofishing or trawl run will be recording in field logs. Start and end times will also be marked on the hard copy print out from the echosounder. The coordinates, water depth, and time of deployment and recovery will be logged for stationary equipment such as fyke nets and set lines. Each fishing activity (i.e., each run or deployment of a particular fishing tool) will be given a sequential number for record keeping and sample identification purposes.

The following data will be recorded for every individual fish (with the exception of forage fish):

- Method of Collection
- Time of Collection
- Length
- Weight
- Abnormalities (i.e., tumors, lesions)

Because of their small size, forage fish (gizzard shad) will not be logged individually. All forage fish from a particular fishing location/method will be combined in a plastic bag and forwarded to the analytical lab for compositing.

2.2.6.3 *Compositing*

Carp, drum, and gizzard shad (species with ecological relevance) will be analyzed as composite samples; carp and drum composites will consist of 5 individuals in each composite, and gizzard shad composites will consist of 25 individuals in each composite. Similarly sized individuals will be grouped into compositing classes, typically two-inch size classes. To the extent possible, fish will be collected which are representative of the size classes listed in Table 2-3. The specific two-inch compositing classes will be determined in the field using a representative range of specimens in the target length window. Ideally, composites will be prepared for each of the five two-inch classes in the target length window. However, some compositing classes may be represented by two samples, whereas other classes may contain no samples, depending on the catch.

The Lead Fish Biologist has the responsibility for allocating fish specimens to compositing groups (see Section 1.2.1.6). The oversight agencies or their designated representatives will be notified in the event compositing classes need to be enlarged based on availability of target specimens.

Each of the fishing stations representing an operable unit or sub-unit are comprised of multiple fishing sites and fishing methods. To the extent possible, gizzard shad composites will be prepared using fish obtained from a single fishing site. Carp and drum composites, on the other hand, may be combined from multiple fishing sites; the primary consideration for these older fish is preparing composites based on a relatively narrow range of fish lengths. In no case will fish be composited across stations (i.e., across operable units, or across sub-units in OU 2 or OU 5).

2.2.6.4 Fish Tissue Preparation

Walleye will be analyzed as skin-on fillets and channel catfish will be analyzed as skin-off fillets. These species (with human health relevance) will be analyzed on an individual basis to be consistent with methods used in the State Fish Consumption Advisory Program. Species with ecological relevance (carp, drum, and gizzard shad) will be analyzed as composite samples of whole fish (see Appendix E: Biological Tissue Preparation SOP, Pace Analytical).

2.2.6.5 Tissue Archiving

Aliquots of all homogenized fish tissue samples (including both individual and composited samples) will be set aside and archived (frozen) for possible future analysis.

For human health species (i.e., walleye and channel catfish), one fillet will be analyzed and the other side will be archived. For large composited ecological species (i.e., carp and drum), each fish will be individually homogenized, then equal masses of tissue will be drawn from each individual sample to prepare the composite sample. The remainder of the individual samples will be archived for possible future analysis in case it is later determined that analysis of individual fish would be useful. For gizzard shad, a representative sample of the small fingerlings will be set aside and archived.

2.3 Sample Handling and Custody Requirements

The following sections describe the procedures for sample handling; preservation, transportation, and storage (see *Shipping and Packaging of Non-hazardous Samples* SOP in Appendix C). Sample chain-of-custody procedures are also described (see *COC Documentation* SOP in Appendix D). Copies of sample laboratory COC forms, sample labels, and custody seals are provided in Appendix D.

2.3.1 Sample Handling, Preservation, Transportation, and Storage

Table 2-6 lists the required sample containers, preservation requirements, and holding times for the specified analytical methods and sample matrices. Sample bottles will be provided by the laboratory and prepared in accordance with *The Samplers Guide to the CLP Program* (USEPA, 2001b). Sample containers will be purchased by the laboratory pre-cleaned to requirements of the USEPA Office of Solid Waste and Emergency Response Directive 9240.05A. Sample containers will be kept closed and in a cooler until used.

Vendor certificates of cleanliness for sampling supplies will be accepted and on file at the analytical laboratories. For PCB congener analysis by EPA 1668A, ultra-low level detection limits are required, and there is increased risk of cross-contamination; therefore, additional precautions are necessary. Procedures that will be implemented for tracking, lot checking,

and ensuring clean sample containers are delivered to the field crew are specified in the *Lot Checking Sample Containers SOP* (Appendix D).

2.3.1.1 Sample Packaging

Sample packaging and shipping procedures are designed to ensure that the samples and their accompanying COC will arrive at the laboratory intact. A temperature blank is required in all coolers. Packaging, marking, labeling, and shipping of samples will comply with the regulations of the U.S. Department of Transportation in 49 CFR 171-177.

Excess sample material, decontamination water, disposable equipment and supplies, and other generated wastes will be collected and properly disposed in accordance with applicable rules and regulations.

2.3.1.2 Shipping Airbills

If samples are shipped, airbills will be retained to provide a record of sample shipment to the laboratory. Completed airbills will accompany shipped samples to the laboratory and will be forwarded along with data packages. Airbills will be kept as part of the data packages in the project files.

2.3.2 Chain of Custody

Adherence to proper sample and data custody procedures is necessary to provide relevant and defensible data. Custody is addressed during field sample collection, during data analyses in the laboratory, and through proper handling of project files. Persons will have custody of samples when samples are in their physical possession, in their view after being in their possession, or in their possession and secured to prevent tampering. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

COC forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Field personnel designated as responsible for sample custody will fill out COC forms at each sampling site, at a group of sampling sites, or at the end of each day of sampling. Original COC forms will accompany samples to the laboratory, and copies will be forwarded to the project files.

2.3.2.1 Field Custody Procedures

COC forms will be required for all samples. The sample processing team will initiate COC forms. COC forms will contain the sample's unique identification number, sample date and time, sample description, sample type, preservation (if any), and analyses required. Original COC forms, signed by the field team, will accompany the samples to the laboratory. A copy of relinquished COC forms will be retained with the field documentation. COC forms will

remain with the samples at all times. Samples and signed COC forms will remain in the possession of the field team until samples are delivered to the express carrier (e.g., Federal Express), hand delivered to the laboratory, or placed in secure storage. See Appendix D for an example COC form and Appendix D for the *COC Documentation* SOP.

2.3.2.2 Laboratory Sample Receipt and Storage

Upon sample receipt, the laboratory sample custodian will verify package seals, open the packages, check temperature blanks (and record temperatures), verify sample integrity, and inspect contents against COC forms. The laboratory PM will be contacted to resolve any discrepancies between sample containers and COCs. After the shipment and COC are in agreement, the sample custodian will initiate an internal COC as well as supply the laboratory task manager with a sample acknowledgement letter. If the sample temperatures are outside the required range, the laboratory will contact the Respondent Team Project Manager or Project Coordinator to determine the proper course of action.

Samples will be logged into the Laboratory Information Management System (LIMS), which assigns a unique laboratory number to each sample. LIMS will be used by all laboratory personnel handling samples to ensure all sample information is tracked and recorded.

After the laboratory labels the samples, they will be moved to secured refrigerators where they will be maintained at 4 degrees Celsius (°C) or frozen, as appropriate. Access to refrigerators and freezers will be limited to authorized laboratory personnel.

2.4 Laboratory Analytical Methods

The analytical parameters and methods specified for water and fish tissue analysis are described in Sections 2.4.1 and 2.4.2, respectively. Different analytical methods will be used to quantify PCBs in water and fish tissue. In water, PCB congeners will be analyzed using EPA Method 1668A to achieve ultra-low level detection limits without the need for large sample volumes. Although this method differs in a number of important respects from the WSLH method of congener analysis, which was used in many of the existing water sampling programs on the Lower Fox River, it is expected to provide for more efficient sample collection and lower levels of field blank contamination, as well as substantially lower detection limits. In fish, PCB Aroclors will be extracted and analyzed using WSLH methods to ensure consistency with historical fish monitoring data and the state fish consumption advisory program.

2.4.1 Water Analysis

Twelve rounds of water column samples (once a month for a year) will be collected at ten stations, for a total of 120 samples plus quality control samples.

2.4.1.1 Analytical Parameters

All water column samples will be analyzed for the following:

- PCB Congeners (209 total) by EPA Method 1668A (high-res GC/MS)
- Total Suspended Solids (TSS) by EPA Method 160.2
- Total Organic Carbon (TOC/DOC) by EPA Method 415.1

2.4.1.2 Methods and Reporting Limits

Analytical methods and reporting limits for water analysis are summarized in Table 2-7. Estimated detection limits (EDL) and reporting limits for PCB congeners by Method 1668A are listed in Table 2-8. Sample containers, holding times, and preservation requirements are listed in Table 2-6.

2.4.2 Fish Tissue Analysis

For human health indicator species (walleye and channel catfish), fifteen individual specimens will be analyzed from nine different stations, for a total of 135 analyses for each species. For ecological indicator species (carp, drum, gizzard shad), five composite samples will be analyzed from nine different stations, for a total of 45 analyses for each species. Altogether, considering the sum of all replicates, stations, and species, 405 samples of fish tissue will be analyzed, plus quality control samples.

2.4.2.1 Analytical Parameters

To ensure consistency with past monitoring data, analytical methods will follow procedures used by the Wisconsin State Lab of Hygiene (WSLH) to the extent possible. Fish tissue samples will be analyzed according to the following methods:

- Tissue Extraction by WSLH Method
- PCB Aroclors by EPA Method 8082
- Lipid Content (Randall et al., 1991; see Appendix E)

In addition, walleye samples from Lake Winnebago and Station OU 2C will be analyzed for:

- Mercury by EPA Method 7471

2.4.2.2 Methods and Reporting Limits

Analytical methods and reporting limits for tissue analysis are summarized in Table 2-7. Sample containers, holding times, and preservation requirements are listed in Table 2-6.

2.4.3 Estimated Values below Reporting Limit

Values reported above the method detection limit but below the reporting limit (also known as the limit of quantitation) will be reported by the laboratories as estimated with a "J" qualifier to indicate that the reported value is less accurate in this region of measurement.

Matrix effects should be considered in assessing the laboratory's compliance with method detection limits and reporting limits. The laboratory will provide a detailed discussion of all failures to meet sensitivity specifications in the data package narrative. If a sample dilution results in non-detected values for analytes that had been detected in the original analysis, the results of the original run and the dilution will be reported with the appropriate notations in the case narrative.

2.5 Quality Control Requirements

The overall QA objectives for this project are to collect data of a known and high level of quality through the specification and implementation of quality control procedures during field sampling, sample handling, laboratory analysis, and data management.

Field sampling locations must be determined to within known accuracy specifications. Water quality monitoring stations will be located to a target accuracy of within 2 meters using a differential global positioning system (DGPS) calibrated to known shoreline benchmarks before and after each sampling transect. The beginning, end, and turning points of fishing transects will be located to a target accuracy of within 10 meters using a global positioning system (GPS) as well as references to shoreline landmarks. Project-specific location control requirements, calibration protocols, and quality indicators are described in the SOPs *Location Control – Water Quality Monitoring* and *Location Control – Electroshocking Vessel* (see Appendix C).

Analytical specifications, reporting limits, quality control procedures, assessment criteria, and corrective actions are summarized in the following tables:

- *Table 2-7.* Laboratory Analytical Methods and Reporting Limits
- *Table 2-8.* PCB Congener Reporting Limits
- *Table 2-9.* Quality Control Procedures, Criteria, and Corrective Actions—PCB Aroclors, Mercury, and Conventionals
- *Table 2-10.* Quality Control Procedures, Criteria, and Corrective Actions—PCB Congeners

The quality assurance program is designed to generate data of known and acceptable precision, accuracy, representativeness, comparability, and completeness, as described below.

2.5.1 Precision

Precision is a measure of reproducibility of sample results. All work for site actions will adhere to established protocols presented in this Plan. Checks for field and analytical precision will include the analysis of MS and MSDs, field duplicates/triplicates (water), and field replicates (fish).

To provide an overall assessment of the field and analytical precision associated with PCB congener analysis, triplicate samples will be collected and analyzed at two monitoring stations during two rounds of baseline monitoring. Triplicate samples will be collected at the Lake Winnebago (upstream background) and OU 4 monitoring stations, providing an assessment of precision over the range of PCB concentrations expected in the Lower Fox River. During all other monitoring rounds, one duplicate sample will be collected randomly from one of the ten water quality monitoring stations.

Field replicate samples will be collected and prepared for both individual and composite samples of fish, as indicated in Table 2-4. For those species analyzed on an individual basis (i.e., walleye and channel catfish), a pair of fish specimens from the same haul, and nearly identical in size (i.e., within one inch in length), will be designated as a primary specimen and a replicate specimen. For those species analyzed on a composited basis (i.e., carp, drum, and gizzard shad), a replicate composite grouping will be prepared from a second group of fish in the same size class. For carp and drum, replicate composite groups may be prepared from multiple hauls. For gizzard shad, replicate composite groups should be prepared from the same haul as the original sample, to the extent possible.

Field duplicate, triplicate, and replicate data will be evaluated in the LTMP Work Group. If significant discrepancies are evident in field duplicate, triplicate, or replicate results, the field documentation will be reviewed to determine whether the discrepancies are potentially caused by field sampling error or alternatively, natural heterogeneities in environmental media which are beyond the control of the sampling crew. Note that it may not always be possible to differentiate these two potential sources of sampling variability. Appropriate response actions, if warranted, will be discussed in the LTMP Work Group.

2.5.2 Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, internal standards, MSs, blank samples, LCS, and surrogate standards will be used to assess the accuracy of the analytical data.

Accuracy will be calculated in terms of percent recovery, as follows:

$$\%\text{Recovery} = \frac{(A-X)}{B} \times 100$$

where:

A = Value measured in spiked sample or standard

X = Value measured in original sample

B = True value of amount added to sample or true value of standard

This formula uses an assumption of constant accuracy between the original and spiked measurements.

2.5.3 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions. Representativeness is dependent on sampling and analytical variability and the variability of environmental media at the site.

2.5.3.1 Representativeness in Space

Accurate and precise location control is critical for obtaining representative samples (see Appendix C: Location Control SOP). In addition, representativeness of water samples will be achieved through the use of modified USGS "quarter-point" sampling procedures which provide systematic characterization of water quality over the depth and across the width of the river. Representativeness will be further assessed by analyzing the spatial variability of field parameter measurements at the time of sample collection.

Representativeness of fish samples will be achieved by collecting specimens from a range of sizes and a cross-section of habitats which are frequented by the target fish species in the various operable units of the Lower Fox River. Because fish are migratory, they provide spatial integration of contaminant exposures over the extent of their home range. Each fish sampling station will consist of specimens collected at four or more separate fishing sites, and using at least two types of fishing techniques (electroshocking and netting). Collecting specimens from multiple fishing sites helps to provide representative geographic coverage of particular river reaches or bay areas. Using different and complementary fishing techniques helps to minimize the potential for field sampling bias (i.e., potential for one type of fishing gear to preferentially sample particular species or sizes).

Numerous sources of data exist to evaluate the degree of spatial homogeneity or heterogeneity within an operable unit. In all cases, human health target species will be analyzed individually, thus providing point-specific concentration data; only ecological species will be composited. To the extent possible, gizzard shad will be composited from within a particular

fishing site (i.e., each fish station is comprised of at least four fishing sites). Finally, OU 2 and OU 5 will be characterized by multiple fish stations in sub-units of the operable units (OU 2A, 2B, and 2C; OU 5A and 5B); compositing groups will be formed within individual sub-units and will not cross sub-unit boundaries.

2.5.3.2 Representativeness in Time

Representativeness of water samples will be achieved through the use of systematic monthly sampling over the course of an entire year. Representativeness of fish samples will be achieved by targeting a late summer (August 15 – September 15) sampling window, as recommended by EPA (2000), and maintaining this same sampling window throughout all baseline and long-term monitoring events to minimize seasonal variability in fish lipid content and contaminant levels.

2.5.4 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Internal consistency will be achieved by occupying the same sampling stations and performing the same field and analytical methods in baseline monitoring and all long-term monitoring events. Quantitative statistical analysis of monitoring data will be performed using only data collected in accordance with this Baseline Monitoring Plan and forthcoming Long-Term Monitoring Plan. Internal consistency between baseline and long-term monitoring events will be ensured by:

- Occupying the same water monitoring stations and the same general fishing areas during all baseline and long-term monitoring events
- Utilizing the same field sampling and analytical techniques during all monitoring events
- Collecting water data according to the same sampling schedule during all monitoring events (i.e., monthly water sampling for one year)
- Adhering to a fish sampling window between August 15 and September 15 during all monitoring events to minimize seasonal variations in tissue concentrations

Historical data will be used in a more qualitative than quantitative manner because monitoring stations, field and analytical methods specified in this Plan are not always comparable to those used in historical studies of the Lower Fox River and Green Bay. Comparability with historical data will need to be determined on a case-by-case basis. Comparability issues may arise due to station positioning methods, sampling and processing methods, analytical methods, and the level of data quality review.

Comparability with past and ongoing studies will be optimized by:

- Utilizing sample preparation and analytical methods which are comparable to past and ongoing studies, to the extent possible (e.g., use of WSLH fish tissue extraction and tissue analysis methods)
- Occupying sampling stations which are coincident with stations occupied during past and ongoing studies to the extent possible (e.g., collocation with the USGS Oil Depot station at the mouth of the Lower Fox River)
- Collecting fish species (e.g., walleye, carp, gizzard shad) that have been routinely collected in past monitoring studies, to the extent possible

2.5.5 Completeness

The data completeness of field and laboratory results will be assessed for compliance with the amount of data required for decision-making. Complete data are data that were collected and analyzed as planned and not rejected during the validation process. Data qualified with qualifiers such as "J" are still deemed acceptable and can still be used to make project decisions (Appendix B).

The completeness of the analytical data is calculated using the following equation:

$$\% \text{ Completeness} = [(\# \text{ Valid Sample Results}) / (\# \text{ Samples Collected})] \times 100$$

The overall completeness goal for the laboratory is 90 percent. All valid and usable data must have accompanying location control and field documentation.

Completeness is also measured in the field. For example, some samples may be lost, certain fish species may be sparse or unavailable in particular river reaches, and water sampling may be precluded in winter months at one or more stations because of unstable ice cover or other severe weather safety issues.

The completeness of the field data is calculated using the following equation:

$$\% \text{ Completeness} = [(\# \text{ Samples Collected}) / (\# \text{ Samples Planned})] \times 100$$

The overall completeness goal for the water column sampling program is collection of valid water samples in at least 7 out of 8 "warm weather" months (i.e., 88 percent) and at least 2 out of 4 "cold weather" months (i.e., 50 percent) (see Section 2.1.3). The overall completeness goal for human health fish species is collection of 8 out of 15 specimens at a given sampling station (i.e., 53 percent). The overall completeness goal for ecological fish species is collection of 5 individual fish as opposed to 5 composites of 5 fish each (i.e., 20 percent of the individuals, and 100 percent of the laboratory analyses). These reduced numbers of sam-

ples should still provide sufficient statistical power to assess progress toward meeting RAOs, as discussed in Section 1.7.7. If completeness goals are not met for water, additional sampling may be required; if completeness goals are not met for fish, alternate species may need to be collected and analyzed. In the event completeness goals are not met for water or fish, appropriate contingency actions are described in Sections 3.5.1 and 3.5.2, respectively.

2.6 Instrument Testing, Inspection and Maintenance

2.6.1 Field Instruments Calibration

Field instruments will be calibrated daily in accordance with manufacturers' specifications before the beginning of sampling activities (see Appendix C: Water Quality Meter SOP). Standards used to calibrate the field instruments will be traceable to the standards of the National Institute of Standards and Technology whenever possible. The DGPS system will be checked against known benchmarks before and after each water sampling transect. Project-specific location control requirements, calibration protocols, and quality indicators are described in the SOPs *Location Control – Water Quality Monitoring* and *Location Control – Electroshocking Vessel* (see Appendix C).

2.6.2 Laboratory Instruments Calibration

Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit. The frequency and QC limits for the analytical instrument calibrations are located in Appendix E.

2.7 Data Management

2.7.1 Field Documentation

2.7.1.1 Field Logbooks

Field logbook entries will be described in as much detail as possible so that persons going to the site could reconstruct a particular situation without reliance on memory. Modifications to field sampling protocols must be documented in the field logbook. The Field Supervisor is responsible for ensuring that modifications to sampling protocols are documented in the field logbook (see Appendix C: Field Logbook SOP).

2.7.1.2 Field Forms

Additional information may be recorded on separate field forms and referenced in the field notebook (see Appendix C: Field Logsheet SOP). Shaw/Anchor field team members will manage the raw data during field activities. Periodically, The QAM will collect and compile the field data to maintain a current summary of field activities and results. All forms MUST include the project name, OU, date and time, sample location and sample number(s), and

name and signature of the person completing the form. Examples of standardized field forms that will be used on this project include the following:

- Field Change Request (FCR) Form (Appendix C)
- Other Forms (Appendix C.)
- COC Form. (Appendix D: COC Documentation SOP)

As a component of the communication of necessary modifications of the project design or the sampling strategy, a copy of the FCR form will be sent to the Shaw Project Coordinator, as well as the WDNR PM, and the USEPA Project Coordinator.

2.7.1.3 Photographs

Photographs will be taken to document field activities when required. Hard copy photographs will be stored in the project file. After the photograph is developed, the information recorded in the field notebook will be transferred to the back of each picture. The information that will be recorded includes:

- Name of person taking the picture
- Film roll number and sequential number of the photograph
- Date and time photograph was taken
- Location and direction toward which the photograph was taken
- Description of the photograph

Digital photograph files will be downloaded from the camera to the project directory on the Shaw server and the information listed above will be linked to each photograph.

2.7.2 Laboratory Documentation

2.7.2.1 Laboratory Logbooks

Workbooks, bench sheets, instrument logbooks, and instrument printouts will be used to trace the history of samples through the analytical process and document important aspects of the work, including associated quality controls. As such, all logbooks, bench sheets, instrument logs, and instrument printouts will be part of the permanent record of the laboratory. In addition, relevant information will be entered into the LIMS at the time information is generated.

Each page or entry will be dated and initialed by the analyst at the time of entry. Errors in entry will be crossed out in indelible ink with a single stroke, corrected without obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Lining out unused portions and initialing by the person lining out the page will complete pages of logbooks that are not used.

The analyst will record information about the sample, analytical procedures performed, and results on laboratory forms or personal notebook pages and enter this information in LIMS. These notes will be dated and will also identify the analyst; instruments used, and instrument conditions.

Sufficient raw data records must be retained to permit reconstruction of initial instrument calibrations (e.g., calibration date, test method, instrument, analysis date, each analyte name, concentrations and responses, calibration curves, response factors, or unique equations or coefficients used to reduce instrument responses into concentrations).

Laboratory notebooks will be reviewed periodically by the laboratory group leaders for accuracy, completeness, and compliance with the requirements of this Plan. The laboratory group leader will verify all entries and calculations. If all entries on the pages are correct, the laboratory group leader will initial and date the pages. Corrective action will be taken for incorrect entries before the laboratory group leader signs.

2.7.2.2 Laboratory Project File

In accordance with subcontract laboratory's records information management, documentation will be placed in secured project files which will be maintained by the laboratory records manager (see Appendix E). These files will consist of the following components:

- Agreements
- Correspondence
- Memos
- Notes and data

Filed materials may only be removed by authorized personnel on a temporary basis. The name of the person removing the file will be recorded. Laboratories will retain project files and data packages for a minimum of 10 years unless otherwise agreed upon.

2.7.2.3 Electronic Data Storage

The analytical laboratories Pace and STL will provide the full data package, including chromatograms and all raw data, in pdf format on a CD-ROM. These electronic data will be archived in project files for the duration of the monitoring program. Laboratory instrument files and instrument software will be archived at the analytical laboratories for a minimum of ten years, which surpasses the NELAC standard for data storage. The laboratory will provide notice to the Analytical QA Manager or Project Coordinator before purging any instrument files or instrument software at the end of the archiving period.

2.7.3 Data Reporting

For the purposes of the baseline monitoring, two levels of data reporting have been defined. They are as follows:

- *Field Screening Data.* Field Data and Health and Safety Reporting: This level of minimal or "results only" reporting is used for the field data recording and health and safety monitoring. This type of reporting does not generate or require extensive supporting documentation.
- *Laboratory Analytical Data*: Full "contract laboratory program (CLP)-equivalent" reporting is required for all water and fish tissue analyses. Analytical results must include, at a minimum, the elements listed in Sections 2.4 and 2.5.

2.7.3.1 Field Data Reporting

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks, data sheets, and/or forms and then entered into an electronic data log. Data will be reviewed by the Field Supervisor for adherence to the requirements of this Plan. Any concerns identified as a result of this review will be discussed with the QAM, corrected if possible, and incorporated into the data evaluation process.

Field data calculations, transfers, and interpretations will be conducted by the field team and reviewed for accuracy by the Field Supervisor. The appropriate task manager will review field documentation, data reduction, and accuracy of data entries into the data log. The data logs and documents will be checked for the following:

- General completeness and readability
- Use of appropriate procedures and modifications
- Instrument calibration and maintenance records (as appropriate)
- Reasonability of data collected
- Correctness of sample locations
- Correctness of reporting units, calculations, and interpretations

Where appropriate, field data forms and calculations will be processed and included in appendices to the appropriate report. Original field logs, documents, and data reductions will be kept in the project file.

2.7.3.2 Laboratory Data Reporting

Calculations to be used for data reduction are specified in the referenced analytical methods.

Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system. Raw data will be stored electronically and a hard copy file will be

maintained. Laboratory data entered will be sufficient to document information used to arrive at reported values.

Electronic data storage will be utilized when possible. All electronic data will be maintained in a manner that prevents inadvertent loss, corruption, and inappropriate alteration. Per the requirements of the AOC, electronic data will be accessible and retrievable for a period of 10 years after project completion and the Response Agencies will be notified prior to destruction of a data files (USEPA, 2004).

Raw data will be examined to assess compliance with QC guidelines. Surrogate, MS, and QC check sample recoveries will be checked. In addition, samples and laboratory blanks will be checked for possible contamination or interferences. Chromatograms and concentrations will be checked to ensure that sample results are within the calibration range; if necessary, dilutions will be performed when the sample concentration of a constituent exceeds the initial calibration range of instrument.

Deviations from guidelines will call for corrective action. Deviations determined to be caused by factors outside the laboratory's control, such as matrix interference, will be noted with an explanation in the report narrative. Calculations will be checked and the report reviewed for errors and oversights.

Upon completion, a report will be reviewed for discrepancies, errors, or omissions. Data will then be submitted to the laboratory PM for review and approval. The laboratory PM will review the package, conduct a forms review on 100 percent of definitive data, and ensure that any necessary corrections are made and that the package is complete. A copy of the data package will be filed in the project file. Mailed data packages, along with applicable electronic data deliverables (EDD), will be sealed in an appropriate shipping container and logged into a document mailing log. Data packages will be made available, upon request, to the WDNR.

Data reports for all parameters will include, at a minimum, the following items:

Case Narrative. Summary of activities that took place during the course of sample analysis, including the following information:

- Laboratory name and address
- Date of sample receipt
- Laboratory ID number cross-referenced to contractor ID number.
- Analytical methods used
- Deviations from specified protocol, if any
- Corrective actions taken

- Sample handling documents including; field and internal COC forms, air bills, or bills of lading from couriers

Chemical Analytical Results. The following information, as applicable, will be reported with the analytical results:

- Sample results with laboratory sample identification, client sample identification, and station identification
- Detection and reporting limits
- Extraction and analysis times
- Sample volume
- Percent moisture
- Dilution factor
- Surrogate recovery
- LCS/LCD accuracy and precision summary
- MS/MSD accuracy and precision summary
- Method blank summary
- Initial calibration summary–including concentration levels, retention times, response factors, and linearity demonstration
- Calibration blank summary
- Continuing calibration summary–including unique instrument/column identification, retention times, retention time windows, calibration factors, percent difference, or drift as appropriate to method
- Internal standard recoveries
- Degradation summary
- Analytical sequence
- Compound identification summary

2.7.3.3 Electronic Data Deliverable (EDD) Format

One EQuIS® -compatible EDD file will be generated by the laboratory for every sample delivery group (SDG). These files will be incorporated into the Fox River Database/ Environmental Information Management System (EIMS). Each file will be named "*.txt," where "*" represents the batch SDG number. The EDD format and requirements are contained in Appendix F. The USEPA Region 5 valid value list will be used for field and parameter names (see http://www.epa.gov/region5superfund/edman/download/EDD%20V1_05.pdf).

3.0 Assessment and Oversight

Assessment and oversight activities are performed to determine whether the quality control measures identified in this Baseline Monitoring Plan are implemented and documented as required. The Project Coordinator, Project Manager, and Field Supervisor will perform assessment and oversight to check conformance to plans. For example, during a review, the Field Supervisor may check that a sample has been processed and labeled correctly or that the field QC samples were collected at the appropriate frequency. The need for a check can be determined independently by the Project Coordinator or Project Manager, or assigned by these persons to another team member.

Response Agency oversight activities may be performed by USEPA and WDNR. At all reasonable times, USEPA and WDNR personnel and their authorized representatives shall have the authority to enter and freely move about all on-site and off-site areas where work, if any, is being performed, for the purposes of inspecting conditions, activities, the results of activities, records, operating logs, field notes, and data related to these monitoring activities, provided project health and safety requirements are followed.

Aspects of the Baseline Monitoring Program will be adaptively managed through the Long-Term Monitoring Plan Work Group (LTMP Work Group), whose members include the Respondents, Response Agencies (WDNR and USEPA), and other participating agencies. Using an adaptive management approach, information collected during the early stages of the monitoring program may be used to guide or improve the performance of later field tasks. LTMP Work Group meetings will provide a forum for the Respondents and Response Agencies to discuss monitoring progress, preliminary results, problems encountered, if any, and recommended modifications to field or analytical procedures.

3.1 Field Audits

Planning, scheduling, and conducting QA audits and surveillance are required to verify that site activities are being performed efficiently in conformance with approved plans, standards, federal and state regulatory requirements, sound scientific practices, and contractual requirements. Planned and scheduled audits may be performed to verify compliance with aspects of the QA program and to evaluate the effectiveness of the QA program. Audits include an objective examination of work areas, activities, processes, review of documents and records, interviews with project personnel, and review of plans and standards.

Internal review of the sampling program will be conducted on a regular basis during the field activities. Reviewers will pay particular attention to the sampling program with respect to

representativeness, comparability, and completeness of the specific measurement parameters involved.

Field documentation (e.g., COC forms, field sampling forms, and logbooks) will be reviewed as it is generated, by the Field Supervisor or designee, for accuracy, completeness, and compliance with the requirements of this Plan. The Field Quality Assurance Manager, Project Manager, or Project Coordinator will audit field sampling procedures periodically for compliance with Plan procedures. The auditor will check that the following items have been addressed:

- Sampling protocols are being followed.
- Samples are placed in proper containers.
- Samples are stored and transported properly.
- Field documentation is completed.

Internal field audits will be conducted by the individuals listed above at the beginning of each new field activity (i.e., fish sampling in river and bay; water sampling in cold and warm weather) and during a significant crew change (i.e., replacement of Field Supervisor). Additional field audits may be conducted on an as-needed basis if potential data quality issues are identified by field staff or during senior review of field reports and field documentation.

In addition to internal field audits, the USEPA and WDNR oversight team may also conduct field audits. Corrective action shall be performed as provided in Section 3.4 of this Plan.

3.2 Laboratory Audits

The laboratory QAM may conduct internal system audits. An internal audit is a qualitative evaluation of all components of the laboratory QC measurement system. The audit serves to determine whether measurement systems are being used appropriately. The system audits are conducted to evaluate the following:

1. Sample handling procedures
2. Calibration procedures
3. Analytical procedures
4. QC results
5. Safety procedures
6. Recordkeeping procedures
7. Timeliness of analysis and reporting

In addition, laboratories are subject to external audits. The focus of these audits is to assess general laboratory practices and conformance to the requirements of this Plan. Laboratory

audits may be performed prior to the start of analyses for this project and at any time during the course of the project as deemed necessary.

The laboratory QAM will review internal laboratory performance. The laboratory QAM will evaluate laboratory precision and accuracy by comparing results of duplicate samples, QC samples, spikes, and blanks. When a beyond-control limit situation is encountered, analytical results are checked by the laboratory manager or other client services individual prior to distribution.

External reviews of laboratory performance may also be conducted based on evaluation of the results of check samples analyzed as part of the USEPA and/or Wisconsin state certification requirements. In addition, performance audits may be conducted by sending double-blind performance evaluation samples (samples that are not discernable from routine field samples) to the analytical laboratory.

The USEPA and WDNR may also perform laboratory audits in addition to routine certification audits or performance evaluation sample results. Any discrepancies will be remedied as described in this Plan.

3.3 Reports to Management

Requirements for progress reports and communications with WDNR and USEPA are detailed in the AOC. Monthly progress reports are to be submitted to the WDNR and USEPA Project Coordinators. Conference calls or meetings are to take place between the WDNR, USEPA, Oversight Contractors (Boldt and NRT), G-P, NCR, Shaw Project Coordinator, and Anchor Technical Director twice a month.

At least 15 days of notice shall be given to the WDNR and USEPA Project Coordinators prior to beginning sampling.

3.4 Corrective Actions

3.4.1 Field Corrective Action

Any project team member may initiate a field corrective action process. The corrective action process consists of identifying a problem, acting to eliminate the problem, monitoring the effectiveness of the corrective action, verifying that the problem has been eliminated, and documenting the corrective action.

Corrective actions include correcting COC forms; correcting problems associated with sample collection, packaging, shipping, or field record keeping; or additional training in sampling and analysis. Additional approaches may include re-sampling or evaluating and amending sampling procedures. The Field Supervisor will summarize the problem, establish

possible causes, and designate the person responsible for a corrective action. The Field Supervisor will verify that the initial action has been taken, that it appears to be effective, and then follow up at a later date to verify that the problem has been resolved.

Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformances or suspected deficiencies by reporting the situation to the Field Supervisor. The Field Supervisor will assess suspected problems in consultation with the Project Coordinator, Project Manager, and/or Quality Assurance Manager, as appropriate, and reach a coordinated decision based on the potential for the situation to impact data quality. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, a nonconformance report will be initiated by the Field Supervisor.

3.4.2 Stop Work Order

The Project Coordinator has the authority to stop work based on quality control, health and safety, or other serious deficiencies that may compromise the integrity of the Baseline Monitoring Program. The decision to stop work will be determined on a case-by-case basis in consultation with the Project Manager, Field Quality Assurance Manager, Field Supervisor, and as appropriate, the WDNR Project Coordinator and USEPA Remedial Project Manager. Stop work decisions may also be made on the basis of hazardous field conditions by the Field Supervisor, Corporate H&S Manager and/or the boat captain.

3.4.3 Laboratory Corrective Action

Corrective actions may be required for two classes of problems: analytical/equipment problems and noncompliance problems. Analytical/equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, or data review.

For noncompliance problems, a corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the proper project member. If the problem is analytical in nature, information on these problems will be communicated to the laboratory QAM, who will in turn direct information to proper project members. Implementation of corrective action will be confirmed through similar channels.

Implementation of all corrective actions will be documented. No staff member will initiate corrective action without prior communication of action needing correction and proposed corrective action through the proper channels. If corrective actions are insufficient, the Project Coordinator or the QAM may stop work by issuing a stop-work order.

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the

event. Laboratory personnel are alerted that corrective actions may be necessary if the following situations occur:

- QC data are outside the warning or acceptable windows for precision and accuracy
- Blanks contain target analytes above acceptable levels (Tables 2-9 and 2-10)
- Undesirable trends are detected in spike recoveries or RPD between duplicates
- Unusual changes in detection limits occur
- Deficiencies are detected by the laboratory QAM during internal or external audits or from results of performance evaluation samples
- Inquiries concerning data quality are received

Corrective action procedures are often handled at the bench level by the analyst, who reviews preparation or extraction procedures for possible errors, and checks instrument calibrations, spike and calibration mixes, and instrument sensitivity. If problems persist or cannot be identified, matters are referred to the laboratory supervisor, laboratory PM, and/or laboratory QAM for further investigation. Full documentation of the corrective action procedures is filed with the laboratory QAM after approval by Shaw/Anchor. Corrective action may include the following:

- Re-analyzing the samples, if sample or extract volume is adequate and holding time criteria permits
- Performance of additional cleanup steps
- Re-sampling and analyzing
- Evaluating and amending sampling procedures
- Evaluating and amending analytical procedures
- Accepting data and acknowledging the level of uncertainty

If re-sampling is deemed necessary due to laboratory problems, the Respondent Team's Project Coordinator must identify the appropriate approach, including cost recovery from the laboratory for the additional sampling effort.

If either a field or laboratory corrective action results in a change or modification to the procedures defined in this Plan, review and approval by the WDNR and USEPA may be required prior to implementing procedural modifications.

3.5 Field Contingency Plans

3.5.1 Water Sampling Contingency Plan

It is possible that ice cover, severe weather conditions, or other safety concerns will preclude water sampling at one or more locations, especially during the winter months of December through March. Water sampling will be targeted for the first two weeks of each month. If severe weather or other field conditions delay sampling, sampling will be performed as soon as possible during the month. If sampling cannot be completed at all during the month, the monthly sampling event will be lost.

The overall completeness goal for the water column sampling program is collection of valid water samples in at least 7 out of 8 "warm weather" months and at least 2 out of 4 "cold weather" months (see also Section 2.1.3). If this completeness goal is not met, the deficiency will be presented to the LTMP Work Group, and an appropriate corrective action will be determined. Corrective action may include:

- Acceptance of fewer than the required number of sampling events at certain stations to represent baseline conditions
- Assignment of two sampling events in one month to make up for the deficiency
- Extension of the monitoring program into the following year

3.5.2 Fish Sampling Contingency Plan

It is possible that a sufficient number of appropriately sized, primary and secondary fish species will not be obtainable during the August 15 though September 15 sampling period. This section and Figure 3-1 describe the steps that will be taken to optimize collection efforts during the sampling period, as well as a field decision framework that will be followed to ensure that the most comparable and representative samples are obtained during baseline as well as future monitoring events.

At the outset of the sampling effort, three days will be allocated for collection at each station. Fyke nets will be deployed upon arrival at the station and checked at regular intervals. Electrofishing will be conducted concurrently with net deployment at the primary and secondary fishing locations as shown on Figures 2-2 through 2-9. Fishing methods and locations will be modified as necessary to target the remaining species and sizes needed at each station. All primary, secondary, and alternate species that are within the specified size ranges, as well as two inches shorter or two inches longer than the specified size ranges will be collected and archived in the event that all target species and sizes are not obtainable.

The sampling crew will move to the next station as soon as the requisite species and sizes have been collected or after three days are spent at the station. The sampling crew will com-

plete the circuit of eight stations in this manner. If some stations still lack the full complement of target species and sizes, then a field contingency strategy will be implemented, as described below, to guide follow-up sampling efforts.

1. *Resample Incomplete Stations.* Once the circuit of eight fishing stations has been completed, the sampling crew will circle back and resample any stations where additional species and/or sizes are needed. The remaining number of available sampling days will be allocated among the remaining incomplete stations, and the sampling crew will continue to collect fish at each station until the requisite numbers of species are collected or the allotted number of sampling days have been exhausted. It is estimated that an additional one or two days will be allocated to the incomplete stations.

2. *Expand Target Size Ranges.* If all sizes and species have not been collected after the second attempt, the target size ranges will be expanded plus or minus two inches to achieve the requisite numbers of fish to prepare the individual and composite samples.

3. *Reduce Sample Sizes.* If the requisite numbers of fish cannot be achieved even after expanding the target size ranges, then fewer numbers of fish will be provided to the laboratory for individual analysis for human health species, and fewer fish will be used to prepare the composites for ecological species. Sampling will be considered complete if eight or more fish are obtained for each human health species, at least one fish is obtained for each of the five composites for ecological species, and at least 10 gizzard shad are obtained for each forage fish composite.

4. *Use Alternate Species.* If there are still insufficient numbers of a target fish species, consideration will be given to the use of alternate species that were collected and archived at the site. Alternate human health, ecological, and forage fish species are described in Section 2.2.4.

3.6 Assessment of Sample Size Adequacy

The statistical power of the first year of water and fish monitoring data will be evaluated and compared to the statistical assumptions that were originally used to estimate sample sizes. If the power of the data is significantly lower than expected (i.e., coefficient of variation is significantly higher than expected), additional samples may be necessary to increase our ability to detect concentration reductions and trends during long-term monitoring. If the statistical power objectives are not met, the need for additional sampling would be discussed in the LTMP Work Group. If it were to occur, it is expected that a second year of monitoring would be a reduced level of effort compared to the first year, and focused on key data gaps, for example, particular operable units, water seasons, or index species.

The need for and timing of any follow-on baseline monitoring activities will need to consider the potential impacts of ongoing remedial actions in OU 1 as well as the upcoming Phase I removal action in the head of OU 4, which is currently scheduled for April-May 2007.

4.0 Data Validation and Usability

Data validation is the process by which data generated in support of this project are evaluated according to the QA/QC requirements of this Baseline Monitoring Plan. The data are evaluated for precision and accuracy against the analytical protocol requirements. Nonconformance or deficiencies that could affect the precision or accuracy of the reported result are identified and noted. The effect on the result is then considered when assessing whether the result is sufficient to achieve project DQOs.

4.1 Data Review and Validation

The data validation process is conducted to assess the effect of the overall sampling and analysis process on the usability of the data. There are two areas of review: laboratory performance evaluation, and the effect of matrix and sampling interference. Evaluation of laboratory performance is a check for compliance with the method requirements and is a straightforward examination: the laboratory either did or did not analyze the samples within the QC limits of the analytical method and according to protocol requirements. For this project, holding time exceedances for PCBs will be qualified, rather than invalidated. The assessment of potential matrix and sampling effects consists of a QC evaluation of the analytical results; the results of testing blank, duplicate, and MS samples; and assessing how, if at all, this could affect the usability of the data.

All analytical data will be supported by a data package. The data package will contain the supporting QC data for the associated field samples (see Section 2.7.3 for deliverable requirements). Before the laboratory will release each data package, the laboratory QAM (or the analytical section supervisor) must carefully review the sample and laboratory performance QC data to verify sample identity, the completeness and accuracy of the sample and QC data, and compliance with method specifications.

4.1.1 Field Screening Data

Field screening data are data for which QA/QC and documentation requirements do not allow definitive assessment of analytical performance. Field screening data include measurements of water temperature and turbidity, fish length and weight. These data will be validated by checking the completeness and accuracy of field measurements, field documentation, and

location control. In addition, the calibration records for the water probe will be reviewed for accuracy, completeness, and adherence to the calibration schedule.

4.1.2 Laboratory Data Validation and Verification

One hundred percent of the PCB laboratory data will undergo a forms review by the laboratory consistent with the procedures specified in this Baseline Monitoring Plan. A minimum of ten percent of the PCB data will undergo third-party data validation using USEPA's Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 1999) and USEPA's Contract Laboratory Program National Functional Guidelines for Inorganic Review (USEPA, 2002b) (the "National Functional Guidelines"). This is consistent with USEPA Region 5 QAPP guidance (USEPA, 2000a) which cites the National Functional Guidelines as appropriate for use in data validation at Superfund sites in this region. Third-party data validation will start at ten percent unless problems are encountered that warrant increasing data validation requirements. One-hundred percent of the data from the first week of sampling will undergo validation early in the project to ensure adherence to protocols. This initial validation effort will allow for the early implementation of any necessary corrective actions. This effort will be counted towards the overall 10 percent data validation requirement.

While maintaining consistency with the National Functional Guidelines, the Region 5 QAPP guidance also allows for the definition of additional project-specific data qualifiers. For this program, a project-specific data qualifier may be developed for water monitoring results analyzed by EPA Method 1668A with too-few congener detections. The specific procedures for data qualification in these circumstances will be developed in the LTMP Work Group, as discussed in Section 4.2.1.2.

The data packages will be sent directly to the QAM by the subcontract laboratories. The QAM will then select 10 percent of the data to be validated by the third party validation subcontractor. The QAM will provide the third-party validation subcontractor with copies of the selected data packages. Once validated, the third-party validation subcontractor will make copies of the data validation report as well as the summary forms and submit them to the QAM, the USEPA Project Coordinator, and the WDNR PM. The acceptance criteria for data validation are those listed in Table 2-9 and Table 2-10 of this Baseline Monitoring Plan. The QC requirements specified in this Baseline Monitoring Plan shall take precedence over the Functional Guidelines requirements.

Data validation is at times based upon professional judgment. In order to achieve consistent data validation, data worksheets will be completed for each data validation effort. A data review worksheet is a summary form on which the data validator records data validation notes

and conclusions specific to each analytical method. The worksheets will help the validator track and summarize the overall quality of the data. Sample results will then be assigned a degree of usability based upon the overall data quality.

The Shaw/Anchor project team will evaluate the data validation results. This evaluation will assess how the data, as qualified by the data validation process, can be used on the project.

The data, after validation, will also be verified to assess whether the correct samples were analyzed and the correct parameters were reported. The data will also be verified to assess whether the EDDs and the hard copy data deliverables are consistent with one another to ensure an accurate database. Also, the data will be evaluated to determine whether the results are consistent with prior expectations, based on an analysis of existing data (see Section 1.5). If they are, no corrective action will be deemed necessary. However, if the data obtained from the laboratories are not consistent with the anticipated results, a more in-depth evaluation of the results may be necessary to interpret the deviation.

One hundred percent of the laboratory data collected during this Baseline Monitoring program will undergo a forms review by the laboratory prior to submittal to the Shaw/Anchor team and subsequent submittal to the third-party validator. The data package supplied by the laboratory will be validated with the forms review process as described below. The data packages will be reviewed for the following:

- Holding times and sample temperature
- Surrogate recovery
- MS/MSD precision and accuracy
- LCS precision and accuracy
- Initial calibration and continuing calibration precision and accuracy
- Instrument tuning criteria (where applicable)
- Blank contamination
- Field duplicate precision and accuracy

The QA criteria to be implemented during the forms review process are presented in Table 2-9 and Table 2-10.

4.1.3 Reconciliation with Data Quality Objectives

The goal of the data collection effort is to acquire enough information and data to verify that sediment remedial actions in the Lower Fox River result in substantive reductions in water column and fish tissue PCB concentrations and PCB loads. Field and laboratory data will be evaluated in accordance with the DQOs established in Section 1.7. Remediation goals will be evaluated using the data analysis methods and statistical procedures described in Section 4.2

below. Determining that the data are sufficient to achieve project objectives will be the collective responsibility of the Shaw/Anchor Team, USEPA, and WDNR.

4.2 Data Analysis

4.2.1 PCB Summation

In water samples, total PCBs will be summed using zero for congeners undetected at the estimated detection limit (EDL). In tissue samples, total PCBs will be summed using zero for aroclors undetected at the method detection limit (MDL). J-flagged values between the EDL/MDL and the reporting limit will be included in the summation.

4.2.1.1 Aroclors versus Congeners

It should be noted that total PCBs which are summed using congener data are not generally comparable to total PCBs which are summed using aroclors. These different analytical techniques and quantitation methods respond differently to matrix interference, PCB weathering, and instrument sensitivity. Therefore, comparing baseline or long-term water quality data as planned herein with historical data reported as aroclors is problematic, especially for identifying time trends, unless the bias between the two different analytical and summation methods is adequately understood. As a result, historical data prior to the baseline monitoring event will generally not be used for statistical analysis of post-construction time trends.

4.2.1.2 Minimum Detected Congeners

It is estimated that approximately 90 percent of the total PCB mass is distributed among the top 20 to 30 individual congeners out of 209 possible congeners. Therefore, the goal for this study is to detect and quantify 20 to 30 individual congeners in each sample, at concentrations above the method detection limit, and preferably above the reporting limit. Detections of fewer numbers of congeners may tend to bias results low because some fraction of the PCB mass would be undetected or "censored". In addition, highly contaminated samples should be diluted such that 20 to 30 individual congeners continue to be detected in the diluted sample.

If fewer than 20 to 30 congeners are detected in some samples, the Long-Term Monitoring Work Group will convene to determine whether some type of corrective action is warranted to improve the estimate of total PCBs. Possible corrective actions may include:

- Qualify the PCB summation as "estimated" and report the number of detected congeners that contribute to the total value
- Develop a correction factor to account for undetected PCB mass in the "censored" part of the data

- Modify the field and/or analytical procedures in an attempt to achieve lower detection limits (it should be noted, however, that congener detection limits proposed for use in this study are at or near the limits of commercially available technology)

4.2.2 Blank Qualification

Blank qualification procedures (relative to the method detection limit, or MDL, and the reporting limit, or RL) are as follows:

- If detected concentrations in both the sample and blank are below the RL, then the sample concentration will be considered to be zero
- If the detected concentration in the blank is greater than the sample concentration, then the sample concentration will be considered to be zero
- If detected concentrations in both the sample and blank are above the RL, then the data will be qualified according to standard EPA validation procedures (i.e. sample concentrations less than five times the blank concentration will be considered nondetect)
- If the sample detection is above the RL, and blank detection is between the MDL and the RL, results will be evaluated on case-by-case basis to determine usability

4.2.3 Statistical Analysis of Monitoring Data

Water and fish tissue data will be statistically analyzed to assess the performance of the monitoring program and the more fundamental objective of monitoring progress toward achieving the RAOs. Descriptive statistics, distribution tests, and correlation tests will be performed using baseline monitoring data.

Time trend analysis of water and fish tissue concentrations cannot be performed using baseline data only, but must await the collection of post-remediation monitoring data (see Section 4.2.3.4). In general, time trend analysis during the post-construction period will be performed by comparing mean values between successive monitoring events (i.e., two-sample comparisons) and by using simple or multiple regression techniques. Time trend analytical techniques are discussed briefly below and in more detail in Appendix J; they will also be discussed further in the Long Term Monitoring Plan which will be submitted as part of the 60 Percent Design.

4.2.3.1 Descriptive Statistics

When a sufficient number of samples have been collected, descriptive statistics will be calculated for each OU and each fish species. Descriptive statistics will include mean, median, minimum and maximum, 10th, 25th, 50th, 75th, and 90th percentiles, percent nondetects, stan-

dard deviation and coefficient of variation (CV). These statistics will be used to verify the assumptions underlying the sampling design.

4.2.3.2 Statistical Distribution Tests

Water and fish data will be subjected to statistical distribution tests to assess conformance with standard normal or lognormal distributions. Conformance with these distributions will allow the data to be analyzed using more powerful parametric testing procedures. Distribution testing will utilize either numerical procedures (i.e., Shapiro-Wilk or D'Agostino Tests) or graphical procedures (i.e., normal probability plots).

4.2.3.3 Correlations and Controlling Variables

The data will be tested for statistical correlations between PCB concentrations and potential controlling variables. In particular, aqueous PCB concentrations will be tested for correlations with flow, temperature, and TSS concentrations. Fish tissue PCB concentrations will be tested for correlations with fish length (a surrogate for fish age and the primary basis for fish consumption advisories) and lipid content.

4.2.3.4 Trend Analysis

A primary objective of the baseline and long-term monitoring programs is to evaluate risk reduction success as measured by declining PCB concentrations in water and fish tissue. The essence of this analysis is determining the significance and magnitude of trends in the monitoring data. Statistical testing of the difference between monitored site concentrations and background concentrations will be an alternate means of demonstrating risk reduction success (i.e., concentrations not significantly different from background).

Comparison of Means. A simple test of significance is a comparison of mean PCB values between two monitoring events to determine if the mean value of the later event is significantly lower than the earlier event. If a decreasing trend is present, the power of this type of test will generally tend to increase as the time between monitoring events increases (i.e., the length of the monitoring record increases). Using this type of analysis, the estimated percent reduction and statistical significance of PCB concentration reductions can be calculated.

Simple Linear Regression. The data will be analyzed to determine an appropriate trend model. The default assumption is that PCB reductions will follow an exponential decay model. This model can be tested by fitting a linear regression through a plot of log PCB concentrations (in water or tissue) versus time. Time regressions will be performed separately for each OU and each fish species. It may be appropriate to either stratify the data (i.e., water by season; fish by size class) or normalize the data (i.e., fish tissue normalized by lipid content or length/age) to reduce the effects of confounding variables. Nonparametric trend analysis may be considered if the data are poorly described by standard statistical distributions.

Multiple Regression. If warranted, more complex analytical procedures (i.e., multiple regression, ANCOVA) may also be considered. In particular, multiple regression techniques may be useful if significant correlations are established with controlling variables (LTI, 2002; 2005; see also Appendix J).

Multiple linear regression provides a way to estimate the effects of an independent variable on water column PCB concentrations, such as the effect of sediment remediation, while controlling for the effects of other variables known to affect PCBs, such as flow and seasonal trends. To estimate the effects of remediation, the method would use baseline data and data from a post-remediation sampling round. These two rounds of data would be pooled to estimate the coefficients of an equation predicting PCB concentrations. One of the independent variables would be an indicator for post-remediation data, equal to 0 for the baseline and 1 for post-remediation data. The estimated coefficient of this indicator would provide an estimate of the effect of remediation, after controlling for the effects of the other included variables. A test of the hypothesis of "no effect of remediation" could be structured as a t-test of the null hypothesis that this coefficient is equal to zero.

A finding of a "significant effect" requires rejection of the null hypothesis at a given level of confidence (i.e. probability of Type I error, which is the rejection of the hypothesis if it is true). The smaller the prediction error of the regression equation and the larger the number of data points in each monitoring round, the more accurately the effect of remediation can be estimated, widening the range of estimates that can be judged "significantly different from zero". Similarly, smaller prediction errors and larger sample sizes also reduce the likelihood of accepting a null hypothesis of no effect if it is false, increasing the "power of the test". Appendix J presents one framework for estimating the effectiveness of remediation; testing the hypothesis of no effect and the power of the test; and shows how each depends on sampling frequency.

Variations in the specification of the regression equation can be made, depending on what variables are known to affect PCB concentration and whether their effects are linear, nonlinear, or interactive. One variation, in which the natural logarithm of PCB concentration is assumed to be a linear function of its determinants, is presented in Appendix J. The inclusion of variables and their functional forms should be dictated by scientific understanding of cause and effect relationships, supplemented by comparisons of goodness-of-fit of alternative forms of the equation, and variables should be retained in the regression equation if the hypothesis of "no effect" for each independent variable can be rejected at a high level of significance.

4.2.3.5 PCB Loading Calculations

One of the RAOs for the remedial action is to achieve a reduction of PCB loadings to Green Bay to accelerate natural recovery of bay sediments. To address this objective, PCB loads will be calculated at the mouth of the Lower Fox River at the USGS Oil Depot gage. PCB loads will also be calculated at several upstream reference locations to monitor the natural recovery of the river system as a whole in response to sediment remedial actions. Specifically, PCB loads will be calculated at the downstream ends of the following reaches:

- Lake Winnebago (background loading to Lower Fox River)
- OU 1
- OU 2
- OU 4 (discharge to Green Bay)

Loadings will be estimated using Beale's ratio estimator method. The Beale's method uses daily flow measurements and less frequent concentration measurements to estimate the average daily load. This estimate is computed as the average of loads for all days that both flow and concentration are measured, with a bias correction that accounts for higher- or lower-than average flows on the days when concentration was sampled. Richards (1999) provides formulas for the estimate of the average daily load and its root mean squared error, and Appendix J discusses the relationship between sampling frequency and root mean squared error of the load estimate. Daily gaged flows are available at Rapide Croche, and can be scaled according to watershed area ratios to estimate daily flows at the four stations for which loads are to be estimated.

4.2.3.6 Effects of Ongoing Remedial Activities

Interpretation of baseline monitoring data in OU 1 and potentially also downstream in OU 2, OU 3 and OU 4 will need to consider the possible effects of ongoing remedial activities in OU 1 as well as the Phase I removal action at the head of OU 4 scheduled to begin in Spring 2007. These remedial actions may affect water quality and possibly tissue concentrations in young forage fish (gizzard shad), and thus complicate the interpretation of baseline monitoring data. Older and larger fish with residual burdens of PCBs in their tissue from past years will be less affected.

Interpreting the effects of ongoing or pending remedial actions on baseline monitoring data will be discussed in the LTMP Work Group. The evaluation is likely to be qualitative in nature because statistical treatments are probably not able to unambiguously remove these effects from the data. Dredging resuspension and release calculations may be used to provide screening-level estimates of potential water quality effects from remedial activities.

5.0 References

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TABLES

Table 1-1. Summary of Recent Water Quality Data, Lower Fox River
Lower Fox River Baseline Monitoring Plan

		Total Suspended Solids (mg/L)						Total PCB Concentration (ug/L)									
Survey	Location	Number of Samples	Baseflow Average	Mean (All Events)	Standard Deviation	Median	Coefficient of Variation	Number of Samples	Mean (Dissolved)	Standard Deviation (Dissolved)	Coef. of Variation (Dissolved)	Mean (Particulate)	Standard Deviation (Particulate)	Coef. of Variation (Particulate)	Mean (Total)	Standard Deviation (Total)	Coef. of Variation (Total)
1994-95 Lake Michigan Mass Balance Study Tributary Data	Fox River Mouth	68	N/A	31.90	16.14	31.50	0.51	42	0.0150	0.0078	0.5214	0.0415	0.0257	0.6198	0.0565	0.0322	0.5691
1998 FRG Fox River Sediment, Surface Water and Biota Surveys	Fox River Little Lake Butte Des Morts	10	N/A	15.85	10.74	19.50	0.68	10	0.0101	0.0047	0.4622	0.0133	0.0067	0.5054	0.0234	0.0097	0.4141
	Fox River: DePere Dam to Kaukauna	10	N/A	20.60	10.42	23.00	0.51	10	0.0099	0.0032	0.3290	0.0132	0.0050	0.3802	0.0230	0.0066	0.2869
	Above Depere Dam	20	N/A	47.68	30.04	48.00	0.63	20	0.0147	0.0118	0.7999	0.0236	0.0109	0.4621	0.0383	0.0211	0.5507
	Downstream of Highway 172 Bridge	21	N/A	37.11	27.37	40.00	0.74	21	0.0154	0.0104	0.6792	0.0226	0.0112	0.4943	0.0380	0.0189	0.4988
	Mouth of Fox River	20	N/A	40.00	23.50	41.00	0.59	20	0.0136	0.0067	0.4932	0.0214	0.0080	0.3736	0.0350	0.0109	0.3105
2000-01 FRG Fox River Surface Water Surveys	Neenah Channel	8	15.25	18.53	17.70	13.25	0.96	12	0.0020	0.0011	0.5436	0.0018	0.0009	0.4983	0.0031	0.0021	0.6777
	Menasha Channel	6	17.03	16.77	14.76	14.70	0.88	6	0.0019	0.0011	0.5797	0.0027	0.0019	0.7269	0.0028	0.0027	0.9679
	LLBDM Outlet	9	8.80	16.89	10.53	16.00	0.62	9	0.0028	0.0021	0.7442	0.0043	0.0028	0.6517	0.0066	0.0047	0.7097
	Appleton	14	19.85	20.04	13.96	18.50	0.70	14	0.0033	0.0021	0.6369	0.0039	0.0030	0.7642	0.0072	0.0048	0.6728
	Kaukauna	10	15.52	16.48	10.85	15.00	0.66	10	0.0041	0.0025	0.6200	0.0037	0.0024	0.6451	0.0077	0.0048	0.6225
	Little Rapids	11	20.12	26.42	20.78	23.00	0.79	11	0.0038	0.0025	0.6692	0.0042	0.0028	0.6804	0.0076	0.0040	0.5300
	Upstream of DePere Dam	14	19.24	31.49	19.52	31.00	0.62	14	0.0039	0.0023	0.5990	0.0066	0.0048	0.7286	0.0105	0.0066	0.6265
	DePere STP	11	24.03	38.65	47.30	25.00	1.22	11	0.0074	0.0058	0.7847	0.0137	0.0081	0.5882	0.0204	0.0129	0.6295
	Upstream of Ft. James	10	26.36	42.23	50.93	26.25	1.21	10	0.0068	0.0056	0.8148	0.0122	0.0078	0.6399	0.0190	0.0125	0.6557
	Downstream of East River	11	23.35	36.01	42.98	28.00	1.19	11	0.0083	0.0078	0.9414	0.0127	0.0083	0.6562	0.0209	0.0141	0.6762
	Upstream of Mouth	14	20.25	28.04	18.46	27.00	0.66	14	0.0093	0.0068	0.7280	0.0178	0.0121	0.6782	0.0271	0.0177	0.6526
TOTAL		267				*AVG:*	*0.77*	245		*AVG:*	*0.64*		*AVG:*	*0.59*		*AVG:*	*0.59*

Resources Referenced:
1994-95 Lake Michigan Mass Balance Study Tributary Data (USEPA, 2002a, 2004b)
1998 FRG Fox River Sediment, Surface Water and Biota Surveys (Exponent, 1999; BBL, 1999, 2002)
2000-01 FRG Fox River Surface Water Surveys (LTI, 2002)

Table 1-2. Summary of Recent Fish Tissue Data in Lower Fox River
Lower Fox River Baseline Monitoring Plan

		OU 1: LLBM					OU 2: Appleton to Little Rapids					OU 3: Little Rapids to DePere					OU 4: DePere to Green Bay					Green Bay Zone 2					Green Bay Zone 3				
Fish Species	Tissue Prep	# Samples	Median	Mean Value (mg/kg)	Standard Deviation	Coef. of Variation	# Samples	Median	Arithmetic Mean	Standard Deviation	Coef. of Variation	# Samples	Median	Arithmetic Mean	Standard Deviation	Coef. of Variation	# Samples	Median	Arithmetic Mean	Standard Deviation	Coef. of Variation	# Samples	Median	Arithmetic Mean	Standard Deviation	Coef. of Variation	# Samples	Median	Arithmetic Mean	Standard Deviation	Coef. of Variation
Alewife	Whole organism																2	1.95	1.95	0.35	0.18	2	0.78	0.78	0.46	0.59	1	0.49	0.49		
Black Crappie	Skin-on fillet	5	0.09	0.16	0.13	0.79											3	0.55	0.45	0.29	0.65										
Black Crappie	Whole organism											2	0.67	0.67	0.15	0.22														
Bluegill Sunfish	Skin-on fillet	4	0.15	0.13	0.05	0.40						2	0.18	0.18	0.028	0.16														
Bluegill Sunfish	Whole organism	1	1.70	1.70								2	0.93	0.93	0.382	0.41														
Brown Bullhead	Whole organism	1	1.50	1.50																										
Brown Trout	Whole organism																										9	0.71	0.99	0.86	0.87
Carp	Fillet	22	2.94	3.06	2.19	0.72	6	0.66	0.83	0.46	0.55	2	1.91	1.91	2.11	1.11	7	5.50	5.83	5.31	0.91	5	3.20	3.00	2.79	0.93	3	2.40	2.13	1.52	0.71
Carp	Skin-on fillet	9	3.70	3.17	2.29	0.72						8	3.80	3.68	2.00	0.54	2	2.65	2.65	0.49	0.19										
Carp	Whole organism	12	0.89	1.03	0.62	0.60	12	2.30	2.64	1.98	0.75	14	3.25	3.47	1.81	0.52	41	7.40	8.44	5.87	0.70	5	1.70	1.68	1.54	0.92	3	0.31	0.58	0.63	1.10
Channel Catfish	Skin-off fillet						2	1.30	1.30	0.28	0.22																				
Crappie (unk. sp.)	Skin-on fillet																2	1.27	1.27	0.61	0.48										
Drum family	Whole organism	1	0.06	0.06			1	3.00	3.00			1	0.62	0.62																	
Emerald Shiners	Whole organism																5	3.60	3.52	0.34	0.10										
Flathead Catfish	Skin-off Fillet											3	0.52	0.64	0.51	0.80														
Gizzard shad	Whole organism											3	0.36	0.35	0.03	0.09	7	3.40	2.58	1.64	0.64	7	2.20	2.49	0.74	0.30	2	2.19	2.19		
Golden Shiner	Whole organism	2	0.99	0.99	0.21	0.21						2	1.02	1.02	0.02	0.02	2	1.38	1.38	0.08	0.06										
Greater Redhorse	Whole organism																16	5.85	5.99	0.98	0.16										
Green Sunfish	Whole organism						1	1.20	1.20																						
Northern Pike	Fillet	1	0.23	0.23			6	0.33	0.52	0.41	0.78	2	0.44	0.44	0.09	0.21	7	0.39	0.42	0.08	0.18	2	0.57	0.57	0.46	0.81	1	0.14	0.14		
Northern Pike	Skin-on fillet	2	0.48	0.48	0.45	0.94						3	0.96	0.88	0.36	0.41	10	0.49	0.66	0.30	0.46										
Northern Pike	Whole organism	1	1.50	1.50			4	1.30	1.27	0.41	0.32	1	3.30	3.30			6	2.25	2.60	1.26	0.48	1	0.77	0.77			4	0.27	0.28	0.21	0.74
Rainbow Smelt	Whole organism																					4	0.42	0.40	0.08	0.20					
Redhorse Sucker	Whole organism																5	5.40	4.98	2.60	0.52										
Rock Bass	Skin-on fillet											1	0.25	0.25																	
Rock Bass	Whole organism	1	0.25	0.25			1	1.10	1.10																						
Smallmouth Bass	Fillet	1	0.26	0.26			3	0.20	0.24	0.14	0.59	1	0.12	0.12			4	0.43	0.39	0.10	0.26	3	0.50	0.45	0.14	0.32	2	0.37	0.37	0.03	0.08
Smallmouth Bass	Skin-on fillet	3	0.26	0.32	0.20	0.63	2	0.28	0.28	0.04	0.15	15	0.20	0.25	0.22	0.86	7	0.53	0.76	0.50	0.66										
Smallmouth Bass	Whole organism	2	1.20	1.20	1.27	1.06	4	1.25	1.22	0.68	0.56	2	1.45	1.45	0.64	0.45	4	1.24	1.20	0.35	0.29	3	1.90	1.93	0.06	0.03	2	0.51	0.51	0.20	0.39
Walleye	Fillet	2	0.33	0.33	0.04	0.13	4	0.49	0.63	0.39	0.63	9	0.28	0.43	0.32	0.74	21	0.84	1.01	0.52	0.52	2	2.80	2.80	1.13	0.40	1	1.10	1.10		
Walleye	Liver																					4	4.77	4.94	2.22	0.45	4	3.02	4.12	2.54	0.62
Walleye	Remaining Carcass																8	7.05	5.25	3.19	0.61										
Walleye	Skin-on fillet	23	0.30	0.24	0.18	0.77	2	0.39	0.39	0.39	1.01	45	0.44	0.57	0.48	0.84	39	0.96	1.16	0.80	0.69										
Walleye	Unknown	1	0.00	0.00																											
Walleye	Whole organism	7	1.21	1.12	0.69	0.62	4	2.90	2.95	0.74	0.25	4	3.57	3.53	1.05	0.30	11	5.50	5.33	1.93	0.36	8	4.55	4.80	3.65	0.76	16	7.56	8.04	4.89	0.61
Walleye	Whole w/o liver																					1	7.50	7.50			2	7.36	7.36	3.04	0.41
White Bass	Fillet						3	1.91	1.81	0.74	0.41																				
White Bass	Remaining Carcass																8	6.35	6.06	2.63	0.43										
White Bass	Skin-on fillet	13	0.17	0.16	0.07	0.46	7	0.76	0.98	0.62	0.63	14	0.67	0.85	0.89	1.04	26	2.30	2.34	1.10	0.47										
White Bass	Unknown	1	0.00	0.00																											
White Bass	Whole organism						2	2.05	2.05	0.21	0.10																				
White Perch	Skin-on fillet											3	0.59	0.68	0.21	0.30														
White Sucker	Fillet	10	0.41	0.47	0.29	0.61											2	0.515	0.515	0.134	0.26						1	0.35	0.35		
White Sucker	Remaining Carcass																2	3.74	3.74	3.91	1.05										
White Sucker	Skin-on fillet						3	0.91	0.90	0.40	0.44						12	0.63	0.86	0.55	0.63										
White Sucker	Whole organism	1	0.43	0.43			3	3.40	3.20	1.71	0.53						13	1.40	1.51	0.54	0.36						1	0.54	0.54		
Yellow Perch	Fillet											1	0.11	0.11			3	0.21	0.18	0.07	0.40										
Yellow Perch	Fillet composite	1	0.11	0.11			1	0.07	0.07													3	0.13	0.12	0.01	0.09	2	0.04	0.04	0.01	0.17
Yellow Perch	Skin-on fillet	6	0.10	0.15	0.10	0.64						3	0.21	0.37	0.43	1.16	6	0.15	0.14	0.05	0.32	4	0.19	0.17	0.10	0.60					
Yellow Perch	Whole organism	2	0.14	0.14			4	0.59	0.59	0.14	0.24	1	0.51	0.51			6	1.24	1.30	0.83	0.64	5	0.57	0.60	0.23	0.38	4	0.16	0.13	0.09	0.66
TOTAL		135			*AVG:*	*0.62*	75			*AVG:*	*0.50*	144			*AVG:*	*0.54*	287			*AVG:*	*0.46*	59			*AVG:*	*0.49*	58			*AVG:*	*0.58*

Data Sources: USEPA, 2002a, 2004b; Stratus, 1999; Retec, 2002a, 2002b; Exponent, 1999, BBL, 1999, 2002; LTI, 2002

Table 1-3. Fish Consumption Advisory Summary
Lower Fox River Baseline Monitoring Plan

Species	OU1 through OU3	OU4	Southern Green Bay
Brown trout	---	---	12 meals/year to DNE; size dependent
Black Crappie	---	12 meals/year	---
Bluegill	---	12 meals/year	---
Carp	DNE	DNE	DNE
Channel Catfish	---	DNE	6 meals/year; size dependant
Chinook Salmon	---	---	6 to 12 meals/year; size dependent
Northern Pike	12 meals/year	6 to 12 meals/year; size dependant	12 meals/year; size dependent
Rainbow Trout	---	---	12 meals/year
Rock Bass	---	12 meals/year	---
Sheepshead	---	6 to 12 meals/year to DNE; size dependent	12 meals/year
Smallmouth Bass	12 meals/year	12 meals/year	12 meals/year
Splake	---	---	6 to 12 meals/year to DNE; size dependent
Sturgeon	---	---	DNE
Walleye	12 meals/year	6 to 12 meals/year to DNE; size dependent	6 to 12 meals/year to DNE; size dependent
White Bass	12 meals/year	DNE	DNE
White Perch	12 meals/year	6 meals/year	6 meals/year
White Sucker	---	6 meals/year	12 meals/year
Whitefish	---	---	6 meals/year
Yellow Perch	12 meals/year	12 meals/year	52 meals/year

Note: DNE = Do Not Eat

Table 1-4 Water Column PCB Summary Statistics

Lower Fox River Baseline Monitoring Plan

Station	Year	N	Mean (ng/L)	CV (unitless)	Distribution Test[1] Normal	LogNorm	Other
Year-Round Statistics							
OU 1	1998	10	23	0.41			D,P[1]
	2000-01	9	6.6	0.71			
OU 2	1998	10	23	0.29		D	P
	2000-01	11	7.6	0.53			
OU 3	1998	20	38	0.55	D,P		
	2000-01	14	11	0.63			
OU 4	1994-95	42	57	0.57	D		P
	1998	20	35	0.31			
	2000-01	14	27	0.65			
		Weighted Avg. CV:		0.52			
May through October Statistics							
OU 2	2000-01	7	9.0	0.66	X	X	
OU 3	1998	17	33	0.24	X	X	
	2000-01	9	13	0.48	X	X	
OU 4	1994-95	22	65	0.40		X	
	1998	10	39	0.30	X	X	
	2000-01	9	33	0.30	X		
		Weighted Avg. CV:		0.37			

Notes:

(1) Year-Round Distribution Tests per Retec, 2002c, tested separately for dissolved (D) and particulate (P) fractions.

May-Oct Distribution Tests (X = can't reject w/ 90% confidence) by LTI, this study.

Table 1-5. Fish Tissue PCB Summary Statistics

Lower Fox River Baseline Monitoring Plan

				Mean	CV	Distribution Test[1]		
Species - Analyte	**Prep**	**Station**	**N**	**(mg/kg-ww)**	**(unitless)**	**Normal**	**Lognor**	**Other**
Walleye - PCB [Primary]	Fillet	OU 1	25	0.25	0.72		X	
	Fillet	OU 2	6	0.55	0.76	X		
	Fillet	OU 3	54	0.55	0.82	X		
	Fillet	OU 4	60	1.11	0.63			X
	Fillet	OU 5	2	2.80	0.40	X		
			Weighted Avg. CV:		0.72			
Walleye - Mercury	Fillet	OU 2	10	0.36	0.44	X		
Carp - PCB [Primary]	Whole	OU 1	12	1.03	0.60		X	
	Whole	OU 2	12	2.64	0.75	X		
	Whole	OU 3	14	3.47	0.52			X
	Whole	OU 4	41	8.44	0.70	X		
	Whole	OU 5	5	1.68	0.92	X		
			Weighted Avg. CV:		0.68			
Gizzard Shad - PCB [Primary]		OU 1-2	<No Data>					
	Whole	OU 3	3	0.35	0.09	X		
	Whole	OU 4	7	2.58	0.64	X		
	Whole	OU 5	7	2.49	0.30			
			Weighted Avg. CV:		0.40			
Drum - PCB [Secondary]	Whole	OU 1	1	0.06	N/C	N/T		
	Whole	OU 2	1	3.00	N/C	N/T		
	Whole	OU 3	1	0.62	N/C	N/T		
		OU 4-5	<No Data>					
			Weighted Avg. CV:		N/C			
Channel Catfish - PCB [Secondary]		OU 1	<No Data>					
	Fillet	OU 2	2	1.30	0.22	N/T		
		OU 3-5	<No Data>					
			Weighted Avg. CV:		N/C			
White Bass - PCB [Alternate]	Fillet	OU 1	13	0.16	0.46	N/T		
	Fillet	OU 2	7	0.98	0.63	N/T		
	Fillet	OU 3	14	0.85	1.04	N/T		
	Fillet	OU 4	26	2.34	0.47	N/T		
		OU 5	<No Data>					
			Weighted Avg. CV:		0.62			
White Sucker - PCB [Alternate]	Whole	OU 1	1	0.43	N/C	N/T		
	Whole	OU 2	3	3.20	0.53	N/T		
		OU 3	<No Data>					
	Whole	OU 4	13	1.51	0.36	N/T		
		OU 5	<No Data>					
			Weighted Avg. CV:		0.39			

Notes:

(1) Distribution Tests per Retec, 2002c, based on whole fish samples

N/C = Not Calculated due to insufficient sample size; N/T = Not Tested

Table 1-6. Sample Location Rationale

STATION	GENERAL	WATER	FISH
All Stations	Characterize effectiveness of LFR remedial actions and natural recovery processes. Collocate fish and water sampling stations to characterize bioaccumulation pathways. OU 2 and OU 5 are subsampled on a finer scale to provide more detailed characterization of monitored natural recovery areas.	Preference for locations in relatively straight reaches with simple U-shaped cross-sections and relatively uniform flow. Preference for locations near downstream OU boundaries, to monitor cumulative impacts from the entire OU, and net contributions (contaminant loadings) to the next OU.	Preference for known productive fishing sites based on input from WDNR biologists. Preference for tailwater locations below dams where upstream-migrating species (i.e., walleye) may congregate. Preference for matching habitat of target species. It is assumed fish migrate freely between dams, and provide spatial representativeness of an entire OU. OU 2 is further subdivided because of length, dam interruptions, and variable riffle and pool habitats. OU 5 is further subdivided because of areal extent.
Lake Winnebago	Characterize ambient background conditions upstream of LFR remediation areas.	Characterize ambient background PCB concentrations upstream of LFR remediation areas. Estimate background PCB loading to OU 1.	Characterize ambient background PCB and mercury (walleye) concentrations upstream of LFR remediation areas.
OU-1	Characterize effectiveness of OU 1 remedial action.	Characterize water column PCB concentrations at the downstream end (exit point) of OU 1 remedial action area. Estimate downstream PCB loading to OU 2.	Characterize fish tissue PCB concentrations in OU 1 remedial action area. Assume fish migrate freely within OU 1 below Neenah and Menasha dams.
OU-2A	Characterize natural recovery processes in OU 2, along with the effectiveness of prior remedial action in Deposit N. Characterize environmental conditions in a reach with steep gradients and swift water velocities.	Characterize water column PCB concentrations in upstream reach of OU 2 natural recovery areas. Characterize environmental conditions in a reach with steep gradients and swift water velocities. Anticipated year-round boat access.	Characterize fish tissue PCB concentrations in the upstream reach of OU 2 natural recovery areas. Characterize environmental conditions in a reach with steep gradients and swift water velocities. Available boat access.
OU-2B	Characterize natural recovery processes in OU 2, along with the effectiveness of prior remedial action in Deposit N. Characterize environmental conditions in a reach with gentler gradients and slower water velocities (i.e., more likely depositional).	Characterize water column PCB concentrations in central reach of OU 2 natural recovery areas. Characterize environmental conditions in a reach with gentler gradients and slower water velocities (i.e., more likely depositional). Anticipated year-round boat access.	Characterize fish tissue PCB concentrations in the central reach of OU 2 natural recovery areas. Characterize environmental conditions in a reach with gentler gradients and slower water velocities (i.e., more likely depositional). Available boat access.
OU-2C	Characterize natural recovery processes in OU 2, along with the effectiveness of prior remedial action in Deposit N, and pending remedial action in Deposit DD.	Characterize water column PCB concentrations at the downstream end (exit point) of OU 2 natural recovery areas. Estimate downstream loading to OU 3. Anticipated year-round boat access.	Characterize fish tissue PCB and mercury (walleye) concentrations at the downstream end of OU 2 natural recovery areas. Available boat access.
OU-3	Characterize effectiveness of OU 3 remedial action.	Characterize water column PCB concentrations at the downstream end (exit point) of OU 3 remedial action areas.	Characterize fish tissue PCB concentrations in OU 3 remedial action areas. Assume fish migrate freely within OU 3 below Little Rapids dam.
OU-4	Characterize effectiveness of OU 4 remedial action.	Characterize water column PCB concentrations at the downstream end (exit point) of OU 4 remedial action areas. Estimate downstream loading to Green Bay. Collocate with historical and ongoing USGS monitoring station near Oil Depot gage. Location is beyond the influence of upstream migration of bay water under seiche conditions.	Characterize fish tissue PCB concentrations in OU 4 remedial action areas. Assume fish migrate freely within OU 4 downstream of DePere dam. Anticipate congregation of walleye in DePere dam tailwaters; popular fishing area.
OU-5A	Characterize natural recovery processes in Green Bay, downstream of Lower Fox River remedial actions.	Characterize surface water longitudinal PCB gradient in Green Bay (Zone II) and water column stratification (surface and deep).	Characterize fish tissue concentrations in shallow, inner reaches of Green Bay subject to discharges from the mouth of the Lower Fox River.
OU-5B	Characterize natural recovery processes in Green Bay, downstream of Lower Fox River remedial actions.	Characterize surface water longitudinal PCB gradient in Green Bay (Zone III-South) and water column stratification (surface and deep).	Characterize fish tissue concentrations in depositional areas along eastern shoreline of Green Bay where highest sediment PCB concentrations have historically been measured.
OU-5C	Characterize natural recovery processes in Green Bay, downstream of Lower Fox River remedial actions.	Characterize surface water longitudinal PCB gradient in Green Bay (Zone III-South) and water column stratification (surface and deep).	No fish samples in this zone. This area is too far removed from Fox River inputs and thus subject to unrelated contaminant contributions and other confounding influences (e.g. atmospheric fallout, Lake Michigan, etc.).

Table 1-7. Estimated Sample Sizes for Water and Fish Tissue
Lower Fox River Baseline Monitoring Plan

Minimum Detectable Difference:		50%					
Confidence (alpha)	Power (beta)	Coefficient of Variation					
		0.3	0.4	0.5	0.6	0.7	0.8
0.2	0.2	1	2	2	3	5	6
0.1	0.2	2	3	5	7	9	12
0.05	0.2	3	5	7	10	14	18

Table 2-1. Water Sampling and Analysis Plan
Lower Fox River Baseline Monitoring Plan

	Number of Monthly Samples	Number of Water Layers	Total Number of Analyses	Field Parameters [Temp, Turb]	Total Suspended Solids [EPA 160.2]	Total Organic Carbon [EPA 415.1]	PCB Congeners [EPA 1668A]
LWB-yy-mmdd	12	1	12	X	X	X	X
OU1-yy-mmdd	12	1	12	X	X	X	X
OU2A-yy-mmdd	12	1	12	X	X	X	X
OU2B-yy-mmdd	12	1	12	X	X	X	X
OU2C-yy-mmdd	12	1	12	X	X	X	X
OU3-yy-mmdd	12	1	12	X	X	X	X
OU4-yy-mmdd	12	1	12	X	X	X	X
OU5A-yy-mmdd	12	2	24	X	X	X	X
OU5B-yy-mmdd	12	2	24	X	X	X	X
OU5C-yy-mmdd	12	2	24	X	X	X	X
		TOTAL	**156**	**12**			

Table 2-2. Water Sampling Locations

TRANSECT	POSITION	X_WTM27	Y_WTM27	LAT	LONG	X_WTM8391	Y_WTM_8391	X_WTM8397	Y_WTM_8397
LW	W	625,570.9	392,511.6	44.1770	-88.4293	645,558.6	412,726.3	645,558.6	412,726.3
	M	626,486.3	393,941.9	44.1897	-88.4175	646,474.0	414,156.6	646,474.1	414,156.5
	E	627,390.4	395,354.4	44.2022	-88.4058	647,378.1	415,569.1	647,378.1	415,569.1
OU1	W	624,543.6	399,939.0	44.2440	-88.4403	644,531.4	420,153.7	644,531.5	420,153.7
	M	624,583.4	399,885.2	44.2435	-88.4399	644,571.2	420,100.0	644,571.2	420,099.9
	E	624,618.2	399,838.1	44.2431	-88.4394	644,606.1	420,052.9	644,606.1	420,052.8
OU2A	W	632,719.0	404,099.2	44.2800	-88.3369	652,706.7	424,314.1	652,706.7	424,314.1
	M	632,733.4	404,035.9	44.2794	-88.3368	652,721.1	424,250.8	652,721.2	424,250.8
	E	632,748.7	403,968.7	44.2788	-88.3366	652,736.4	424,183.5	652,736.5	424,183.5
OU2B	W	642,374.1	408,026.7	44.3135	-88.2149	662,361.7	428,241.7	662,361.7	428,241.7
	M	642,412.9	407,981.5	44.3131	-88.2145	662,400.4	428,196.5	662,400.5	428,196.5
	E	642,452.0	407,935.8	44.3127	-88.2140	662,439.5	428,150.8	662,439.6	428,150.8
OU2C	W	649,029.5	415,113.5	44.3759	-88.1295	669,017.0	435,328.8	669,017.1	435,328.8
	M	649,069.9	415,075.2	44.3756	-88.1290	669,057.4	435,290.5	669,057.4	435,290.5
	E	649,102.9	415,043.9	44.3753	-88.1286	669,090.4	435,259.2	669,090.4	435,259.1
OU3	W	653,989.4	422,665.1	44.4428	-88.0650	673,976.8	442,880.6	673,976.8	442,880.6
	M	654,035.1	422,628.1	44.4425	-88.0645	674,022.4	442,843.6	674,022.4	442,843.6
	E	654,089.7	422,583.8	44.4421	-88.0638	674,077.0	442,799.3	674,077.1	442,799.3
OU4	W	658,157.1	432,421.3	44.5297	-88.0097	678,144.2	452,637.0	678,144.3	452,636.9
	M	658,219.2	432,409.2	44.5296	-88.0089	678,206.4	452,624.8	678,206.4	452,624.8
	E	658,268.4	432,399.5	44.5295	-88.0083	678,255.5	452,615.2	678,255.5	452,615.2
OU5A	W	661,673.8	447,914.6	44.6683	-87.9606	681,660.9	468,130.4	681,660.9	468,130.4
	M	665,240.2	445,524.8	44.6460	-87.9164	685,227.3	465,740.6	685,227.3	465,740.6
	E	668,192.8	443,546.4	44.6275	-87.8798	688,179.9	463,762.2	688,180.0	463,762.2
OU5B	W	677,042.5	470,189.2	44.8651	-87.7591	697,029.3	490,404.9	697,029.3	490,404.9
	M	680,384.7	468,332.4	44.8475	-87.7175	700,371.4	488,548.3	700,371.4	488,548.2
	E	684,550.8	466,017.9	44.8257	-87.6657	704,537.5	486,233.9	704,537.5	486,233.8
OU5C	W	694,096.6	493,039.9	45.0661	-87.5347	714,082.5	513,255.5	714,082.6	513,255.4
	M	700,718.8	488,882.8	45.0269	-87.4523	720,704.6	509,098.5	720,704.7	509,098.5
	E	705,333.7	485,985.7	44.9995	-87.3950	725,319.5	506,201.6	725,319.5	506,201.6

Notes:
Quarter-point sampling location code: W = west, M = middle, E = east location in water sampling transect
All Wisconsin Transverse Mercator (WTM) coordinates are in meters

Table 2-3. Target Fish Species and Size Ranges
Lower Fox River Baseline Monitoring Plan

SPECIES	SIZE RANGE	Skin-on Fillet	Skinned Fillet	Whole Fish	No. Individuals	No. Composites[1]	No. Fish/Composite
Walleye	12 to 22 inches	X			15		
Carp	10 to 20 inches			X	25	5	5
Gizzard Shad	< 3 inches			X	125	5	25
Channel Catfish	12 to 22 inches		X		15		
Drum	12 to 22 inches			X	25	5	5
(1) Walleye and channel catfish will be analyzed as individuals, not composites							

Table 2-4. Tissue Sampling and Analysis Matrix

Lower Fox River Baseline Monitoring Plan

	Number of Composites	# Fish / Composite	# Individual Fish	Total Number PCB Analyses	Number Field Replicates	Minimum Size (inches)	Maximum Size (inches)	Preparation Method	PCB Aroclors [8082-SLOH]	Lipid Content [EPA, 2000]	Mercury [EPA 7471]	Archive [Freeze]
LWB-YY-WA-000			15	15	1	12	22	SOF	X	X	X	X
OU1-YY-WA-000			15	15	1	12	22	SOF	X	X		X
OU2A-YY-WA-000			15	15		12	22	SOF	X	X		X
OU2B-YY-WA-000			15	15		12	22	SOF	X	X		X
OU2C-YY-WA-000			15	15	1	12	22	SOF	X	X	X	X
OU3-YY-WA-000			15	15		12	22	SOF	X	X		X
OU4-YY-WA-000			15	15	1	12	22	SOF	X	X		X
OU5A-YY-WA-000			15	15		12	22	SOF	X	X		X
OU5B-YY-WA-000			15	15	1	12	22	SOF	X	X		X
LWB-YY-CC-000			15	15	1	12	22	SF	X	X		X
OU1-YY-CC-000			15	15	1	12	22	SF	X	X		X
OU2A-YY-CC-000			15	15		12	22	SF	X	X		X
OU2B-YY-CC-000			15	15		12	22	SF	X	X		X
OU2C-YY-CC-000			15	15	1	12	22	SF	X	X		X
OU3-YY-CC-000			15	15		12	22	SF	X	X		X
OU4-YY-CC-000			15	15	1	12	22	SF	X	X		X
OU5A-YY-CC-000			15	15		12	22	SF	X	X		X
OU5B-YY-CC-000			15	15	1	12	22	SF	X	X		X
LWB-YY-CA-000	5	5		5	1	10	20	WF	X	X		X
OU1-YY-CA-000	5	5		5	1	10	20	WF	X	X		X
OU2A-YY-CA-000	5	5		5		10	20	WF	X	X		X
OU2B-YY-CA-000	5	5		5		10	20	WF	X	X		X
OU2C-YY-CA-000	5	5		5		10	20	WF	X	X		X
OU3-YY-CA-000	5	5		5		10	20	WF	X	X		X
OU4-YY-CA-000	5	5		5	1	10	20	WF	X	X		X
OU5A-YY-CA-000	5	5		5		10	20	WF	X	X		X
OU5B-YY-CA-000	5	5		5	1	10	20	WF	X	X		X
LWB-YY-DR-000	5	5		5	1	12	22	WF	X	X		X
OU1-YY-DR-000	5	5		5	1	12	22	WF	X	X		X
OU2A-YY-DR-000	5	5		5		12	22	WF	X	X		X
OU2B-YY-DR-000	5	5		5		12	22	WF	X	X		X
OU2C-YY-DR-000	5	5		5		12	22	WF	X	X		X
OU3-YY-DR-000	5	5		5		12	22	WF	X	X		X
OU4-YY-DR-000	5	5		5	1	12	22	WF	X	X		X
OU5A-YY-DR-000	5	5		5		12	22	WF	X	X		X
OU5B-YY-DR-000	5	5		5	1	12	22	WF	X	X		X
LWB-YY-GS-000	5	25		5	1	2	3	WF	X	X		X
OU1-YY-GS-000	5	25		5	1	2	3	WF	X	X		X
OU2A-YY-GS-000	5	25		5		2	3	WF	X	X		X
OU2B-YY-GS-000	5	25		5		2	3	WF	X	X		X
OU2C-YY-GS-000	5	25		5		2	3	WF	X	X		X
OU3-YY-GS-000	5	25		5		2	3	WF	X	X		X
OU4-YY-GS-000	5	25		5	1	2	3	WF	X	X		X
OU5A-YY-GS-000	5	25		5		2	3	WF	X	X		X
OU5B-YY-GS-000	5	25		5	1	2	3	WF	X	X		X
			Total:	405	22							

Notes: SOF = Skin-On Fillet; SF = Skinned Fillet, WF = Whole Fish
WA = walleye; CC = channel catfish; CA = carp; DR = drum; GS = gizzard shad
See Section 2.2.5 for key to sample identification system

Table 2-5. Fish Habitat and Collection Methods
Lower Fox River Baseline Monitoring Plan

SPECIES	HABITAT	Electrofish	Fyke Net	Mini-Fyke	Trawl	Angler-Sport Catch	Hoop Net	Set Line	Gillnet
Lower Fox River (LWB, OU 1 - OU 4)									
Walleye	Below dams, near discharges, hard bottom	X							
Carp	Weedy, muddy, flats and bays; shorelines	X	X						
Gizzard Shad	Near shore	X		X					
Channel Catfish	All over, deaper holes		X			X	X	X	
Drum	All over	X	X			X	X	X	
Green Bay (OU 5)									
Walleye	Rocky, gravel shorelines, weed beds	X	X						
Carp	Weedy, muddy, flats and bays; shorelines	X	X						
Gizzard Shad	Near shore at night	X		X	X				
Channel Catfish	Muddy flats		X			X			X
Drum	Near shore to 30' of water; all substrates	X			X	X			

Table 2-7. Laboratory Analytical Methods and Reporting Limits
Lower Fox River Baseline Monitoring Plan

Analytical Parameter	Matrix	Proposed Laboratory	Analysis Methods	Laboratory SOP Number	Reporting Limit	Units
Aroclor 1016	Tissue	Pace Kimberly	Method 8082	KM-O-002	50	ug/kg
Aroclor 1221	Tissue	Pace Kimberly	Method 8082	KM-O-002	50	ug/kg
Aroclor 1232	Tissue	Pace Kimberly	Method 8082	KM-O-002	50	ug/kg
Aroclor 1242	Tissue	Pace Kimberly	Method 8082	KM-O-002	50	ug/kg
Aroclor 1248	Tissue	Pace Kimberly	Method 8082	KM-O-002	50	ug/kg
Aroclor 1254	Tissue	Pace Kimberly	Method 8082	KM-O-002	50	ug/kg
Aroclor 1260	Tissue	Pace Kimberly	Method 8082	KM-O-002	50	ug/kg
Mercury	Tissue	Pace Kimberly	Method 7471	KM-M-010	0.01	ug/kg
Lipids	Tissue	Pace Kimberly	EPA 2000	KM-L-003	0.1	%
TOC	Water	Pace Kimberly	EPA 415.1	K2-WCM-1	2	mg/L
TSS	Water	Pace Green Bay	EPA 160.2	G2-WCM-01 r.2	1	mg/L
PCB Congeners	Water	STL Knoxville	EPA 1668A	KNOX-ID-0013	0.020 – 0.031 [See Table 2-8]	ng/L

Table 2-8. PCB Congener Reporting Limits

Lower Fox River Baseline Monitoring Plan

Method Reference	Parameter	Average EDL (ng/L)	Reporting Limit (ng/L)	Precision (%RPD)	Accuracy (%R)
PCB Congeners by 1668A – 2 Liter Sample					
CAS	PCB				
Registry #	#			MS/MSD LCS/LCSD Not Required by Method	OPR
2051-60-7	1	.00128	.0200	NA	50-150
2051-61-8	2	.00114	.0200	NA	
2051-62-9	3	.00105	.0200	NA	50-150
13029-08-8	4	.01263	.0314	NA	50-150
16605-91-7	5	.00790	.0200	NA	
25569-80-6	6	.00726	.0200	NA	
33284-50-3	7	.00759	.0200	NA	
34883-43-7	8	.00730	.0269	NA	
34883-39-1	9	.00763	.0200	NA	
33146-45-1	10	.00783	.0200	NA	
2050-67-1	11	00755	.0239	NA	
2974-92-7	12	.00730	0259	NA	
2974-90-5	13	.00729	.0259	NA	
34883-41-5	14	.00719	.0200	NA	
2050-68-2	15	.00637	.0200	NA	50-150
38444-78-9	16	.00731	.0200	NA	
37680-66-3	17	00589	.0200	NA	
37680-65-2	18	00487	.0224	NA	
38444-73-4	19	00636	.0200	NA	50-150
38444-84-7	20	.00216	0200	NA	
55702-46-0	21	.00223	.0200	NA	
38444-85-8	22	.00234	.0200	NA	
55720-44-0	23	.00240	.0200	NA	
55702-45-9	24	.00427	.0200	NA	
55712-37-3	25	.00203	.0200	NA	
38444-81-4	26	.00224	.0200	NA	
38444-76-7	27	.00416	.0200	NA	

Table 2-8. PCB Congener Reporting Limits

Lower Fox River Baseline Monitoring Plan

Method Reference	Parameter	Average EDL (ng/L)	Reporting Limit (ng/L)	Precision (%RPD)	Accuracy (%R)
7012-37-5	28	.00216	0200	NA	
15862-07-4	29	.00224	0200	NA	
35693-92-6	30	.00487	.0224	NA	
16606-02-3	31	.00220	.0200	NA	
38444-77-8	32	.00382	0200	NA	
38444-86-9	33	.00223	.0200	NA	
37680-68-5	34	.00233	0200	NA	
37680-69-6	35	.00231	.0200	NA	
38444-87-0	36	.00216	.0200	NA	
38444-90-5	37	.00193	.0200	NA	50-150
53555-66-1	38	.00221	.0200	NA	
38444-88-1	39	.00205	.0200	NA	
38444-93-8	40	.00226	.0200	NA	
52663-59-9	41	.00226	.0200	NA	
36559-22-5	42	.00250	.0200	NA	
70362-46-8	43	.00207	.0200	NA	
41464-39-5	44	.00203	.0200	NA	
70362-45-7	45	.00236	.0200	NA	
41464-47-5	46	.00275	.0200	NA	
2437-79-8	47	.00203	.0200	NA	
70362-47-9	48	00226	.0200	NA	
41464-40-8	49	00193	.0200	NA	
62796-65-0	50	.00227	.0200	NA	
68194-04-7	51	.00236	.0200	NA	
35693-99-3	52	00217	.0200	NA	
41464-41-9	53	00227	.0200	NA	
15968-05-5	54	.00342	.0200	NA	50-150
74338-24-2	55	.00170	.0200	NA	
41464-43-1	56	00168	.0200	NA	
70424-67-8	57	.00167	.0200	NA	
41464-49-7	58	00163	.0200	NA	
74472-33-6	59	.00164	.0200	NA	

Table 2-8. PCB Congener Reporting Limits

Lower Fox River Baseline Monitoring Plan

Method Reference	Parameter	Average EDL (ng/L)	Reporting Limit (ng/L)	Precision (%RPD)	Accuracy (%R)
33025-41-1	60	.00165	.0200	NA	
33284-53-6	61	.00158	.0200	NA	
54230-22-7	62	.00164	.0200	NA	
74472-34-7	63	.00156	.0200	NA	
52663-58-8	64	.00164	.0200	NA	
33284-54-7	65	.00203	.0200	NA	
32598-10-0	66	.00155	.0200	NA	
73575-53-8	67	.00146	.0200	NA	
73575-52-7	68	.00151	.0200	NA	
60233-24-1	69	.00193	.0200	NA	
32598-11-1	70	.00158	.0200	NA	
41464-46-4	71	.00226	.0200	NA	
41464-42-0	72	.00161	.0200	NA	
74338-23-1	73	.00207	.0200	NA	
32690-93-0	74	.00158	.0200	NA	
32598-12-2	75	.00164	.0200	NA	
70362-48-0	76	.00158	.0200	NA	
32598-13-3	77	.00145	0200	NA	50-150
70362-49-1	78	.00161	.0200	NA	
41464-48-6	79	.00136	.0200	NA	
33284-52-5	80	.00145	.0200	NA	
70362-50-4	81	.00160	.0200	NA	50-150
52663-62-4	82	.00358	.0200	NA	
60145-20-2	83	.00371	.0200	NA	
52663-60-2	84	.00362	.0200	NA	
65510-45-4	85	.00256	.0200	NA	
55312-69-1	86	.00257	.0200	NA	
38380-02-8	87	.00257	.0200	NA	
55215-17-3	88	00319	.0200	NA	
73575-57-2	89	.00346	.0200	NA	
68194-07-0	90	.00268	.0200	NA	
68194-05-8	91	.00319	.0200	NA	

Table 2-8. PCB Congener Reporting Limits

Lower Fox River Baseline Monitoring Plan

Method Reference	Parameter	Average EDL (ng/L)	Reporting Limit (ng/L)	Precision (%RPD)	Accuracy (%R)
52663-61-3	92	.00324	.0200	NA	
73575-56-1	93	.00313	.0200	NA	
73575-55-0	94	.00342	.0200	NA	
38379-99-6	95	.00313	.0200	NA	
73575-54-9	96	.00238	.0200	NA	
41464-51-1	97	.00257	.0200	NA	
60233-25-2	98	.00318	.0200	NA	
38380-01-7	99	.00255	.0200	NA	
39485-83-1	100	.00313	.0200	NA	
37680-73-2	101	.00268	.0200	NA	
68194-06-9	102	.00318	.0200	NA	
60145-21-3	103	.00293	.0200	NA	
56558-16-8	104	.00231	.0200	NA	50-150
32598-14-4	105	.00141	.0200	NA	50-150
70424-69-0	106	.00157	.0200	NA	
70424-68-9	107	.00139	.0200	NA	
70362-41-3	108	.00154	.0200	NA	
74472-35-8	109	.00257	.0200	NA	
38380-03-9	110	.00227	.0200	NA	
39635-32-0	111	.00218	.0200	NA	
74472-36-9	112	.00255	.0200	NA	
68194-10-5	113	.00268	.0200	NA	
74472-37-0	114	.00125	.0200	NA	50-150
74472-38-1	115	.00227	.0200	NA	
18259-05-7	116	.00256	.0200	NA	
68194-11-6	117	.00256	.0200	NA	
31508-00-6	118	.00131	.0200	NA	50-150
56558-17-9	119	.00257	.0200	NA	
68194-12-7	120	.00210	.0200	NA	
56558-18-0	121	.00229	.0200	NA	
76842-07-4	122	.00162	.0200	NA	
65510-44-3	123	.00130	.0200	NA	50-150

Table 2-8. PCB Congener Reporting Limits

Lower Fox River Baseline Monitoring Plan

Method Reference	Parameter	Average EDL (ng/L)	Reporting Limit (ng/L)	Precision (%RPD)	Accuracy (%R)
70424-70-3	124	.00154	.0200	NA	
74472-39-2	125	.00257	.0200	NA	
57465-28-8	126	00159	.0200	NA	50-150
39635-33-1	127	.00143	.0200	NA	
38380-07-3	128	.00220	.0200	NA	
55215-18-4	129	.00225	.0200	NA	
52663-66-8	130	00286	0200	NA	
61798-70-7	131	.00288	.0200	NA	
38380-05-1	132	00281	.0200	NA	
35694-04-3	133	.00264	0200	NA	
52704-70-8	134	00288	.0200	NA	
52744-13-5	135	.00405	.0200	NA	
38411-22-2	136	.00300	.0200	NA	
35694-06-5	137	.00215	.0200	NA	
35065-28-2	138	.00225	.0200	NA	
56030-56-9	139	.00242	0200	NA	
59291-64-4	140	.00242	.0200	NA	
52712-04-6	141	.00256	.0200	NA	
41411-61-4	142	.00283	.0200	NA	
68194-15-0	143	.00288	.0200	NA	
68194-14-9	144	.00396	0200	NA	
74472-40-5	145	.00307	0200	NA	
51908-16-8	146	.00232	.0200	NA	
68194-13-8	147	.00233	.0200	NA	
74472-41-6	148	.00404	.0200	NA	
38380-04-0	149	00233	.0200	NA	
68194-08-1	150	.00294	.0200	NA	
52663-63-5	151	00405	.0200	NA	
68194-09-2	152	00290	.0200	NA	
35065-27-1	153	00198	.0200	NA	
60145-22-4	154	00347	.0200	NA	
33979-03-2	155	00281	.0200	NA	50-150

Table 2-8. PCB Congener Reporting Limits

Lower Fox River Baseline Monitoring Plan

Method Reference	Parameter	Average EDL (ng/L)	Reporting Limit (ng/L)	Precision (%RPD)	Accuracy (%R)
38380-08-4	156	00175	.0200	NA	50-150
69782-90-7	157	.00175	.0200	NA	50-150
74472-42-7	158	.00172	.0200	NA	
39635-35-3	159	00181	.0200	NA	
41411-62-5	160	.00201	.0200	NA	
74472-43-8	161	.00188	.0200	NA	
39635-34-2	162	.00181	.0200	NA	
74472-44-9	163	.00225	.0200	NA	
74472-45-0	164	.00215	.0200	NA	
74472-46-1	165	00205	.0200	NA	
41411-63-6	166	.00220	.0200	NA	
52663-72-6	167	.00154	.0200	NA	50-150
59291-65-5	168	.00198	.0200	NA	
32774-16-6	169	.00174	.0200	NA	50-150
35065-30-6	170	.00198	.0200	NA	
52663-71-5	171	.00255	.0200	NA	
52663-74-8	172	.00258	.0200	NA	
68194-16-1	173	00255	.0200	NA	
38411-25-5	174	.00239	.0200	NA	
40186-70-7	175	.00229	.0200	NA	
52663-65-7	176	.00182	.0200	NA	
52663-70-4	177	00256	.0200	NA	
52663-67-9	178	.00246	.0200	NA	
52663-64-6	179	00180	.0200	NA	
35065-29-3	180	00167	.0200	NA	
74472-47-2	181	00239	.0200	NA	
60145-23-5	182	.00232	.0200	NA	
52663-69-1	183	.00229	.0200	NA	
74472-48-3	184	.00169	.0200	NA	
52712-05-7	185	.00229	.0200	NA	
74472-49-4	186	.00184	.0200	NA	
52663-68-0	187	.00217	.0200	NA	

Table 2-8. PCB Congener Reporting Limits

Lower Fox River Baseline Monitoring Plan

Method Reference	Parameter	Average EDL (ng/L)	Reporting Limit (ng/L)	Precision (%RPD)	Accuracy (%R)
74487-85-7	188	.00176	.0200	NA	50-150
39635-31-9	189	.00160	.0200	NA	50-150
41411-64-7	190	.00185	.0200	NA	
74472-50-7	191	.00180	.0200	NA	
74472-51-8	192	.00195	.0200	NA	
69782-91-8	193	.00195	.0200	NA	
35694-08-7	194	.00209	.0200	NA	
52663-78-2	195	.00229	.0200	NA	
42740-50-1	196	.00313	.0200	NA	
33091-17-7	197	.00229	.0200	NA	
68194-17-2	198	.00311	.0200	NA	
52663-75-9	199	.00311	.0200	NA	
52663-73-7	200	.00229	.0200	NA	
40186-71-8	201	.00228	.0200	NA	
2136-99-4	202	.00241	.0200	NA	50-150
52663-76-0	203	.00287	.0200	NA	
74472-52-9	204	.00235	.0200	NA	
74472-53-0	205	.00146	.0200	NA	50-150
40186-72-9	206	.00146	.0200	NA	50-150
52663-79-3	207	.00132	.0200	NA	
52663-77-1	208	.00127	.0200	NA	50-150
2051-24-3	209	.00096	.0200	NA	50-150

NA - Not applicable.
RPD - Relative percent difference.

Table 2-9. Quality Control-Corrective Action

Lower Fox River Baseline Monitoring Plan

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
KM-O-002	Aroclors 1016/1260	Five-point initial calibration (ICAL)	Initial calibration prior to sample analysis	Calibration factor of each peak < 20 % RSD	Correct problem, then repeat initial calibration
KM-O-002	Aroclors, 1221, 1232, 1242, 1248, 1254	One point midrange calibration standard	With each Aroclor 1016/1260 initial calibration	Calibration is acceptable if Aroclor 1016 and 1260 meet acceptance criteria.	None, use response factor from mid-range standard to quantify Aroclor if present
KM-O-002	All Aroclors	Qualitative match for Aroclor Identification	Every sample	Minimum 5 peak match for all Aroclors except Aroclor 1221 (3 peak match)	None, do not report as detected Aroclor
KM-O-002	All Aroclors	Retention time window	Each calibration verification	ICAL mean RT + 0.03 minutes	Correct problem, then reanalyze all samples analyzed since the last retention time check
KM-O-002	Aroclors 1016/1260	Calibration verification	After every 10 samples	Average RF of > 5 peaks < 15 % difference from ICAL mean RF	Correct problem, then repeat initial calibration verification and reanalyze all samples since last successful calibration verification
KM-O-002	Aroclors 1016/1260	Ending calibration verification	After all samples analyzed	Average RF of > 5 peaks < 15 % difference from ICAL mean RF	If sensitivity increased > 15 %, no reanalysis of undetected samples needed. If sensitivity decreased > 15 %, reanalyze samples.
KM-O-002/KM-O-001	All Aroclors	Method blank (MB)	One per analytical batch of 20 samples or less	No analytes detected > RL	Correct problem, then repeat prep and analysis of method blank and all samples with detects < 20 X MB processed with the contaminated blank

Table 2-9. Quality Control-Corrective Action

Lower Fox River Baseline Monitoring Plan

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
KM-O-002/KM-O-001	Aroclors 1254	LCS	One LCS per analytical batch of 20 samples or less	40-128%	Assess all other batch QC for same bias, if consistent bias present, repeat prep and analysis of LCS and all samples in the affected analytical batch
KM-O-002/KM-O-001	All Aroclors	Surrogate spikes (TMX, DCB)	Every sample, spiked sample, standard, and method blank	TMX 40-136% DCB 47-145%	If both TCX and DCB out of limit, re-extract and re-analyze sample
KM-O-002/KM-O-001	Aroclor 1254	MS/MSD	One MS/MSD per every 20 project samples	43-130% recovery 56% RPD	If recovery is out of limit, qualify data and note in case narrative suspected matrix problem
KM-O-002/KM-O-001	All Aroclors	Field Duplicates	Submitted blind to lab	< 35 % RPD	May request analysis of additional aliquot(s), data qualified as estimated during validation
K2-WCM-1	TOC (water)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Absolute value < RL of 2 mg/L, if sample level > 20 x MB, no action	Rerun all samples associated with unacceptable blank. If MB > MDL < RL, qualify sample levels < 20 x MB with "A"
K2-WCM-1	TOC (water)	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Percent recovery must be within laboratory control limits 80-120%	If not within laboratory control limits, rerun all associated samples
K2-WCM-1	TOC (water)	MS/MSD	1 per 10 samples, minimum of one per batch of samples processed	Percent recovery must be within laboratory control limits 80 -120% RPD < 20%	Flag data outside of limit

Table 2-9. Quality Control-Corrective Action

Lower Fox River Baseline Monitoring Plan

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
K2-WCM-1	TOC (water)	Update calibration factor with 3 standard plus blank.	Initially and as needed when calibration failures occur	See instrument manual	Correct problem, then repeat initial calibration
K2-WCM-1	TOC (water)	ICV	1 mid-level at beginning of every analytical run	± 10% of true value	Correct problem, then repeat calibration verification and reanalyze all samples not bracketed by an acceptable ICV
K2-WCM-1	TOC (water)	ICB	Immediately after ICV	Absolute value < RL of 2 mg/L	Correct problem, then repeat calibration verification and reanalyze all samples not bracket by acceptable ICB
K2-WCM-1	TOC (water)	CCV	1 mid-level every 10 samples	± 10% of true value	Correct problem, then reanalyze all samples not bracketed by an acceptable CCV
K2-WCM-1	TOC (water)	CCB	Immediately after CCV	Absolute value < RL of 2 mg/L. If sample level >10 x CCB, no action	Correct problem, then reanalyze all samples not bracketed by an acceptable CCB
K2-WCM-1	TOC (water)	Field Duplicate	Submitted blind to lab	<30% RPD	May request analysis of additional aliquot(s), data qualified as estimated during validation
KNOX-ID-0013	PCB Congeners	Quality assurance per SOP	Quality assurance per SOP	Quality assurance per SOP	Corrective actions per SOP

Table 2-9. Quality Control-Corrective Action

Lower Fox River Baseline Monitoring Plan

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
KM-M-010	Mercury by CVAA	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than reporting limit unless sample level > 20 x MB	Correct problem then repeat prep and analysis of method blank and all samples processed with the contaminated blank. If MB > MDL < RL, qualify sample levels < 20 x MB with "A"
KM-M-010	Mercury by CVAA	Initial	5 levels plus blank	"r" correlation coefficient ≥ 0.995	Terminate analysis: correct problem: Recalibrate or reprep with calibration curve
KM-M-010	Mercury by CVAA	ICV	After every initial calibration	±10% of true value	Terminate analysis: correct problem. Recalibrate and rerun all samples not bracketed by acceptable ICV
KM-M-010	Mercury by CVAA	ICB	Immediately following the ICV	< MDL	Terminate analysis: correct problem. Recalibrate and rerun all samples not bracketed by acceptable ICB
KM-M-010	Mercury by CVAA	CCV	Every 10 samples and at the end of each run	±10% of true value	Terminate analysis: correct problem. Recalibrate and rerun all samples not bracketed by acceptable CCV

Table 2-9. Quality Control-Corrective Action

Lower Fox River Baseline Monitoring Plan

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
KM-M-010	Mercury by CVAA	CCB	Immediately following each CCV	< MDL	Terminate analysis: correct problem. Recalibrate and rerun all samples not bracketed by acceptable CCB
KM-M-010	Mercury by CVAA	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Recovery must be within current in-house control criteria	Terminate analysis: correct problem. Rerun all samples associated with unacceptable LCS
KM-M-010	Mercury by CVAA	MS/MSD	Run with each batch of samples processed not to exceed 20 samples	Recovery must be within current in-house control criteria; RPD must be within current in-house control criteria	Flag parent sample result with appropriate qualifier if accuracy and/or are not within acceptance criteria
G2-WCM-01	Total suspended solids	Method Blank	1 with each batch of samples processed not to exceed 20 samples	< + RL	Reanalyze all samples associated with unacceptable MB
G2-WCM-01	Total suspended solids	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	80-120%	Reanalyze all samples associated with unacceptable LCS
G2-WCM-01	Total suspended solids	Duplicate	1 with each batch of samples processed not to exceed 10 samples	< 10% RPD when results >5xs RL	Flag Parent result with appropriate qualifier

Table 2-10. Quality Control Procedures, Criteria, and Corrective Actions – PCB Congeners

Lower Fox River Baseline Monitoring Plan

Parameter/Method	Calibration QC Check	Frequency	Acceptance Criteria	Corrective Action
PCB Congeners by 1668 Revision A	Check of mass resolution mass accuracy (PFK) and gc performance,	Every 12 hours	1) ≥ 10,000 resolving power; 2) ≤ 5 ppm deviation from reference mass. 3) ≤ 40 % valley between PCBs 34 and 23. 4) ≤ 40 % valley between PCBs 187 and 182.	1) Retune or service GC/MS system. 2) Repeat check
	Initial 6-point calibration	*Initially and as needed*	1) *%RSD for CCCs calculated by isotope dilution - ≤ 20%;* 2) %RSD for CCCs calculated by internal standard - ≤ 35%; 3) %RSD for Labeled congeners calculated by internal standard - ≤ 35%;	1) Identify the root cause. 2) Perform corrective action 3) Repeat the initial calibration
	Continuing calibration verification (CCV): level 3 calibration standard	Every 12 hours	1) ≥ 10,000 resolving power; 2) ≤ 5 ppm deviation from reference mass 3) Ion abundance ratios within limit in 1668A Table 8. 4) S/N ≥ 10 for all targets and internal standards. 5) %D for all target PCBs ≤ 30%. 6) % D for labeled internal standards ≤ 50%.	1) If %D > 30% for non-toxic/locs, but is ≤ 60%, use shift response factor. 2) Evaluate system, service as required. 3) Repeat calibration check 4) Perform new initial calibration 5) Reanalyze affected samples.
	Labeled congeners/internal standards	Twenty-eight 13C-labeled congeners added to every sample, QA sample, standard	1) %Recovery 30-140% on LCSs. 2) %Recovery ≥ 25% on samples, blanks.	1) Check all calculations for error. 2) Ensure that instrument performance is acceptable. 3) Recalculate the data and/or reanalyze if either of the above checks reveal a problem 4) If any recovery is < 25%, evaluate labeled congener S/N and EDLs. If S/N ≥ 10 and EDL≤ EML, report with qualifiers and discuss in narrative.

Table 2-10. Quality Control Procedures, Criteria, and Corrective Actions – PCB Congeners

Lower Fox River Baseline Monitoring Plan

	Method blank	One per batch of not more than 20 samples on each instrument to be used for analysis/per 12 hr period.	No target compounds >RL -or at or above 10% of the measured concentration of that analyte in the associated sample, whichever is higher (except for common laboratory contaminants). -or target is not present in sample. -or total PCB concentration is < 300 pg/L. Note: If any target is detected in the method blank, regardless of level, all detections of the target will be qualified with a B qualifier.	1) Service system/glassware to eliminate contamination 2) Notify Shaw POC. 3) Reanalyze blank and all associated samples.
	Laboratory control sample (LCS)	One per batch of not more than 20 samples	All criteria in Table 6. Method 1668A.	1) Corrective action required may include: Re-extraction and Re-analysis of LCS and associated samples If batch is not re-extracted reasons for acceptance must be clearly presented in the project records and report. If re-extraction and reanalysis of the batch is not possible due to limited sample volume or other constraints the OPR is reported and the failure is documented in the project narrative.

CCC = Continuing calibration compounds.
GC/MS = Gas chromatography/mass spectrometry.
RF = Response factor.
LCS = Laboratory control sample.
ND - Not detected
PFK = Perfluorokerosene
RSD = Relative standard deviation.
RL = Reportable limit.

FIGURES

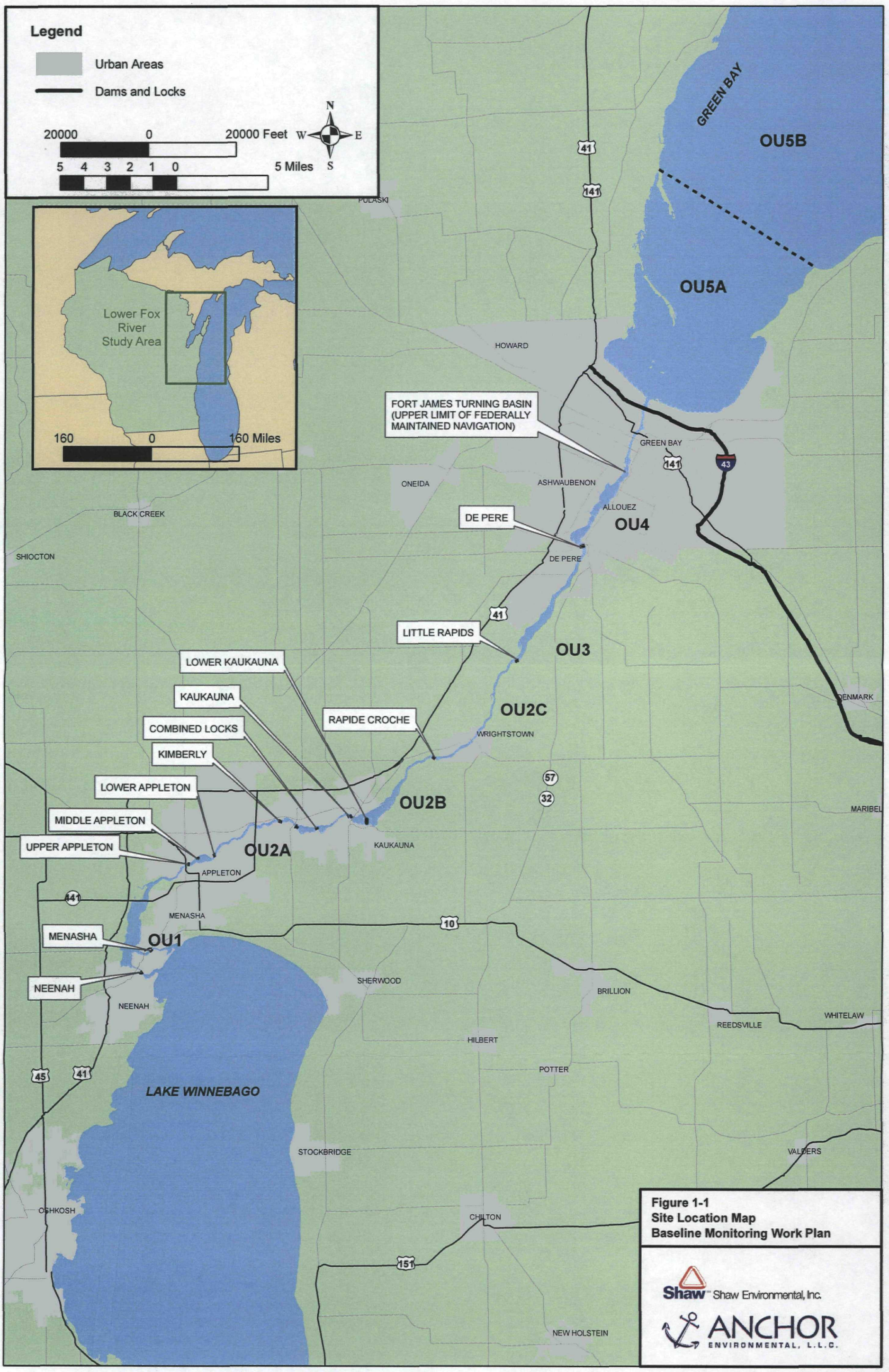


Figure 1-1
Site Location Map
Baseline Monitoring Work Plan

Shaw™ Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1-2. Lower Fox River Baseline Monitoring Plan Project Organization Chart

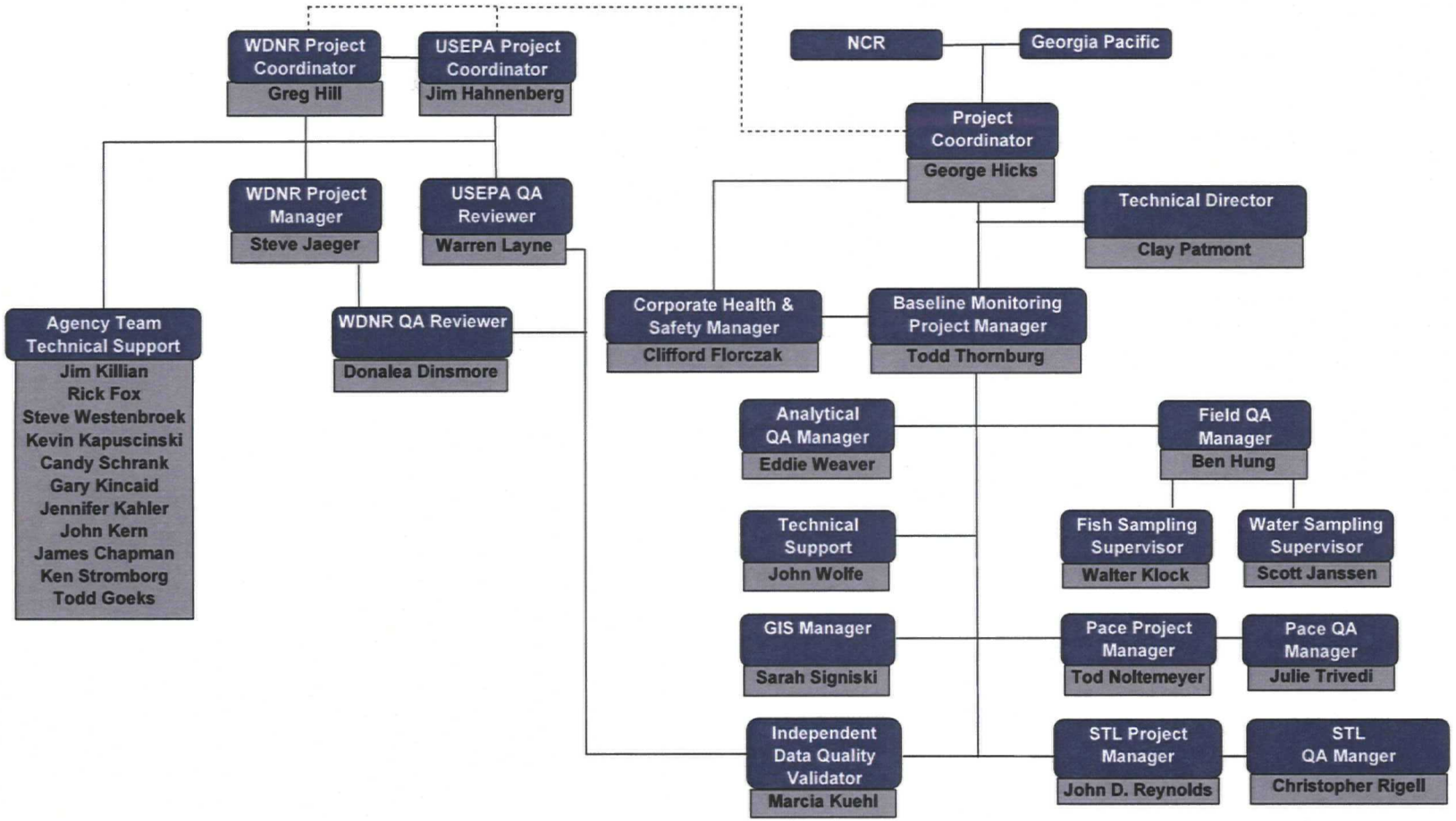
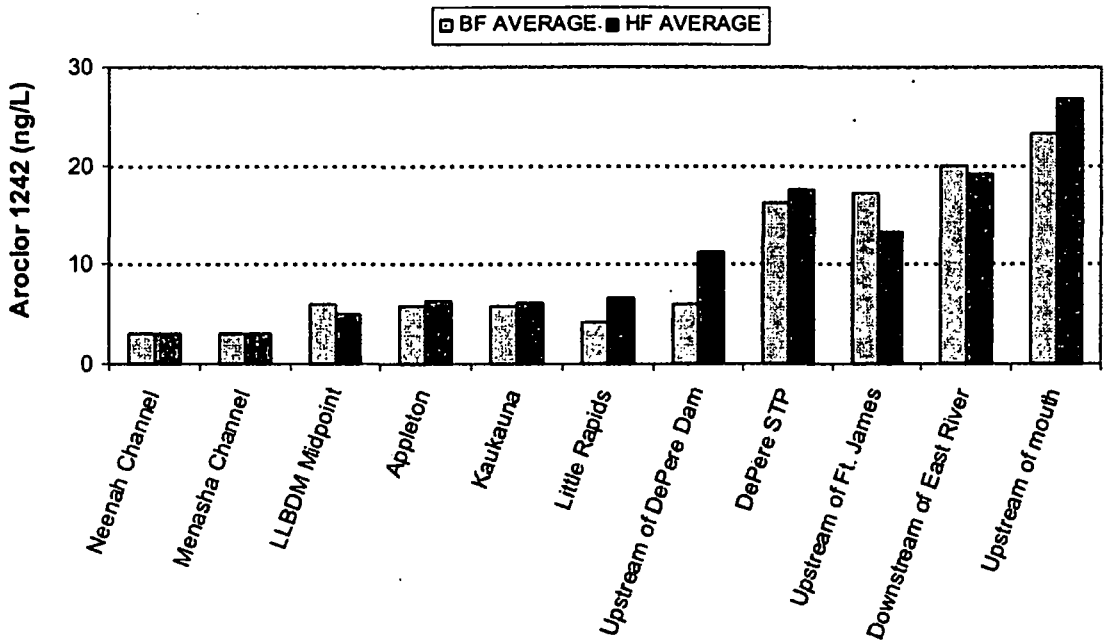
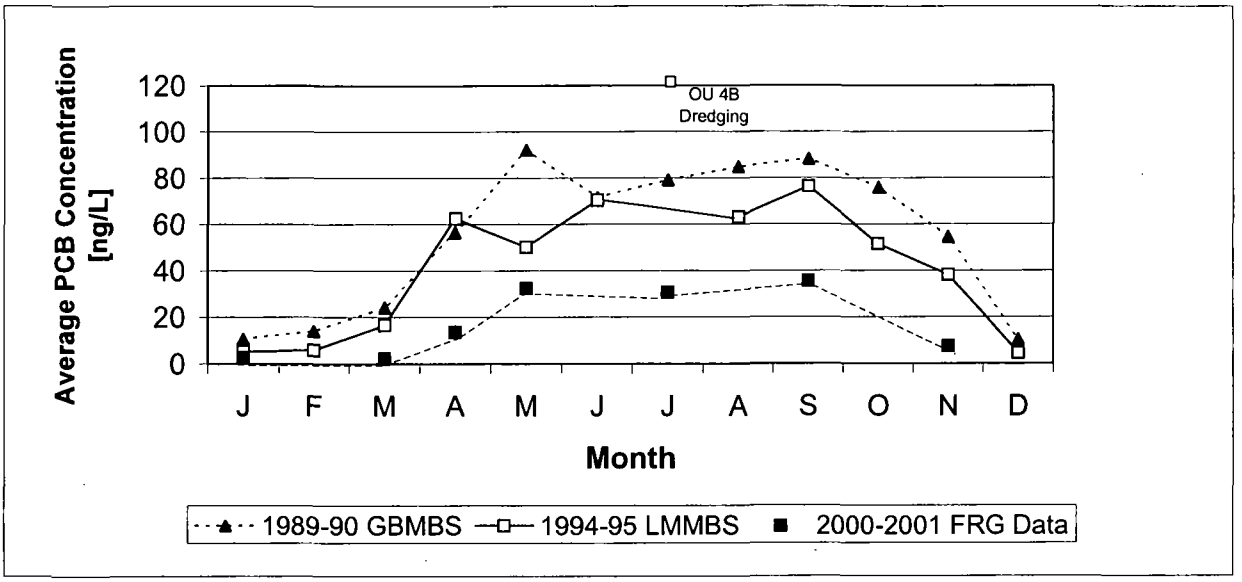


Figure 1-3. Downstream Trends in Water Column PCB Concentrations



Note: Data and graphic from Limno-Tech, 2002

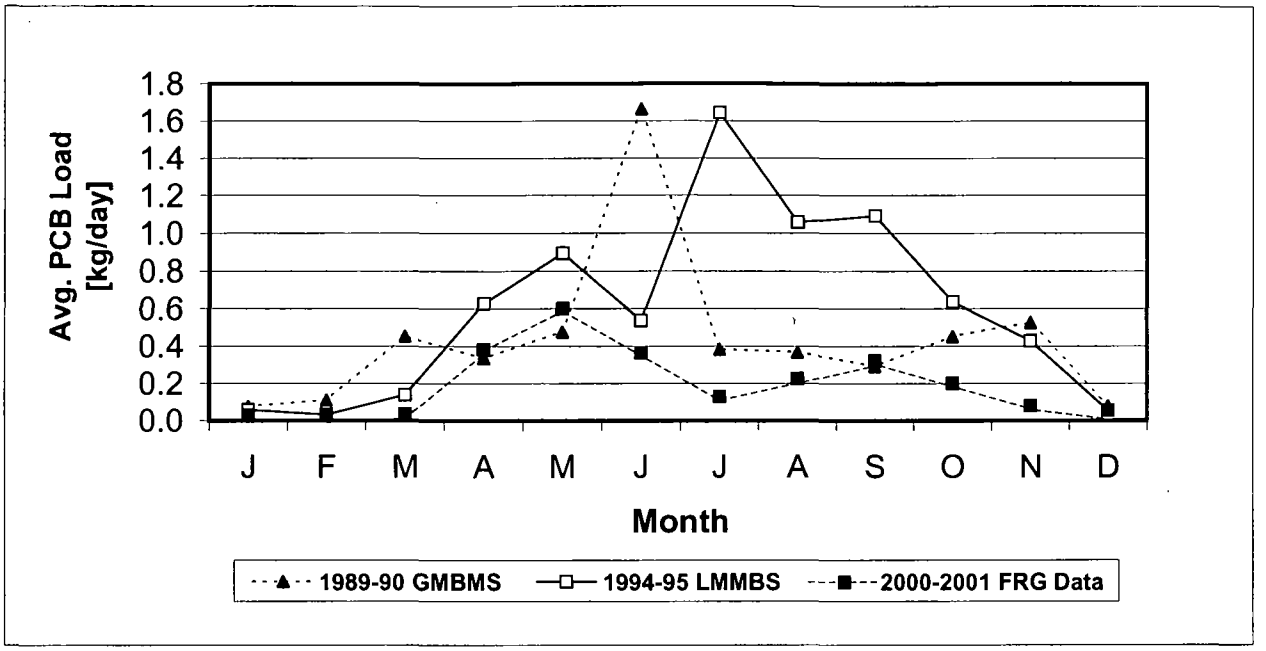
Figure 1-4. Seasonal Trends in Water Column PCB Concentrations



Data sources:
1989-90 GBMBS (Green Bay Mass Balance Study) as reported in Bierman et al., 1992
1994-95 LMMBS (Lake Michigan Mass Balance Study) as reported in USEPA, 2002a, 2004b
2000-2001 FRG (Fox River Group) Data as reported in LTI, 2002

Note:
Time series are provided for characterization of seasonal trends only. The comparability of these various studies has not been established for characterization of long-term trends.

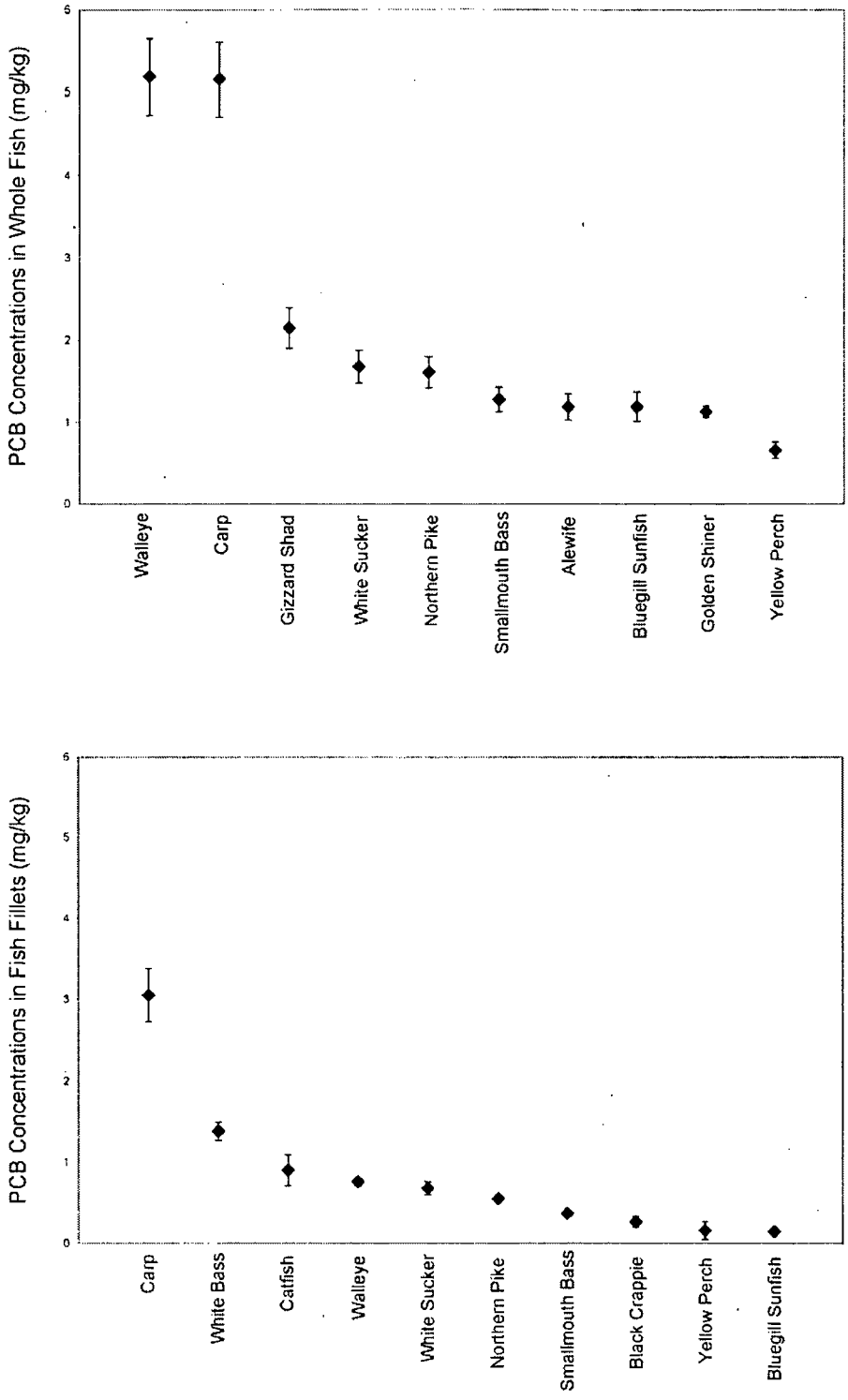
Figure 1-5. Seasonal Trends in PCB Loads



Data sources:
1989-90 GBMBS (Green Bay Mass Balance Study) as reported in Bierman et al., 1992
1994-95 LMMBS (Lake Michigan Mass Balance Study) as reported in USEPA, 2002a, 2004b
2000-2001 FRG (Fox River Group) Data as reported in LTI, 2002

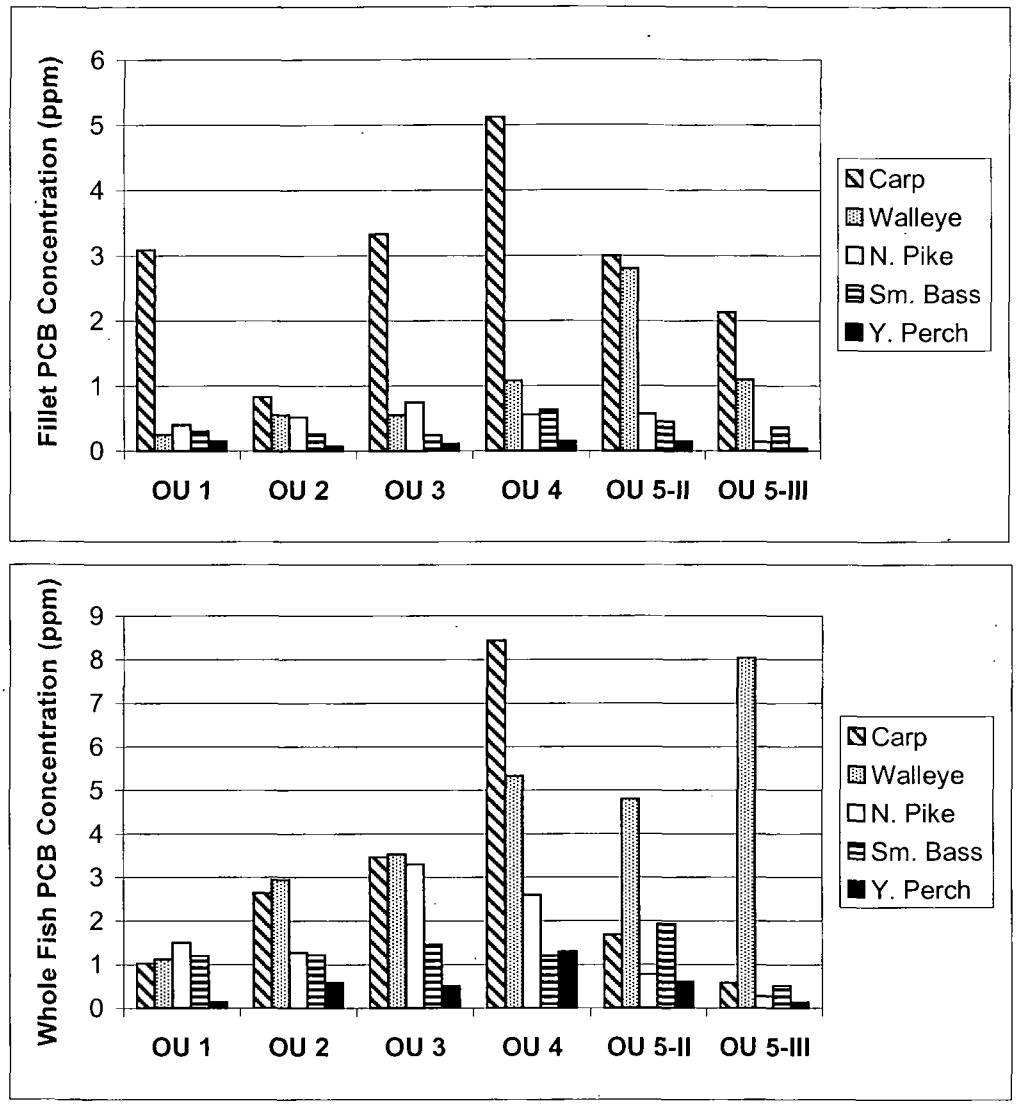
Note:
Time series are provided for characterization of seasonal trends only. The comparability of these various studies has not been established for characterization of long-term trends.

Figure 1-6. Summary Statistics of PCB Concentrations in Fish



Data Sources:USEPA, 2002a, 2004b; Stratus, 1999; Retec, 2002a, 2002b; Exponent, 1999; BBL, 1999, 2002

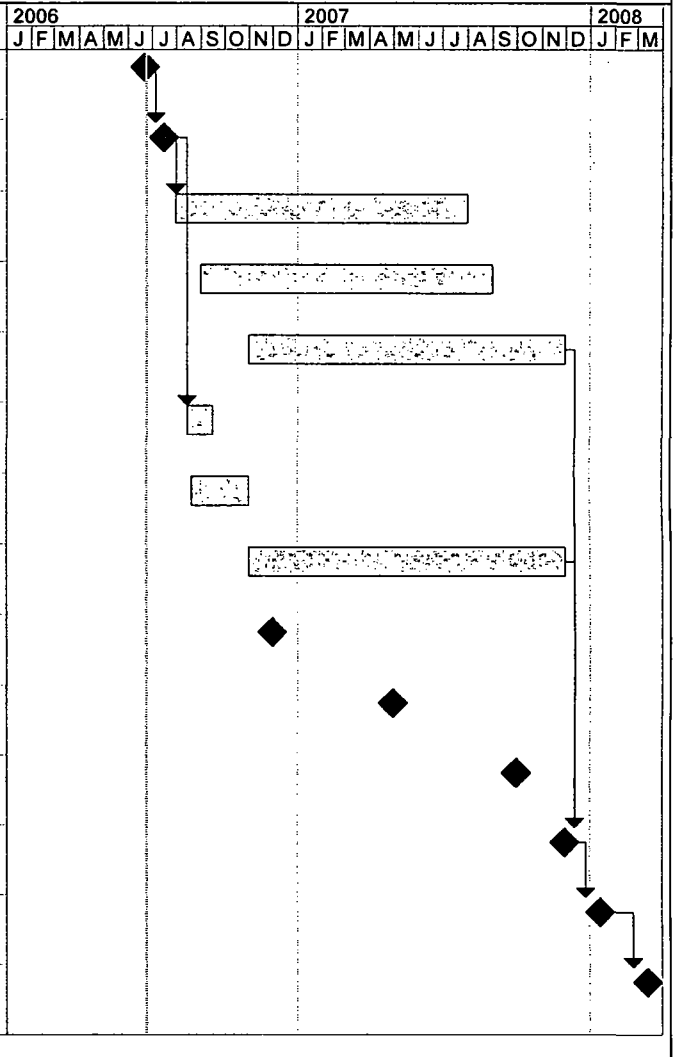
Figure 1-7. Spatial Distribution of PCBs in Fish Tissue



Data Sources:
USEPA, 2002a, 2004b; Stratus, 1999; Retec, 2002a, 2002b;
Exponent, 1999; BBL, 1999, 2002

Figure 1-8 Lower Fox River Baseline Monitoring Schedule

ID	Task Name	Start	Finish	Duration
1	Submit Final Baseline Monitoring Plan	Fri 6/23/06	Fri 6/23/06	1 day
2	Agency approval of Final Baseline Monitoring Plan	Mon 7/17/06	Mon 7/17/06	1 day
3	Perform baseline water column sampling	Tue 8/1/06	Tue 7/31/07	365 days
4	Water sample laboratory analysis	Fri 9/1/06	Fri 8/31/07	365 days
5	Water sample data analysis and reporting	Wed 11/1/06	Fri 11/30/07	395 days
6	Perform baseline fish tissue sampling	Tue 8/15/06	Fri 9/15/06	32 days
7	Fish tissue laboratory analysis	Mon 8/21/06	Tue 10/31/06	72 days
8	Fish tissue data analysis and reporting	Wed 11/1/06	Fri 11/30/07	395 days
9	Long Term Monitoring Work Group Meeting 1	Fri 12/1/06	Fri 12/1/06	1 day
10	Long Term Monitoring Work Group Meeting 2	Tue 5/1/07	Tue 5/1/07	1 day
11	Long Term Monitoring Work Group Meeting 3	Mon 10/1/07	Mon 10/1/07	1 day
12	Submit Draft Baseline Monitoring Report for Agency review	Sat 12/1/07	Sat 12/1/07	1 day
13	Reciept of Agency comments on Baseline Monitoring Report	Tue 1/15/08	Tue 1/15/08	1 day
14	Submit Final Baseline Monitoring Report	Sat 3/15/08	Sat 3/15/08	1 day

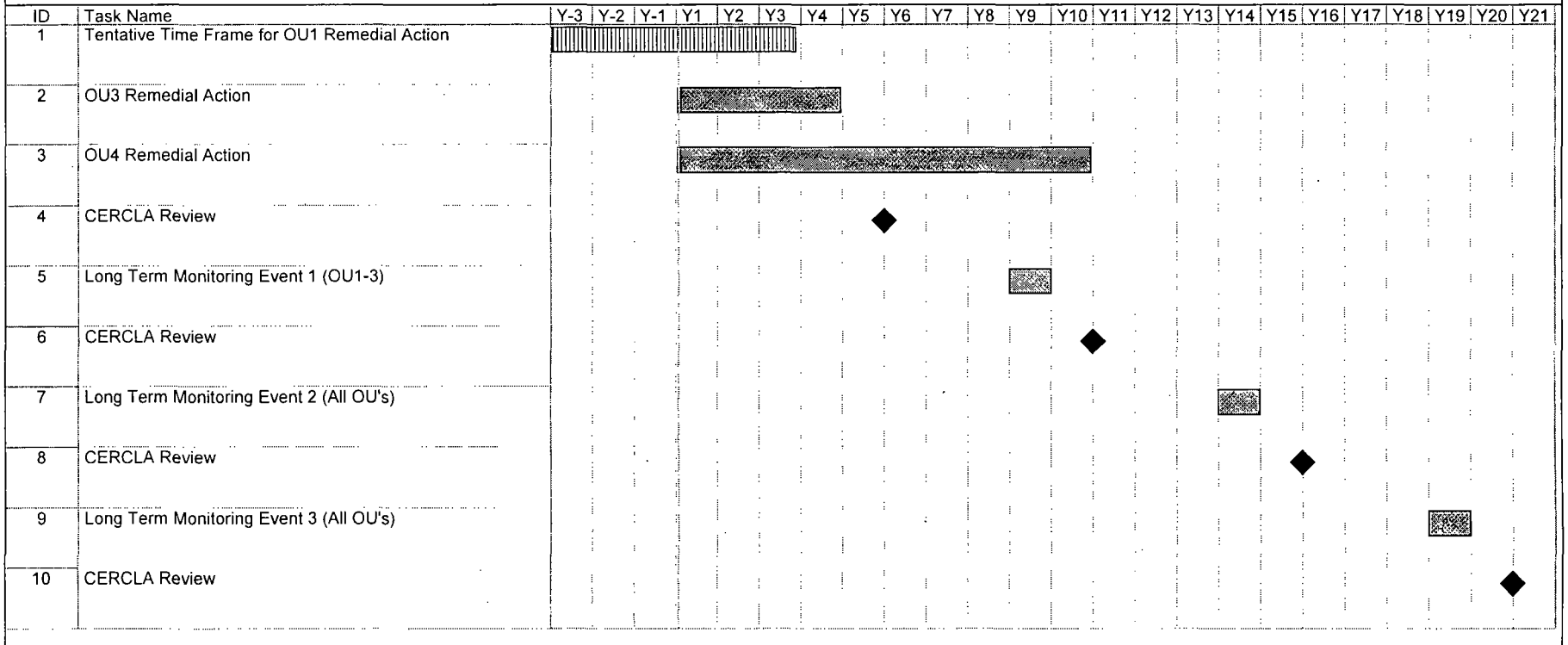


Project: Lower Fox River Monitoring
Date: Fri 6/23/06

Task

Milestone

Figure 1-9 Long Term Monitoring Project Schedule



Project: Long term Monitoring
Date: Fri 1/20/06

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

Note: Year 0 = Beginning of OU2-5 Remediation

Legend

- Fishing Hot Spot - Source: Fishing Hot Spots, Inc.
- Fishing Hot Spot - Source: WDNR
- Dock - Source: OSI 1998
- Outfall - Source: OSI 1998
- Shoreline Type - Described on Map - Source: OSI 1998
- Boat Landing
- Primary Electrofishing Transect Area
- Secondary Electrofishing Transect Area
- Fyke Net Location
- Water Sampling Location
- Water Sampling Transect
- USACE Channel Definition
- Dams
- Shoreline

12000 0 12000 Feet

N W E S

OU1
10
JEFFERSON PARK
LW-52
LW-51
DOTY PARK
LW
LW-50
LW-49
LW-1
PARK AVENUE
LW-48
LW-47
LW-46
LW-2
LW-45
LW-44
LW-43
OSH-O-NEE
LW-41
LW-42
LW-40
LAKE WINNEBAGO
LW-39
SHERMAN ROAD
LW-38
LW-36
LW-37
MURDOCK AVENUE
LW-35
LW-34
MILL STREET
LW-33
FUGLEBURG
LW-31
LW-32
24TH AVENUE
LW-30
LW-29
LW-28
LW-25
LW-27
LW-24
LW-26
LW-3
LW-23
LW-22
LW-20
LW-21
LW-19
LW-18
NAGY PARK
LW-4
LW-17
COUNTY LINE ROAD
LW-5
LW-16
LW-6
LW-15
LW-7
LW-14
LW-13
LW-12
LW-8
LW-11
LW-10
LW-9
45
41
151
6
12
18

Figure 2-2
Lake Winnebago
Baseline Monitoring Stations

Shaw™ Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

Legend

- Fishing Hot Spot - Source: Fishing Hot Spots, Inc.
- Fishing Hot Spot - Source: WDNR
- Dock - Source: OSI 1998
- Outfall - Source: OSI 1998
- Shoreline Type - Described on Map - Source: OSI 1998
- Boat Landing
- Primary Electrofishing Transect Area
- Secondary Electrofishing Transect Area
- Fyke Net Location
- Water Sampling Location
- Water Sampling Transect
- USACE Channel Definition
- Dams
- Shoreline
- Water Depth Contour - 10-Foot Interval
- Water Depth Contour - 2-Foot Interval

2000 0 2000 Feet

Bottom Type

Source: OSI 1998

- Type I - Silt
- Type II - Sand
- Type III - Sand and Gravel
- Type IV - Gravel
- Type V - Cobble

LUTZ PARK
DNR-6
OU1
DNR-5
NINTH STREET
FRITZE PARK
JEFFERSON PARK
DNR-4
LOCK STREET
DNR-3
MENASHA DAM
TAYCOST
Sand and Gravel with Abundant Cobbles
LW-51
Lake Winn
DNR-2
Sandy Clay with Cobbles
Firm Sand and Gravel
DNR-1
DOTY PARK
NEENAH DAM
WINNECONNEAVE
41
47
10
114
N
W
E
S

Figure 2-3
Operable Unit 1
Baseline Monitoring Stations

Shaw™ Shaw Environmental, Inc.
ANCHOR ENVIRONMENTAL, L.L.C.

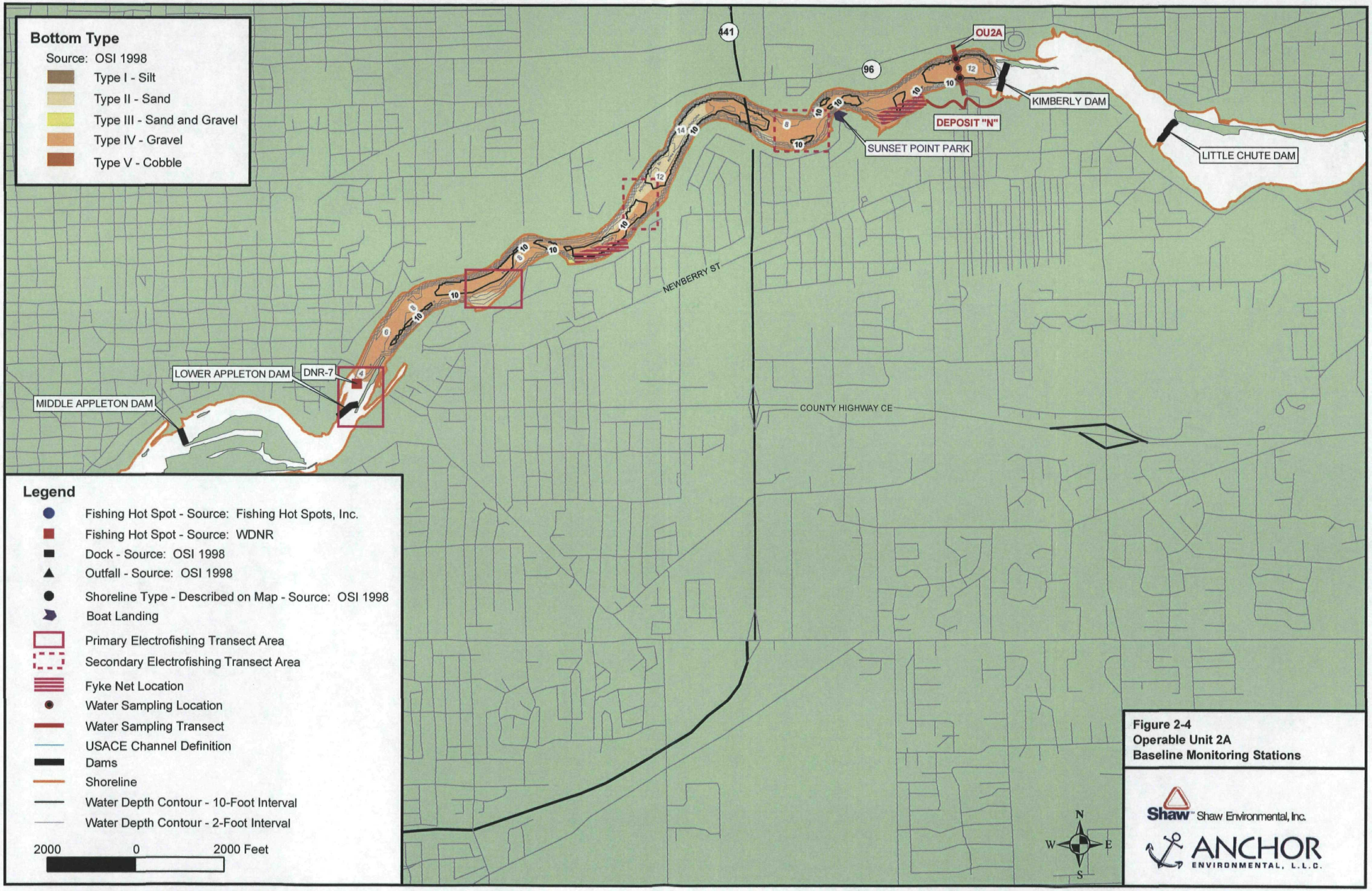


Figure 2-4
Operable Unit 2A
Baseline Monitoring Stations

Shaw™ Shaw Environmental, Inc.
ANCHOR ENVIRONMENTAL, L.L.C.

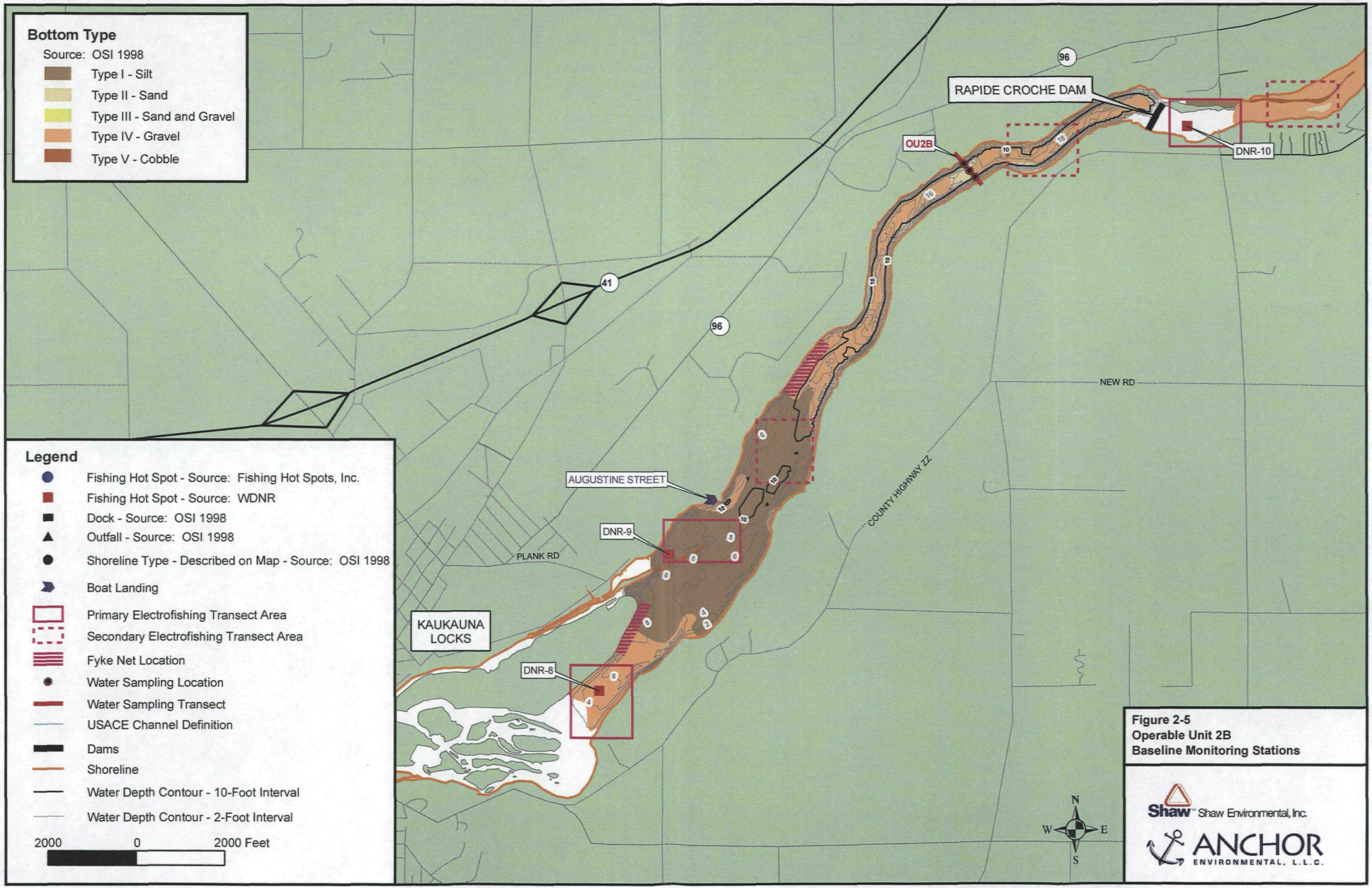


Figure 2-5
Operable Unit 2B
Baseline Monitoring Stations

Shaw Shaw Environmental, Inc.
ANCHOR ENVIRONMENTAL, L.L.C.

Legend

- Fishing Hot Spot - Source: Fishing Hot Spots, Inc.
- Fishing Hot Spot - Source: WDNR
- Dock - Source: OSI 1998
- Outfall - Source: OSI 1998
- Shoreline Type - Described on Map - Source: OSI 1998
- Boat Landing
- Primary Electrofishing Transect Area
- Secondary Electrofishing Transect Area
- Fyke Net Location
- Water Sampling Location
- Water Sampling Transect
- USACE Channel Definition
- Dams
- Shoreline
- Water Depth Contour - 10-Foot Interval
- Water Depth Contour - 2-Foot Interval

2000 0 2000 Feet

Bottom Type

Source: OSI 1998

- Type I - Silt
- Type II - Sand
- Type III - Sand and Gravel
- Type IV - Gravel
- Type V - Cobble

LITTLE RAPIDS DAM

DNR-12

DEPOSIT "DD"

OU2C

DNR-11

WRIGHTSTOWN PARK

DNR-10

RAPIDE CROCHE DAM

41

96

GOLDEN GLOWRD

COUNTY ROAD D

COUNTY ROAD ZZ

WRIGHTSTOWNRD

MEADOWLARKRD

MAINST

ELMRORD

N

W E

S

Figure 2-6
Operable Unit 2C
Baseline Monitoring Stations

Shaw™ Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

Legend

- Fishing Hot Spot - Source: Fishing Hot Spots, Inc.
- Fishing Hot Spot - Source: WDNR
- Dock - Source: OSI 1998
- Outfall - Source: OSI 1998
- Shoreline Type - Described on Map - Source: OSI 1998
- Boat Landing
- Primary Electrofishing Transect Area
- Secondary Electrofishing Transect Area
- Fyke Net Location
- Water Sampling Location
- Water Sampling Transect
- USACE Channel Definition
- Probable Spawning Area - Source: WDNR
- Documented Spawning Area - Source: WDNR
- Marina - Source: WDNR
- Dams
- Shoreline
- Water Depth Contour - 10-Foot Interval
- Water Depth Contour - 2-Foot Interval

2000 0 2000 Feet

Bottom Type

Source: OSI 1998

- Type I - Silt
- Type II - Sand
- Type III - Sand and Gravel
- Type IV - Gravel
- Type V - Cobble

FR-3
DNR-16
FR-2
DNR-14
DNR-15
FR-1
DE PERE DAM
FOX RIVER DRIVE
OU3
DNR-13
Gravel with Cobbles
DEPOSIT "DD"
Gravel with Cobbles
DNR-12
LITTLE RAPIDS DAM
OU2C
STATE HIGHWAY 32
BROADWAY
FOX RIVERDR
COUNTY ROAD PP
GREENLEAFRD
COUNTY ROAD D
41
57
N
W
E
S

Figure 2-7
Operable Unit 3
Baseline Monitoring Stations

Shaw™ Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

Legend

- Fishing Hot Spot - Source: Fishing Hot Spots, Inc.
- Fishing Hot Spot - Source: WDNR
- Dock - Source: OSI 1998
- Outfall - Source: OSI 1998
- Shoreline Type - Described on Map - Source: OSI 1998
- Boat Landing
- Primary Electrofishing Transect Area
- Secondary Electrofishing Transect Area
- Fyke Net Location
- Water Sampling Location
- Water Sampling Transect
- USACE Channel Definition
- Probable Spawning Area - Source: WDNR
- Documented Spawning Area - Source: WDNR
- Marina - Source: WDNR
- Dams
- Shoreline
- Water Depth Contour - 10-Foot Interval
- Water Depth Contour - 2-Foot Interval

2000 0 2000 Feet

Bottom Type
Source: OSI 1998
- Type I - Silt
- Type II - Sand
- Type III - Sand and Gravel
- Type IV - Gravel
- Type V - Cobble

Green Bay

GB-8
FR-26
FR-24
FR-25
GREEN BAY YACHT CLUB
FR-23
FR-22
OU4
FR-21
FR-20
FR-19
FR-18
FR-17
FR-16
DNR-24
FR-15
FR-14
FR-13
DNR-23
DNR-22
DNR-21
FR-12
FR-11
FORT JAMES TURNING BASIN
DNR-20
FR-9
FR-10
DNR-19
FR-8
FR-7
FR-6
DNR-18
FR-5
FR-4
FOX POINT
BROWN COUNTY FAIRGROUNDS
DNR-17
DNR-16
FR-3
FR-2
DNR-15
DE PERE DAM
DNR-14
FR-1
BROADWAY
WALNUTST
I-43
141
57
172
32
29
10
20
30
40

Operable Unit 4A

Operable Unit 4B

Figure 2-8
Operable Unit 4
Baseline Monitoring Stations

Shaw™ Shaw Environmental, Inc.
ANCHOR ENVIRONMENTAL, L.L.C.

Legend

- Fishing Hot Spot - Source: Fishing Hot Spots, Inc.
- Fishing Hot Spot - Source: WDNR
- Dock - Source: OSI 1998
- Outfall - Source: OSI 1998
- Shoreline Type - Described on Map - Source: OSI 1998
- Boat Landing
- Water Depth Contour - 5-Foot Interval
- USACE Channel Definition
- Dams
- Shoreline

20000 0 20000 Feet

5 4 3 2 1 0 5 Miles

- Primary Electrofishing Transect Area
- Secondary Electrofishing Transect Area
- Fyke Net Location
- Water Sampling Location
- Water Sampling Transect

Surface Sediment PCB Concentrations (ppm)

- 0 - .0125
- 0.125 - 0.5
- 0.5 - 1.0
- 1.0 - 1.6

RED ARROW
LITTLE RIVER
OU5C
MURPHY PARK
Y
PESHTIGO HARBOR
OCONTO PARK II
OCONTO PARK I
OCONTO HARBOR
OU5B
PENSAUKEE RIVER
141
41
J
S
C
57
SUGAR CREEK COUNTY PARK
CHAUDOIR DOCK PARK
STONE QUARRY
POTAWATOMI STATE PARK
SHERWOOD POINT
RILEY POINT
STEVENSON PIER ROAD
OU5B FISHING STATION
RED RIVER COUNTY PARK
GREEN BAY
SUAMICO RIVER
OU5A
BAY SHORE PARK
VOKE'S LANDING
LONG TAIL POINT
HOWARD MEMORIAL
WINDJAMMER CLUB
GREEN BAY YACHT CLUB
GREEN BAY SAILING CLUB
OU5A FISHING STATION
I-43
30
25
20
15
10
5

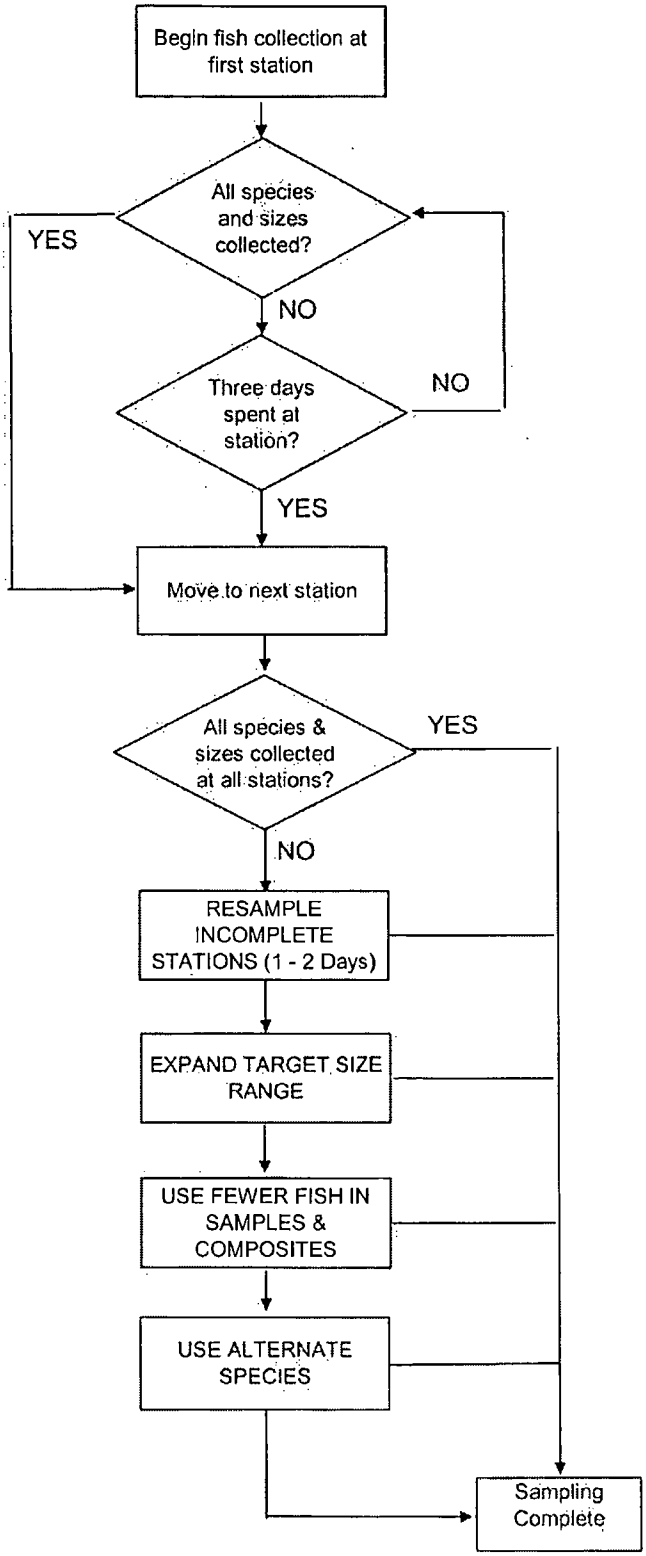
N W E S

Figure 2-9
Lower Green Bay
Baseline Monitoring Stations

Shaw™ Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 3-1. Field Decision Flow Chart for Fish Sampling



APPENDIX
A

Appendix A –

Pace and STL QA Plan and Certifications

Document List

1. Pace Analytical Green Bay Wisconsin Laboratory Certification 1
2. Pace Analytical Kimberly Wisconsin Laboratory Certification 2
3. Pace Analytical Minneapolis Quality Manual
4. STL Knoxville Laboratory Response Letter to the Wisconsin Department of Resources (Congener Analysis) audit report dated November 18th 2004
5. Wisconsin Department of Natural Resources Report of On-Site Evaluation for STL Knoxville
6. Wisconsin Department of Natural Resources Letter- Conclusion of Evaluation Process for STL Knoxville
7. STL Knoxville Quality Manual

The State of Wisconsin

DEPARTMENT OF NATURAL RESOURCES

Hereby grants

Wisconsin Certification under NR 149

under the provisions of ch. NR 149, Wisconsin Administrative Code to:

En Chem - a Div. of Pace Anal.
1241 Bellevue Street
Green Bay, WI 54302

Lab ID Number: **405132750**

Issued Date: **November 9, 2004**

Expiration Date: **August 31, 2005**

for the following test categories:

- Oxygen Utilization
  - Biochemical Oxygen Demand
  - Carbonaceous BOD
- Nitrogen
  - Ammonia as N
  - Nitrite as N
  - Nitrate as N
  - Nitrate + Nitrite as N
  - Total Kjeldahl Nitrogen
- Phosphorus
  - Orthophosphate
  - Total Phosphorus
- Physical
  - Oil and Grease (HEM)
  - Total Dissolved Solids
  - Total Solids
  - Total Suspended Solids
  - Total Vol. Suspend Solids
  - Total Volatile Solids
- General I
  - Alkalinity/Acidity
  - Color
  - Hardness
- General II
  - Chloride
  - Cyanide
  - Chemical Oxygen Demand
  - Fluoride
  - Total Phenolic Compounds
  - Sulfide
  - Sulfate
- General III
  - Corrosivity
  - Waste Fingerprinting
  - Ignitability
  - SPLP
  - TCLP
- Metals I
  - Silver
  - Aluminum
  - Arsenic
  - Boron
  - Barium
  - Beryllium
  - Calcium
  - Cadmium
  - Cobalt
  - Chromium (Total)
  - Copper
  - Iron
  - Chromium (Hexavalent)
  - Mercury
  - Potassium
  - Magnesium
  - Manganese
  - Molybdenum
  - Sodium
  - Nickel
  - Lead
  - Antimony
  - Selenium
  - Strontium
- Metals I
  - Thallium
  - Vanadium
  - Zinc
- Metals II
  - Titanium
- Organics; Purgeable
  - Purgeable Aromatics
  - Purgeable Halocarbons
  - Volatile Organics (VOCs)
- Semivolatiles by GC/MS
  - Base/Neutral/Acid Extract
  - PAHs by GC/MS-SIM
- Petroleum Hydrocarbons
  - Diesel Range Organics
  - Gasoline Range Organics
  - Petroleum VOCs
- Organics; Organochlorine
  - PCBs

David Webb

Chief, Environmental Science Services

P. Scott Hassett

Secretary

Certification or registration by the State of Wisconsin is not an endorsement or guarantee of the validity of data generated by this laboratory. This certificate is valid unless revoked or suspended and supersedes all previous certificates.

The State of Wisconsin

DEPARTMENT OF NATURAL RESOURCES

Hereby grants

Wisconsin Certification under NR 149

under the provisions of ch. NR 149, Wisconsin Administrative Code to:

En Chem, Inc. (Kimberly)
1090 Kennedy Avenue
Kimberly, WI 54136

Lab ID Number: **445134030**

Issued Date: **August 20, 2004**

Expiration Date: **August 31, 2005**

for the following test categories:

- Nitrogen
  - Nitrite as N
  - Nitrate as N
- Physical
  - Total Dissolved Solids
  - Total Solids
  - Total Suspended Solids
  - Total Volatile Solids
- General I
  - Bromide
  - Hardness
  - Silica
- General II
  - Chloride
  - Fluoride
  - Sulfate
- General III
  - Total Organic Carbon
- Metals I
  - Silver
  - Aluminum
  - Arsenic
  - Boron
  - Barium
  - Beryllium
  - Calcium
  - Cadmium
  - Cobalt
  - Chromium (Total)
  - Copper
  - Iron
- Metals I
  - Mercury
  - Potassium
  - Magnesium
  - Manganese
  - Molybdenum
  - Sodium
  - Nickel
  - Lead
  - Antimony
  - Selenium
  - Tin
  - Thallium
  - Vanadium
  - Zinc
- Organics; Purgeable
  - Purgeable Aromatics
  - Purgeable Halocarbons
  - Volatile Organics (VOCs)
- Semivolatiles by GC/MS
  - Base/Neutral/Acid Extract
  - PAHs by GC/MS-SIM
- Organics; Organochlorine
  - PCBs
  - Organochlorine Pesticides
- Safe Drinking Water
  - Arsenic
  - Barium
  - Beryllium
  - Cadmium
  - Chromium
- Safe Drinking Water
  - Copper
  - Mercury
  - Nitrate + Nitrite
  - Sodium
  - Nickel
  - Nitrite
  - Nitrate
  - Lead
  - Antimony
  - Selenium
  - Thallium
  - Total Trihalomethanes
  - Volatile Organics

David Webb

Chief, Environmental Science Services

P. Scott Hassett

Secretary

Certification or registration by the State of Wisconsin is not an endorsement or guartantee of the validity of data generated by this laboratory. This certificate is valid unless revoked or suspended and supersedes all previous certificates.

Pace Analytical™
www.pacelabs.com

QUALITY MANUAL

Quality Assurance/Quality Control Policies and Procedures

Prepared by Pace Analytical Services, Inc.
1700 Elm Street S.E., Suite 200
Minneapolis, Minnesota 55414
(612) 607-1700

for:

Asheville Laboratory 2225 Riverside Drive Asheville, NC 28804 828-254-7176	Charlotte Laboratory 9800 Kincey Avenue #100 Huntersville, NC 28078 704-875-9092	Houston Laboratory 900 Gemini Avenue Houston, TX 77058 281-488-4661	SE Kansas Lab 808 West McKay Frontenac, KS 66763 620-235-0083
Indianapolis Laboratory 7726 Moller Road Indianapolis, IN 46268 317-875-5894	Kansas City Laboratory 9608 Loiret Blvd. Lenexa, KS 66219 913-599-5665	Minnesota Laboratory 1700 Elm Street S.E. Minneapolis, MN 55414 612-607-1700	
New Orleans Laboratory 1000 Riverbend Blvd. Suite F St. Rose, LA 70087 504-469-0333	Pittsburgh Laboratory 5203 Triangle Lane Export, PA 15632 724-733-1161	Waltz Mill Radiochemistry Laboratory I-70 Madison Exit Madison, PA 15663 724-722-5214	
Baton Rouge Laboratory 11950 Industriplex Blvd. Baton Rouge, LA 70809 225-753-8650	Pace Analytical, Inc. El Retiro Industrial Zone P.O. Box 325 Calle B&C San German, PR 00683 787-720-0329	Shreveport Laboratory 4723 Vinking Drive Bossier City, LA 71111 318-747-6962	

Approval

Steve A. Vanderboom
President, CEO
(612) 607-6409

8-20-04
Date

Clarence L. Haile, Ph.D.
Director of Quality, Safety & Training
(612) 607-6439

20 Aug 2004
Date

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This is COPY# 10 distributed on 8/5/05 by KEB and is ____ CONTROLLED or X UNCONTROLLED.

Signature Page

This document, with the necessary addenda, has been accepted as the Quality Manual.

Laboratory General Manager	Date	Upper Midwest Region Laboratory
Quality Manager	01 NOV 2004. Date	Includes: Minneapolis Laboratory. EnChem Green Bay Laboratory EnChem Kimberly Laboratory.
Technical Director	11-1-04 Date	
Technical Director	11-1-04 Date	
Technical Director	11/1/04 Date	
Technical Director	Date	
Technical Director	Date	

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1.0 INTRODUCTION & ORGANIZATIONAL STRUCTURE

"To meet the business needs of our customers for high-quality, cost-effective analytical measurements and services"

Pace Analytical Statement of Purpose

1.1 Introduction to Pace

Pace Analytical Services, Inc. is a privately-held, full-service environmental testing firm operating a nationwide system of laboratories. Pace offers extensive services beyond standard environmental testing, including: bioassay for aquatic toxicity, air toxics, industrial hygiene testing, explosives, high resolution mass spectroscopy (including dioxins, furans and coplanar PCB's), radiochemical analyses, product testing, pharmaceutical testing, field services and mobile laboratory capabilities. Pace has implemented a consistent Quality System in each of its laboratories and service centers. In addition, the company utilizes an advanced data management system that is highly efficient and allows for flexible data reporting. Together, these systems ensure data reliability and superior on-time marketing performance. This document defines the Quality System and QA/QC protocols.

Pace Analytical's goal is to continue to combine its expertise in laboratory operations with customized solutions to meet the specific needs of its clients.

1.2 Statement of Purpose

To meet the business needs of our customers for high quality, cost-effective analytical measurements and services.

1.3 Quality Policy Statement and Goals of the Quality System

Pace Analytical is committed to providing the highest quality product to our clients, while maintaining good professional practices.

The management of Pace Analytical is responsible for maintaining the highest possible standard of service for our clients by following a documented quality system. The overall objective of this quality system is to provide reliable data by adhering to rigorous quality assurance policies and quality control procedures as documented in this Quality Manual.

All personnel within the Pace network are required to be familiar with all facets of the quality system and implement these policies and procedures in their daily work. This daily focus on quality is applied with the initial project planning, and is continued through all field and laboratory activities and ultimately, to the final report generation.

The management of Pace demonstrates its commitment to quality by providing the resources, including facilities, equipment and personnel to ensure the adherence to these documented policies and procedures. All Pace personnel comply with all current applicable state, federal, and industry standards (such as the NELAC and ISO 17025 standards).

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1.4 Pace Analytical Core Values

- **INTEGRITY**
- **VALUE EMPLOYEES**
- **KNOW OUR CUSTOMERS**
- **HONOR COMMITMENTS**
- **FLEXIBLE RESPONSE TO DEMAND**
- **PURSUE OPPORTUNITIES**
- **CONTINUOUSLY IMPROVE**

1.5 Code of Ethics

Pace Analytical's fundamental ethical principles are as follows:

- Each Pace Analytical employee is responsible for the propriety and consequences of his or her actions.
- Each Pace Analytical employee must conduct all aspects of Company business in an ethical and strictly legal manner, and must obey the laws of the United States and of all localities, states and nations where Pace Analytical does business or seeks to do business.
- Each Pace Analytical employee must reflect the highest standards of honesty, integrity and fairness on behalf of the Company with clients, suppliers, the public, and one another.

Strict adherence by each Pace Analytical employee to this Code of Ethics and to the Standards of Conduct is essential to the continued vitality of Pace Analytical.

Failure to comply with the Code of Ethics and Standards of Conduct will result in disciplinary action up to and including termination and referral for civil or criminal prosecution where appropriate. An employee will be notified of an infraction and given an opportunity to explain, as prescribed under current disciplinary procedures.

1.6 Standards of Conduct

1.6.1 Data Integrity

The accuracy and integrity of the analytical results produced at Pace Analytical are the lifeblood of the company. Lack of data integrity is an assault on our most basic values and puts Pace Analytical and its employees at grave financial and legal risk. Therefore, employees are to accurately prepare and maintain all technical records, scientific notebooks, calculations and databases. Employees are prohibited from making false entries or misrepresentations of data (i.e., dates, calculations, results or conclusions).

Managerial staff must make every effort to ensure that personnel are free from any undue pressures that may affect the quality of their work; including commercial, financial, over-scheduling and working condition pressures.

1.6.2 Confidentiality

Pace Analytical employees must not (directly or indirectly) use or disclose confidential or proprietary information except when in connection with their duties at Pace Analytical. This is effective over the course of employment and for a period of two years thereafter.

Confidential or proprietary information, belonging to either Pace Analytical and/or its clients, includes but is not limited to test results, trade secrets, research and development matters, procedures, methods, processes and standards, company-specific techniques and equipment, marketing and client information, inventions, materials composition, etc.

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1.6.3 Financial Responsibility

Pace Analytical employees must accurately keep all books, records and accounts for which they are responsible. Employees are responsible for maintaining and safeguarding all company funds and/or assets in their possession or control. Additionally, all employees are responsible for submission of accurate reporting documents pertaining to payroll (timesheets, etc.) and reimbursement requests (expense reports, tuition reimbursement, etc.).

1.6.4 Drug-free Workplace

Pace Analytical recognizes that alcoholism and other drug dependencies are a significant social problem with a potential for causing severe detriment to the workforce. Employees have the right to work in an alcohol and drug-free environment. Employees are not to report to work under the influence of alcohol or controlled substances as prescribed in the Drug-free Workplace Program. The possession, use and sale of alcohol and controlled substances as well as detailed information regarding drug testing is described in the Drug-Free Workplace Program Policy handout provided to all new employees. Additional copies are available from Human Resources. Employees are obligated to conform to the strict Drug-Free Workplace Program Policy.

1.6.5 Conflict of Interest

Pace Analytical employees must avoid situations that might involve a conflict of interest or appear questionable to others. The employee must be careful in two general areas:

- Participation in activities that conflict or appear to conflict with Pace Analytical responsibilities.
- Offering or accepting anything that might influence the recipient or cause another person to believe that the recipient may be influenced. This includes bribes, kickbacks or illegal payments.

Employees are not to engage in outside business or economic activity relating to a sale or purchase by the Company. Other questionable activities include service on the Board of Directors of a competing or supplier company, significant ownership in a competing or supplier company, employment for a competing or supplier company or participation in any outside business during the employee's work hours.

1.6.6 Non-Harassment

Pace Analytical endeavors to provide a workplace free of both harassment and discrimination. Harassment of an employee or job applicant on the basis of race, color, creed, religion, national origin, sex, disability, age, marital status, sexual orientation, or any characteristic protected by applicable municipal, state, and federal laws is both illegal and a violation of company policy. Pace Analytical maintains a Sexual Harassment Prevention policy that clearly defines the company's stance against sexual harassment and provides a mechanism for reporting infractions. The Sexual Harassment Prevention Policy is addressed in employee orientation, and employees are provided the Policy handbook. Additional copies are available from Human Resources.

1.6.7 Proper and Professional Conduct

Employees are bound to use fairness, honesty and regard for the law in their business relationships with Pace Analytical investors, clients, suppliers, employees, and applicants as well as all local, national and international communities and governments.

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1.6.8 Protection of Property

Pace Analytical employees have an obligation to protect all company and client property against loss, theft and misuse. Employees are responsible for maintaining an orderly, clean workplace. Employees are also liable for using company and client property for intended purposes only. Employees are prohibited from using company property for their personal use without the expressed permission of their supervisor or General Manager. No such use of property may be made after termination of employment with Pace Analytical. Employees must also make every effort to prevent the misuse of company and client property by other persons. Misuse includes selling, loaning or giving away company or client property.

1.6.9 Communication

Each employee is responsible for obtaining the information necessary to follow directives in the Code of Ethics and the Standards of Conduct, and for reporting to their management or Human Resources representative any observed deviations from these policies. The identity of the employee reporting the infraction will not be disclosed without his/her permission unless disclosure is unavoidable during an investigation. No adverse action will be taken against a Pace Analytical employee because he/she has reported a suspected impropriety. These reports will be treated in confidence to the maximum extent consistent with the fair and rigorous enforcement of the Code of Ethics and Standards of Conduct.

1.6.10 Compliance

All employees are required to read, understand and comply with the various components of the standards listed in this document. As confirmation that they understand this responsibility, each employee is required to sign an acknowledgment form annually that becomes part of the employee's permanent record.

1.7 Laboratory Organization

The Pace Corporate Office centralizes company-wide accounting, business development, financial management, human resources development, information systems, marketing, quality, safety and training activities. Pace Analytical's Director of Quality, Safety and Training is responsible for assisting the development, implementation and monitoring of quality programs for the company. See Figure 1.1 for the Corporate Organizational structure.

Each laboratory within the system operates with local management, but all share common systems and receives support from the Corporate Office.

A General Manager supervises each regional laboratory. Quality Managers at each lab report directly to their General Manager but receive guidance and direction from the Director of Quality, Safety and Training.

Under the direction of the General Manager, the technical staff of the laboratory is generally organized into the following functional groups:

- Organic Sample Preparation
- Wet Chemistry Analysis
- Metals Analysis
- Volatiles Analysis
- Semi-volatiles Analysis
- Radiochemical Analysis
- Product Testing
- Equipment Maintenance
- Microbiology

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Appropriate support groups are present in each laboratory. Figure 1.2 represents a typical organizational structure for a laboratory operation. The organizational structure for a specific laboratory is part of each laboratory's addendum to this Quality Manual.

1.8 Laboratory Job Descriptions

1.8.1 General Manager

1. Oversees all functions of the operations.
2. Authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation.
3. Prepares budgets and staffing plans.
4. Monitors the Quality Systems of the laboratory and advises the Quality Manager accordingly.
5. Ensures compliance with all applicable state, federal and industry standards.

1.8.2 Quality Manager

1. Oversees the laboratory Quality Systems while functioning independently from laboratory operations. Reports directly to the General Manager.
2. Monitors Quality Assurance policies and Quality Control procedures to ensure that the laboratory achieves established standards of quality.
3. Maintains records of quality control data and evaluates data quality.
4. Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or client representatives.
5. Reviews and maintains records of proficiency testing results.
6. Maintains the document control system
7. Assists in development and implementation of appropriate training programs.
8. Provides technical support to laboratory operations regarding methodology and project QA/QC requirements.
9. Maintains certifications from federal and state programs.
10. Ensures compliance with all applicable state, federal and industry standards.

1.8.3 Project Manager

1. Coordinates all aspects of specific projects.
2. Focal point for client contact pertaining to project requirements and project status.
3. Arranges bottle orders and shipment of sample kits to clients.
4. Verifies log-in information relative to project requirements and field sample Chains-of-Custody.
5. Communicates with operations staff to update and set project priorities.
6. Provides results to clients in the requested format (verbal, hardcopy, electronic, etc.).
7. Works with clients, laboratory staff, and other appropriate Pace Analytical staff to develop project statements of work or resolve problems of data quality.

1.8.4 Operations Manager or Department Manager/Supervisor

1. Oversees the day-to-day production and quality activities of the laboratory.
2. Ensures that quality assurance and quality control criteria of analytical methods and projects are satisfied.
3. Assesses data quality and takes corrective action when necessary.
4. Approves and releases technical and data management reports.
5. Ensures compliance with all applicable state, federal and industry standards.

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1.8.5 Group Supervisor/Leader

1. Trains analysts in laboratory operations and analytical procedures.
2. Organizes and schedules analyses with consideration for sample holding times.
3. Implements data verification procedures by assigning data verification duties to appropriate personnel.
4. Evaluates instrument performance and supervises instrument calibration and preventive maintenance programs.
5. Reports non-compliance situations to laboratory management including the Quality Manager.

1.8.6 Analyst

1. Analyzes samples according to published methods and laboratory procedures.
2. Monitors quality control data. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks.

1.8.7 Sample Management Personnel

1. Signs for incoming samples and verifies the data entered on the Chain-of-Custody forms.
2. Enters the sample information into the Laboratory Information Management System (LIMS) for tracking and reporting.
3. Stages samples according to EPA requirements.
4. Assists Project Managers in filling bottle orders and sample shipments.

1.9 Training and Orientation

Each new employee receives a five part orientation: human resources, data integrity ethics, safety, Quality Systems, and departmental.

The human resources orientation includes benefits, salary, and company policies. All records are stored with Human Resources.

The data integrity system of each lab contains four elements:

- Data integrity training
- Signed data integrity documentation for all employees
- In-depth, periodic monitoring of data integrity –including but not limited to:
  - logbook checks
  - raw data review
  - final report review
  - manual integration checks
- Documentation of review and investigations regarding data integrity issues.

The safety orientation includes an in-depth review of the Pace Analytical Chemical Hygiene Plan/Safety Plan, which are consistent with the requirements of OSHA's Hazard Communication Program (29 CFR 1910.1200) and other pertinent regulations.

The Quality Systems orientation provides the new employee with information through an introduction to the Quality Manual and SOPs, acceptable record keeping practices, and the individual's responsibility to data quality.

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The new employee's Department Supervisor provides the employee with a basic understanding of the role of the laboratory within the structure of Pace Analytical and the basic elements of that individual's position.

Supervised training uses the following techniques:

- Hands-on training
- Lectures and training sessions
- Method-specific training packages on PaceNet (WAN)
- Conferences and seminars
- Short courses
- Specialized training by instrument manufacturers
- Quiz
- Proficiency testing programs.

Group Supervisors/Leaders are responsible for providing documentation of training and proficiency for each employee under their supervision. The employee's training file indicates what procedures an analyst or a technician is capable of performing, either independently or with supervision. The files also include documentation of continuing capability (see Section 3.4 for details on Demonstration of Capability requirements). Training documentation files for each person are kept in a central location in each laboratory. The Quality Manager is responsible for maintaining the training files.

All procedures and training records are maintained and available for review during laboratory audits. These procedures are reviewed/updated annually by lab management.

1.10 Laboratory Safety

It is the policy of Pace Analytical to make safety and health an integral part of daily operations and to ensure that all employees are provided with safe working conditions, protective equipment, and requisite training to do their work without injury. Each employee is responsible for his/her own safety by complying with established company rules and procedures.

Sample receiving areas and laboratories are equipped with suitable hoods, protective clothing and eye wear, gloves, barrier creams and any other appropriate measures to prevent or minimize staff contact with hazardous substances. Other appropriate safety equipment such as eyewash stations, drench showers, spill absorbents and neutralizers, fire extinguishers, and first aid materials are available.

Each laboratory has a designated Safety/Chemical Hygiene Officer and Safety Committee that meets regularly and discusses agenda topics and addresses action items. The Safety/Chemical Hygiene Officer facilitates the preparation and maintains the laboratory's Chemical Hygiene Plan/Safety Manual, provides safety and occupational health orientation to new employees, conducts safety training and review sessions as required, and maintains up-to-date familiarity with safety and occupational health issues pertinent to the laboratory.

1.11 Security and Confidentiality

Security is maintained by controlled access to laboratory buildings. Exterior doors to laboratory buildings remain either locked or continuously monitored by Pace Analytical staff. Keyless door-lock combinations (and computer access codes/logins) are changed on a regular basis. Posted signs direct visitors to the reception office and mark all other areas as off limits to unauthorized personnel. All visitors to the facilities must sign the Visitor's Logbook maintained by the receptionist. All visitors are accompanied by a staff member during the duration of their stay on the premises. The staff member escorts the visitor back to the reception area at the end of his/her visit where he/she signs out the Visitor's Logbook. Prior to departure of the last staff member at the close of each day, the facility is checked for security.

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Additional security is provided where necessary, i.e., specific secure areas for sample, data and client report storage, as requested by clients or in cases of national security. These areas are lockable within the facilities, or are in secure offsite storage. Access is limited to specific individuals or their designees. Security of sample storage areas is the responsibility of the Sample Custodian. Security of samples and data during analysis and data reduction is the responsibility of Group Supervisors. Security of client report archive is the responsibility of the Client Services Manager. These secure areas are locked whenever these individuals or their designees are not present in the facility.

Access to designated laboratory sample storage locations is limited to authorized personnel only. Provisions for lock and key access are provided. No samples are to be removed without proper authorization. If requested by client or contract, samples are not to be removed from secure storage areas without filling out the associated Chain-of-Custody records.

Standard business practices of confidentiality are applied to all documents and information regarding client analyses. Specific protocols for handling confidential documents are described in Pace Analytical SOPs. Additional protocols for internal identification of samples and data by number only are implemented as required under contract-specific Quality Assurance Project Plans (QAPPs).

All information pertaining to a particular client, including national security concerns will remain confidential. Data will not be released to outside agencies without written authorization from the client.

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Figure 1.1

Corporate/Management Structure

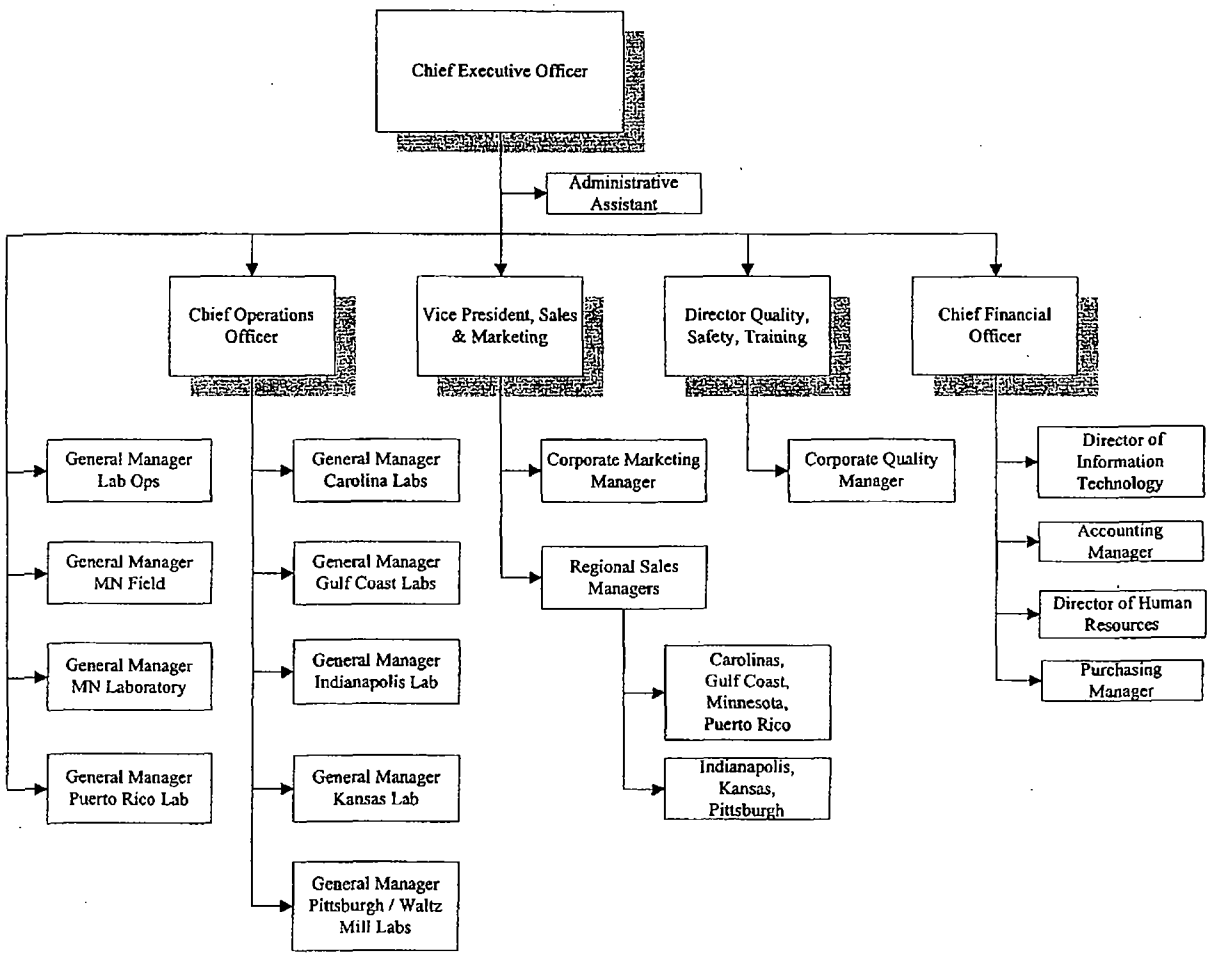
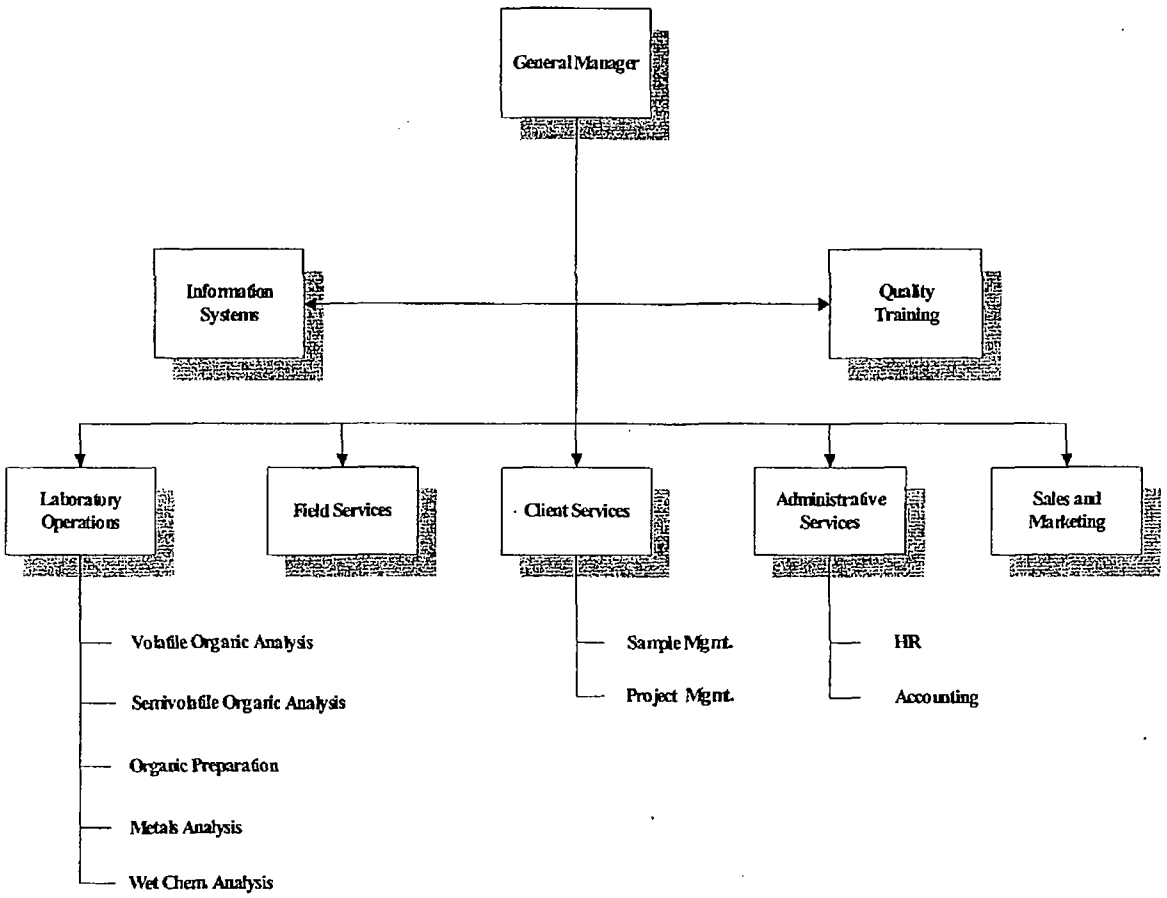


Figure 1.2

Typical Laboratory Organizational Chart



2.0 SAMPLE CUSTODY

2.1 Sampling Support

Each individual Pace Analytical laboratory provides sample containers, shipping containers, sample containers (including applicable chemical preservatives), custody documents, and field quality control samples (i.e., trip blanks) to support field sampling events. Tables 2.1, 2.2, 2.3 and 2.4 list general guidelines for sample container types, preservatives and holding times for a variety of methods. Note that all analyses listed are not necessarily performed at all Pace Analytical locations and there may be additional laboratory analyses performed that are not included in these tables. Pace laboratories provide pick-up and delivery services to their clients when needed.

2.2 Project Initiation

Prior to accepting new work, the lab reviews its capability to perform this work. The purpose of this review is to establish that the lab has sufficient resources (personnel, equipment capacity, analytical method capability, etc.) to complete the required work. Once client needs and data quality objectives are defined, client services personnel or sales representatives contact the laboratory management. Members of the management staff review current instrument capacity, personnel availability and training, analytical procedures capability, laboratory certifications and projected sample load. Management will then inform the sales and client services personnel whether the lab can accept the new projects. This communication is preferably via written correspondence or email, although it may occur during daily operations meetings.

The laboratory maintains records of all such reviews, including discussions with clients. The lab also maintains records of sub-contracted work and keeps a file of all sub-contractor information including current certifications.

2.3 Sample Acceptance Policy

All Pace laboratories have a documented sample acceptance policy that clearly outlines circumstances under which samples will either be accepted or rejected. Documentation of samples rejected under this policy is made on the chain-of-custody or similar document. Results for any sample that does not meet the sample acceptance policy requirements are flagged so that the data user is aware of the nature of the deficiency and the impact on their data. The sample acceptance policy is available to all sample receiving personnel and contains the following requirements:

- Projects must be accompanied by proper documentation including sample identification, location, date and time of sample collection, the sampler's name, preservation types, and any comments made by the sampler.
- Samples must be properly labeled. This includes having a unique field identification written in indelible ink on a durable label.
- The samples must be collected in the appropriate sample containers (See tables 2.1, 2.2, 2.3 and 2.4)
- The samples must be collected and transported to the lab within the required holding times (See tables 2.1, 2.2, 2.3 and 2.4).
- The appropriate sample volume or weight must be available to perform the required tests (including project-specific quality control samples).
- The samples must contain the proper preservative and must not be damaged or contaminated before receipt by the lab.

2.4 Chain-Of-Custody

A chain-of-custody (COC) (see figure 2.1) document provides the legal documentation of samples from time of receipt to completion of analysis. It is important that these documents be as complete as possible. Pace Analytical has implemented standard operating procedures to ensure that sample custody objectives of traceability and responsibility are achieved for every project.

Field personnel or client representatives complete a chain-of-custody form for all samples. Samples are received by the laboratory accompanied by these forms.

If sample shipments are not accompanied by the correct documentation, the Sample Receiving department will notify the Project Manager. The Project Manager is then responsible for obtaining the correct documentation/information from the client so that analysis of samples can proceed.

The sampler is responsible for providing the following information on the chain-of-custody:

- Client project name
- Project location or number
- Field sample number/identification
- Date and time sampled
- Sample type (matrix)
- Preservative
- Requested analyses
- Sampler signature
- Relinquishing signature
- Date and time relinquished
- Sampler remarks
- Custody Seal Number (if applicable)
- Regulatory Program Designation
- The state where the samples were taken to ensure all state requirements are met
- Turnaround time requested
- Purchase order number

The record is filled out completely and legibly with indelible ink. Errors are corrected by drawing a single line through and initialing and dating the change. All transfers of samples must be recorded on the chain-of-custody in the "relinquished" and "received by" sections. All information except signatures should be printed.

2.5 Sample Receipt

Sample receiving personnel inspect each sample shipment upon arrival. The following items are checked:

- Presence of custody seals or tapes on the shipping containers
- Presence of Chain-of-Custody
- Presence of sample tags or labels
- Agreement between the sample tags or labels, Chain-of-Custody, and any client documentation.
- Condition of the samples when received, including:
  - Sample temperature: samples are acceptable if the arrival temperature is within 2°C of the required temperature, except as specified in the applicable test method or other state or federal regulation. Samples that are hand-delivered directly from the field on the same day that they are collected are acceptable if there is evidence that the chilling process has begun (arrival on ice).
  - Sample condition: Intact, broken/leaking
  - Headspace in VOA vials
  - Sample holding time

- Sample pH when required
- Adequate sample volume
- Appropriate containers/preservatives

If discrepancies are found, the Pace Analytical Project Manager is contacted immediately. If the Project Manager is not available, the Quality Manager is contacted for further directions. Discrepancies are documented and reported with analytical results.

2.6 Sample Log-in

After the sample inspection, all sample information on the chain-of-custody is entered into the Laboratory Information Management System (LIMS).

Sample data must include, at a minimum:

- Client name and contact
- Client number
- Pace Analytical project number
- Pace Analytical Project Manager
- Sample descriptions
- Due dates
- List of analyses requested

All samples received are logged into the LIMS system within one working day of receipt. Sample log-in may be delayed due to client clarification of analysis needed, corrective actions for sample receipt non-conformance, or other unusual circumstances.

All sample containers are assigned a unique laboratory identification code that is unequivocally linked to the field Identification code. This code is placed on the sample container as a durable label.

Sample Labels are printed from the LIMS system and affixed to each sample container.

Samples with hold times that are near their expiration date/time may be sent directly to the laboratory for analysis at the discretion of the Project Manager and/or General Manager.

2.7 Sample Storage/Staging

2.7.1 Storage Conditions

Samples are stored away from all standards, reagents, food or other potential sources of contamination. Samples are stored in a manner that prevents cross-contamination (i.e. volatile samples are stored separate from other samples). All sample fractions, extracts, leachates and other sample preparation products are stored in the same manner as actual samples.

2.7.2 Temperature Monitoring

Samples are taken to the appropriate storage location immediately after the samples are entered into the LIMS. All sample storage areas are located in limited access areas and are monitored to ensure sample integrity.

The temperature of each storage areas is maintained at $4^{\circ}C \pm 2^{\circ}C$ unless state or program requirements differ. The temperature of the storage areas is monitored and recorded each workday. If the temperature falls outside the acceptable limits, the following corrective actions are taken and appropriately documented:

- The temperature is rechecked after two hours to verify temperature exceedance. Initiate corrective action if necessary.

- The Quality Manager and/or laboratory management are notified if the problem persists.
- The samples are relocated to a proper environment if the temperature cannot be maintained after corrective actions are implemented.
- The affected clients are notified.
- Documentation is provided on analytical report.

2.7.3 Hazardous Materials

Pure product or potentially heavily contaminated samples are tagged as "hazardous" or "lab pack" and are stored separately from other samples.

2.7.4 Foreign Soils

Depending on the soil disposal practices of the laboratory, foreign soils and soils from USDA regulated areas are segregated. The USDA requires these samples to be incinerated or sterilized by an approved treatment procedure.

2.8 Sample Protection

Pace laboratory facilities are operated under controlled access to ensure sample and data integrity. Only employees are allowed into the laboratory facilities. Visitors must register at the front desk and be properly escorted.

Samples are removed from their proper location by designated personnel and returned the storage area, if necessary, immediately after the required sample quantity has been taken.

Upon client request, additional and more rigorous chain-of-custody protocols for samples and data can be implemented. For example, some projects may require complete documentation of sample custody within the secure laboratory.

2.9 Subcontracting Analytical Services

Every effort is made to perform chemical analyses for Pace Analytical clients within the laboratory that receives the samples. When subcontracting to a laboratory other than the receiving laboratory (inside or outside the Pace network) becomes necessary, a preliminary verbal communication with an appropriate laboratory is undertaken. Clients are notified in writing of the lab's intention to subcontract any portion of the testing to another laboratory. Work performed under specific protocols may involve special considerations.

Prior to subcontracting samples to a laboratory outside Pace Analytical, the laboratory will be qualified by verifying that the subcontractor meets the following criteria:

- All certifications required for the proposed subcontract are in effect,
- Sufficient professional liability and other required insurance coverage is in effect, and
- Is not under investigation by any federal, state, or local government agency for data integrity issues and has not been under such investigation for at any time during the past 5 years.

The contact and preliminary arrangements and terms of agreement are made between the Pace Analytical Project Manager and the appropriate subcontract laboratory personnel. The specific terms of the subcontract laboratory agreement includes the requirement for provision of the following (when applicable):

- Method (EPA or otherwise) of analysis
- Number and type of samples expected
- Project specific QA/QC requirements
- Deliverables required
- Laboratory certification requirement

- Price per analysis
- Turn around time requirements

Chain-of-custody forms are generated for samples requiring subcontracting to other laboratories. The sample receiving personnel re-package the samples for shipment, create a transfer chain-of-custody form and record the following information:

- Pace Analytical Laboratory Number
- Matrix
- Requested analysis
- Special instructions (quick turn-around, required detection or reporting limits, unusual information known about the samples or analytical procedure).
- Signature in "Relinquished By"

All subcontracted sample data reports are sent to the Pace Analytical Project Manager.

Any Pace Analytical work sent to other labs within the Pace network is handled as subcontracted work (also known as inter-regional) and all final reports are labeled clearly with the name of the laboratory performing the work.

2.10 Sample Retention and Disposal

After completion of sample analysis and submission of the analytical report, unused portions of samples are retained by the laboratory for a minimum of 30 days unless otherwise stated by the project contract or client request. After this period expires, non-hazardous samples are properly disposed as non-hazardous waste.

The preferred method for disposition of hazardous samples is to return the excess sample to the client. It may not be feasible to return samples, or the client may require Pace Analytical to dispose of excess samples. In that case, Pace Analytical will arrange for proper disposal by an approved contractor. Pace Analytical will charge a disposal fee to recover costs of this service.

Figure 2.1
Pace Analytical Services, Inc. CHAIN-OF-CUSTODY FORM (EXAMPLE)

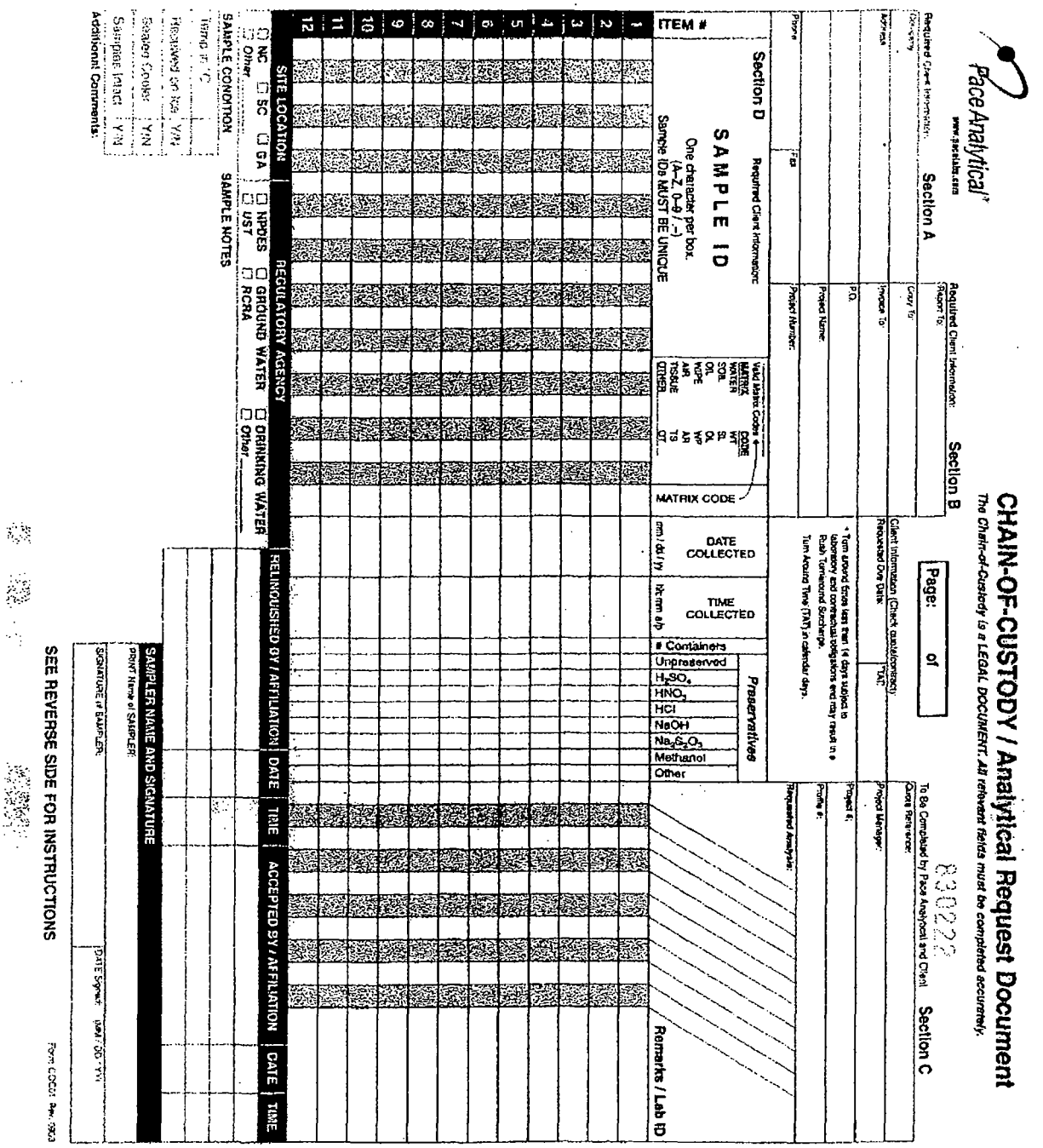


TABLE 2.1 List of Containers, Preservatives and Holding Times for Inorganic and Organic Analyses of Aqueous Samples:

NAME	CONTAINER[1]	PRESERVATION[2]	MAXIMUM HOLDING TIME[3]
Inorganic Tests:			
Acidity	P,G	Cool, 4°C	14 days
Alkalinity	P,G	Cool, 4°C	14 days
Ammonia	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Biochemical oxygen demand	P,G	Cool, 4°C	48 hours
Bromide	P,G	None Required	28 days
Biochemical oxygen demand, carbonaceous	P,G	Cool, 4°C	48 hours
Chemical oxygen demand	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Chloride	P,G	None Required	28 days
Chlorine, total residual	P,G	None Required	Analyze immediately
Color	P,G	Cool, 4°C	48 hours
Cyanide, total amenable to chlorination	P,G	Cool, 4°C, NaOH to pH>12 0.6g ascorbic acid[4]	14 days
Fluoride	P	None Required	28 days
Hardness	P,G	HNO_3, to pH<2, H_2SO_4 to pH<2	6 months
Hydrogen ion (pH)	P,G	None Required	Analyze immediately
Kjeldahl and organic nitrogen	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Nitrate	P,G	Cool, 4°C	48 hours
Nitrate-nitrite	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Nitrite	P,G	Cool, 4°C	48 hours
Oil and grease	G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Organic carbon	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Orthophosphate	P,G	Filter immediately, Cool, 4°C	48 hours
Phenols	G only	Cool, 4°C, H_2SO_4 to pH<2	28 days
Phosphorus (elemental)	G	Cool, 4°C	48 hours
Phosphorus, total	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Residue, total	P,G	Cool, 4°C	7 days
Residue, filterable	P, G	Cool, 4°C	7 days
Residue, nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, volatile	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific conductance	P,G	Cool, 4°C	28 days
Sulfate	P,G	Cool, 4°C	28 days
Sulfide	P,G	Cool, 4°C, add zinc acetate & sodium hydroxide to pH>9	7 days
Sulfite	P,G	None Required	Analyze immediately
Surfactants	P,G	Cool, 4°C	48 hours
Turbidity	P,G	Cool, 4°C	48 hours

TABLE 2.1 (cont.) List of Containers, Preservatives and Holding Times for Inorganic and Organic Analyses of Aqueous Samples:

NAME	CONTAINER[1]	PRESERVATION[2]	MAXIMUM HOLDING TIME[3]
Metals:			
Chromium VI	P,G	Cool, 4^0C	24 hours
Mercury (SW846)	P,G	HNO3 to pH<2	28 days in glass
Mercury (CLP, 200 series)	P,G	HNO3 to pH<2	28 days
Metals, except chromiumVI and mercury	P,G	HNO3 to pH<2	6 months
Organic Tests:			
Oil and Grease	G	Cool, 4^0C, HCl or H_2SO_4 to pH<2	28 days
Organic carbon, Total (TOC)	P,G	Cool, 4^0C, HCl or H_2SO_4 to pH<2	28 days
Purgeable Halocarbons	G,Teflon-lined septum	Cool, 4^0C, 0.008% $Na_2S_2O_3$[4], HCl[5,6] to pH<2	14 days
Purgeable Aromatic Hydrocarbons	G,Teflon-lined septum	Cool, 4^0C, 0.008% $Na_2S_2O_3$[4], HCl[5,6] to pH<2	14 days
Acrolein and acrylonitrile	G,Teflon-lined septum	Cool, 4^0C, 0.008% $Na_2S_2O_3$[4] Adjust pH to 4-5	14 days
Phenols	G,Teflon-lined cap	Cool, 4^0C, 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Benzidines	G,Teflon-lined cap	Cool, 4^0C, 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Phthalate esters	G,Teflon-lined cap	Cool, 4^0	7 days until extraction, 40 days after extraction
Nitrosamines	G,Teflon-lined cap	Cool, 4^0C, store in dark, 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
PCBs	G,Teflon-lined cap	Cool, 4^0C	7 days until extraction, 40 days after extraction
Nitroaromatics and cyclic ketones	G,Teflon-lined cap	Cool, 4^0C, store in dark, 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Polynuclear aromatic hydrocarbons	G,Teflon-lined cap	Cool, 4^0C, 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Haloethers	G,Teflon-lined cap	Cool, 4^0C, 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Chlorinated Hydrocarbons	G,Teflon-lined cap	Cool, 4^0C, HCl or H_2SO_4	7 days until extraction, 40 days after extraction
Dioxins and Furans	G,Teflon-lined cap	Cool, 4^0C, 0.008% $Na_2S_2O_3$[4]	30 days until extraction, 40 days after extraction
Total organic halides (TOX)	G,Teflon-lined cap	Cool, 4^0C, HCl or H_2SO_4 to pH <2	28 days
Pesticides	G,Teflon-lined cap	Cool, 4^0C pH 5-9	7 days until extraction, 40 days after extraction

Table Footnotes:

[1] Polyethylene (P) or glass (G)

[2] Sample preservation should be performed immediately upon sample collection.

[3] Holding times are based from time of sample collection.

[4] Should only be used in the presence of residual chlorine.

[5] Free chlorine must be removed prior to addition of HCl by the appropriate addition of $Na_2S_2O_3$

[6] Sample receiving no pH adjustment must be analyzed within seven days of sampling.

Table 2.2 Required Containers, Preservation Techniques, and Holding Times for Non-Aqueous, Soil or Solid Matrices (as specified in SW-846):

NAME	CONTAINER	PRESERVATION	MAXIMUM HOLDING TIME[1]
Semivolatile Organics/Organochlorine Pesticides/PCBs and Herbicides			
Concentrated waste samples	8 oz. wide mouth glass w/Teflon liner	None	14 days until extraction, 40 days after extraction
Liquid samples, no residual Chlorine present	1 gal. or 2 1/2 gal. amber glass w/Teflon liner	Cool, 4^0C	Samples must be extracted within 7 days & extracts analyzed within 40 days
Residual Chloride, present	1 gal. or 2 1/2 gal. amber glass w/Teflon liner	Add 3mL 10% sodium thiosulfate	Samples must be extracted within 7 days & extracts analyzed within 40 days
Soil/sediments and sludges	8 oz. wide mouth glass w/Teflonlliner	Cool, 4^0C	14 days until extraction, extracts analyzed within 40 days.
Volatile Organics			
Concentrated waste samples	8 oz. wide mouth glass w/Teflonlliner	None	14 days
Liquid samples, no residual Chlorine present	3x40 mL vials w/Teflon lined septum caps	Cool, 4^0C[2]	14 days
Residual Chlorine, present	3x40 mL vials w/Teflon lined septum caps	Collect sample in a 4 oz. soil VOA container which has been pre-preserved w/4 drops of 10% sodium thiosulfate. Gently mix sample & transfer to a 40mL VOA vial[2]. Cool to 4^0C	14 days
Acrolein & Acrylonitrile	3x40 mL vials w/Teflon lined septum caps	Adjust to pH 4-5, Cool to 4^0C	14 days
Soil/sediments and sludges	4 oz. (120mL), wide mouth glass w/Teflon liner or wide mouth glass container sealed w/a septum	Cool to 4^0C	14 days

[1] Holding times are based from time of sample collection.
[2] Adjust pH<2 w/H_2SO_4, HCl or solid $NaHSO_4$

Table 2.3 Required Containers, Preservation, and Technical Hold Times for Air Methods:

TEST	MEDIA	PRESERVATION	MAXIMUM HOLDING TIME [1]
TO1	Tenax tubes	Freezer -20°C	14 days
TO2	Carbo Sieve	Cool to 4°C	14 days
VOST	Tenaz/Tenaz-charcoal	Cool to 4°C	14 days
TO4	Puf 3" long, 60mm diameter	Freezer - 10°C or below	Extracted 7 days after collection
TO1O	Puf 10cm long, 20mm diameter	Cool to 4°C	Extracted 7 days after collection
TO11	Absorbent cartridge	Cool to 4°C	30 days
TO13	Puf XAD/XAD		Extracted 7 days after collection
TO14	Summa canisters Tedlar bags	Room temperature Room temperature	Not specified 48-72 hours (dependant on client)
T09	PUF XAD/XAD	Cool to 4°C	30 days
Method 3C	Summa canisters Tedlar bags	Room temperature	15 days
Method 23	XAD	Cool to 4°C	30 days

1. Holding times are based from time of sample collection.

Table 2.4 Containers, Preservatives and Hold Time Information for Radioactives

Parameter(s)		Matrix	Container Type and Preservation	Hold Time
All radiochemical parameters except Rn-22, tritium, C14 and Iodine 131		Water Solid/Other	1 L Plastic (2 x 2 L Preferred), HNO_3, pH < 2 250 mL Glass Jar	180 Days 180 Days
Rn-222	Radon 222	Water	3 x 40 mL Amber Glass Vial, None	72 Hours
H-3	Tritium	Water Solid/Other	1 L Glass Sample size will vary with moisture content	180 Days 180 Days
C-14	Carbon 14	Water	1 L Plastic	180 Days
I-131	Iodine 131	Water	1 L Plastic	180 Days
New Jersey Special Requirement(s)				
Gross Alpha (48 hour)		Water	1 L Plastic HNO_3;pH < 2	48 hours

3.0 ANALYTICAL CAPABILITIES

3.1 Analytical Method Sources

Pace Analytical laboratories are capable of analyzing a full range of environmental samples from a variety of matrices, including air surface and groundwater, soil, sediment, tissue, and waste. Methodologies are applied from regulatory and professional sources including EPA, ASTM, USGS, NIOSH and, State agencies. Section 11 is a representative listing of general analytical protocol references. In some situations, Pace Analytical develops and validates methodologies that may be more applicable to a specific problem or objective. Pace Analytical discloses in writing to its clients and regulatory agencies any instances in which modified methods are being used in the analysis of samples.

3.2 Analytical Method Documentation

The primary form of documentation of analytical methods is the Standard Operating Procedure (SOP). SOPs contain pertinent information as to what steps are required by an analyst to successfully perform a procedure. The required contents for the SOPs are specified in the company-wide SOP for Preparation of SOPs (ALL-Q-001). The SOPs are consistent company-wide documents with addenda as needed for individual laboratories.

The SOPs are supplemented by Work Processing and Training Documents that further detail how methods are specifically performed with detailed training information.

3.3 Analytical Method Validation

When non-standard methods (i.e. methods other than EPA, NIOSH, ASTM, AOAC, etc.) are required for specific projects or analytes of interest, or when the laboratory develops a method, or modifies a standard method, the laboratory validates the method prior to applying it to client samples. Method validity is established by meeting criteria for precision and accuracy as established by the data quality objectives specified by the end user of the data. The laboratory records the validation procedure, the results obtained and a statement as to the usability of the method. The minimum requirements for method validation include determination of the limit of detection and limit of quantitation of each analyte of interest.

3.4 Demonstration of Capability (DOC)

Analysts complete an initial demonstration of capability (IDOC) study prior to starting a method or when there is a change in instrument type, personnel or test method (when a defined 'work cell' is in operation, the entire work cell must meet the criteria). The mean recovery and standard deviation of each analyte, taken from 4 replicates of a quality control standard, is calculated and compared to method criteria (if available) or established lab criteria for evaluation of acceptance. Each laboratory maintains copies of all demonstrations of capability for future reference and must document the acceptance criteria prior to the analysis of the DOC. Demonstration of capabilities is renewed on an annual basis.

3.5 Regulatory and Method Compliance

Pace Analytical understands that the expectations of our clients commonly include the assumption that laboratory data will satisfy specific regulatory requirements. Therefore Pace Analytical will attempt to ascertain, prior to beginning a project, what applicable regulatory jurisdiction, agency, or protocols apply to that project. This information is also required on the Chain-of-Custody submitted with samples.

Pace Analytical will make every effort to detect regulatory or project plan inconsistencies as they arise and communicate them to the clients to aid in the decision-making process.

It is Pace Analytical policy to disclose in a forthright manner any detected noncompliance that may affect the usability of data produced by our laboratories.

4.0 QUALITY CONTROL PROCEDURES

4.1 Data Integrity System

The data integrity system at Pace Analytical provides assurances to management that a highly ethical approach is being applied to all planning, training and implementation of methods. Data integrity is crucial to the success of our company and Pace is committed to providing a culture of quality throughout the organization. To accomplish this goal, Pace has implemented a data integrity system that encompasses the following four requirements:

- A data integrity training program: standardized training is given to each new employee and a yearly refresher is presented to all employees. Key topics within this training include:
  - Need for honesty in analytical reporting
  - Process for report data integrity issues
  - Specific examples of unethical behavior and improper practices
  - Documentation of non-conforming data that is still useful to the data user
  - Consequences and punishments for unethical behavior
  - Examples of monitoring devices used by management to review data and systems
- Signed data integrity documentation for all employees: this includes the documentation in this Quality Manual and in other Standard Operating Procedures
- In-depth, periodic monitoring of data integrity: including peer data review and validation, internal data audits, proficiency testing studies, etc.
- Documentation of any review or investigation into possible data integrity infractions. This documentation must be available for review for lab assessors.

Pace management makes every effort to ensure that personnel are free from any undue pressures that may affect their quality of work including commercial, financial, over-scheduling, and working condition pressures.

The management also provides a mechanism for confidential reporting of data integrity issues that includes confidentiality and a receptive environment in which all employees are comfortable discussing items of ethical concern.

4.2 Method Blank

A method blank is used to evaluate contamination in the preparation/analysis system. The method blank is processed through all preparation and analytical steps with its associated samples. Any affected sample associated with a contaminated method blank will be re-analyzed or reported with an appropriate data qualifier.

A method blank is processed at a minimum frequency of 1 per preparation batch. In the case of a method that has no separate preparation step (i.e. volatiles), a method blank is processed with no more than 20 samples of a specific matrix performed by the same analyst, in the same method, using the same standards or reagents.

The method blank consists of a matrix similar to the associated samples that is known to be free of the analytes of interest.

Each method blank is evaluated for contamination. The source of any contamination is investigated and documented corrective action is taken when the concentration of any target analyte is detected above the reporting limit and is greater then 1/10 of the amount of that analyte found in any associated sample. Corrective actions may include re-analyzing the samples with a clean blank or reporting the data with the appropriate data qualifiers.

4.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

The Laboratory Control Sample (LCS) is used to evaluate the performance of the entire analytical system including preparation and analysis. The LCS results are compared to established acceptance criteria and if the results are outside of the criteria, then the system is out-of-control. Any affected sample associated with a failing LCS will be re-analyzed or reported with an appropriate data qualifier.

An LCS is processed at a minimum frequency of 1 per preparation batch. In the case of a method that has no separate preparation step (i.e. volatiles), an LCS will be processed with no more than 20 samples of a specific matrix performed by the same analyst, in the same method, using the same standards or reagents.

The LCS consists of a matrix similar to the associated samples that is known to be free of the analytes of interest that is then spiked with known concentrations of target analytes.

The LCS contains all analytes specified by a specific method or by the client or regulatory agency. In the absence of specified components, the lab will spike with the following compounds:

- For multi-peak analytes (i.e. PCBs), a representative standard will be processed.
- For methods with long lists of analytes, a representative number of target analytes may be chosen. The following criteria is used to determine the number of LCS compounds used:
  - For methods with 1-10 target compounds, the lab will spike with all compounds
  - For methods with 11-20 target compounds, the lab will spike with at least 10 compounds or 80%, whichever is greater
  - For methods with greater than 20 compounds, the lab will spike with at least 16 compounds.

The LCS is evaluated against the method or laboratory-derived criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Any associated sample containing an 'out-of-control' compound must either be re-analyzed with a successful LCS or reported with the appropriate data qualifier.

An LCS/LCSD (duplicate LCS) can be substituted in a batch when sufficient sample volume is not available to prepare a matrix spike/ matrix spike duplicate (MS/MSD) pair according to project specific objectives. However, both the LCS and the LCSD must pass LCS criteria for the batch to be acceptable. A matrix spike can be used in place of a failing LCS in a batch as long as the MS passes the LCS acceptance criteria.

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

A matrix spike (MS) is used to determine the effect of the sample matrix on the precision and accuracy of the results for a particular method. The information from these spikes is sample or matrix specific and is not used to determine the acceptance of an entire batch (see LCS).

A **Matrix Spike/Matrix Spike Duplicate** (MS/MSD) set is processed at a frequency specified in a particular method or as determined by a specific client. In the absence of such requirements, an MS/MSD set is routinely analyzed once per every 20 client samples per matrix per method.

The MS and MSD consist of the sample matrix that is then spiked with known concentrations of target analytes.

The MS and MSD contain all analytes specified by a specific method or by the client or regulatory agency. In the absence of specified components, the lab will spike with the same number of compounds as previously discussed in the LCS section.

The MS/MSD are evaluated against the method or laboratory-derived criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. The spike recoveries give the data user a better understanding of the final results based on their site-specific information.

4.5 Surrogates

Surrogates are compounds that reflect the chemistry of target analytes and are typically added to sample for organic analyses to monitor the effect of the sample matrix on compound recovery.

Surrogates are added to each client sample (for organics), method blank, LCS and MS prior to extraction or analysis. The surrogates are evaluated against the method or laboratory-derived criteria. Any surrogate compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Samples with surrogate failures are typically re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error. An exception to this would be samples that have high surrogate values but no reportable hits for target compounds. These samples would be reported because the implied high bias would not affect the final results.

4.6 Sample Duplicate

A sample duplicate is a second portion of sample that is prepared and analyzed along with the first portion. It measures the precision associated with preparation and analysis. A sample duplicate is processed at a frequency specified by the particular method or as determined by a specific client.

The sample and duplicate are evaluated against the method or laboratory-derived criteria for relative percent difference (RPD). Any duplicate that is outside of these limits is considered to be 'out of control' and must be qualified appropriately.

4.7 Internal Standards

Internal Standards are analytes added to every standard, blank, lab control sample, matrix spike, matrix spike duplicate, and sample at a know concentration, prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes.

4.8 Field Blanks

Field blanks are blanks prepared at the sampling site in order to monitor for contamination that may be present in the environment where samples are collected. These field quality control samples may be referenced as field blanks, rinseate blanks, or equipment blanks. The lab analyzes these field blanks as normal samples and informs the client if there are any target compounds detected above the reporting limits.

4.9 Trip Blanks

Trip blanks are blanks that are prepared in the laboratory before the sampling event and are used to monitor for contamination of samples during transport. These blanks accompany the empty sample containers to the field and then accompany the collected samples back to the lab. These blanks are routinely analyzed for volatile sample methods.

4.10 Limit of Detection

Pace laboratories are required to use a documented procedure to determine a method detection limit (MDL) for each analyte of concern in each matrix reported. All sample processing steps of the analytical method are included in this determination. For any test that does not have a valid MDL, sample results below the lowest calibration standard cannot be reported.

The MDL is initially established for the compounds of interest for each method in a clean matrix with no target analytes present and no interferences at a concentration that would impact the results. The MDL is then determined every time there is a change in the test method that affects how the test is performed or when there has been a change in the instrument that affects the sensitivity. The MDL is verified on an annual basis.

Unless otherwise noted, the method used by Pace laboratories to determine MDLs is based on the Method Detection Limit procedure outlined in 40 CFR Part 136, Appendix B. Where required by regulatory program or client, the above referenced procedure will be followed.

4.11 Limit of Quantitation

A limit of quantitation (LOQ) for every analyte of concern must be determined. For Pace laboratories, this LOQ is referred to as the PRL, or Pace Reporting Limit. This PRL is based on the lowest calibration standard concentration that is used in each initial calibration. No results are allowed to be reported below this level since the results would not be substantiated by a calibration standard. For methods with a determined MDL, results can be reported out below the LOQ but above the MDL if they are properly qualified (J flag).

There must be a sufficient buffer between the MDL and the limit of quantitation (LOQ). The PRL must be higher than the MDL.

4.12 Proficiency Testing (PT) Studies

Pace Analytical laboratories participate in the NELAC-defined proficiency testing program. PT samples are obtained from NIST-approved providers and analyzed and reported at a minimum of two times per year for the relevant fields of testing per matrix.

The lab initiates an investigation whenever PT results are deemed 'unacceptable' by the PT provider. All findings and corrective actions taken are reported to the Quality Manager. A corrective action plan (including re-analysis of similar samples) is initiated and this report is sent to the appropriate state accreditation agencies for their review.

PT samples are treated as typical client samples, utilizing the same staff, methods, equipment, facilities, and frequency of analysis. PT samples are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

Comparison of analytical results with anyone participating in the same PT study is prohibited prior to the close of the study.

5.0 DOCUMENT CONTROL AND CHANGE

Documents

5.1 Document Control

Pace Analytical Services has established a procedure for controlling documents that are part of the quality system. The list of controlled documents includes, but is not limited to, Standard Operating Procedures, Quality Manuals, quality policy statements, training documents, work-processing documents, charts, posters, memoranda, notices, forms, software, and any other procedures, tables, plans, etc. that has a direct bearing on the quality system.

A master list of all documents is maintained at each facility identifying the current revision status and distribution of the documents. This establishes that there are no invalid or obsolete documents in use in the lab. All documents are reviewed periodically and revised if necessary and obsolete documents are systematically discarded or archived for legal or knowledge preservation purposes.

Each document related to the quality system is uniquely identified to include the date of issue, the revision identification, page numbering, the total number of pages and the issuing authorities. For complete information on document numbering, refer to the company-wide Standard Operating Procedure Document Numbering (ALL-Q-003).

As an alternative to the hard copy system of control, secured electronic copies of controlled documents may be maintained on the local or wide-area network (WAN). These document files must be read-only for all personnel except the Quality Department and system administrator. Other requirements for this system include:

- Ready accessibility to all laboratory staff
- A complete description of the computerized aspects, including security
- A provision to explicitly indicate that all printed copies are uncontrolled and expire on the date printed.

5.1.1 Quality Manual

The Quality Manual is the company-wide document that describes all aspects of the quality system for Pace Analytical laboratories. It is document-controlled by the corporate quality office and signed copies are distributed to each of the regional Quality Managers. The regional management personnel sign the Quality Manual and the local Quality Manager is then in charge of distribution to employees and external clients or regulatory agencies and maintaining a controlled list of distributed copies. Each laboratory may attach a lab-specific addendum to the Quality Manual as needed.

5.1.2 Standard Operating Procedures (SOPs)

SOPs fall into two categories: company-wide documents (starting with the prefix ALL-) or individual lab documents (starting with the individual lab abbreviation). Company-wide SOPs (ALL SOPs) are document-controlled by the corporate quality office and signed copies are distributed to each of the laboratory Quality Managers. The Laboratory management personnel sign the company-wide (ALL) SOPs and the local Quality Manager then distributes to employees and external clients or regulatory agencies and maintains a controlled list of distributed copies. Each laboratory may attach a lab-specific addendum to any of the Company-wide (ALL) SOPs as needed. Individual lab specific SOPs are controlled by the local Quality Manager in the same manner.

SOPs are reviewed every two years at a minimum (a more frequent review may be required by state agencies or clients). Documentation of this review and any applicable revisions is made in the last section of each SOP. This provides a historical record of all revisions.

All superseded SOPs are removed from general use and are either destroyed by the Quality Manager or archived for audit or knowledge preservation purposes. This ensures that all Pace employees use only the most current version of each SOP.

5.1.3 Work-processing documents

These documents, more commonly in the form of flowcharts, are internal documents intended to aid the analysts in the processing of the work. These documents are controlled by the local Quality Managers in the same manner as the SOPs.

5.1.4 Training documents

The training documents are more detailed documents that describe lab-specific details such as computer and equipment set-up, sample preparation and analysis steps, data validation steps, documentation requirements, and data packet preparation. Documentation that an analyst has completed their training via these training documents, including successfully passing a quiz, is maintained in their training file.

5.2 Document Change

Changes to documents are reviewed and approved in the same manner as the original document control. Any revision to a document requires the approval of the applicable signatories. After revisions are approved, a revision number is assigned and the previous version of the document is officially retired. Copies may be kept for audit or knowledge preservation purposes.

All controlled copies of the previous document are replaced with controlled copies of the revised document and the old copies are destroyed or archived. All affected personnel are advised that there has been a revision and any necessary training can be scheduled.

6.0 EQUIPMENT AND CALIBRATION

Each Pace lab is equipped with instrumentation and support equipment to perform the required analyses. Support equipment includes chemical standards, thermometers, balances, pipettes, etc. This section will detail some of this equipment and instrumentation and the procedures necessary for its proper calibration.

6.1 Standards and Traceability

Reference measurement standards are required to provide an assurance that laboratory results are traceable to an acceptable standard. Laboratories document the purchase, receipt, origin, preparation and use of all standards, reagents, and other chemicals.

Upon receipt, all purchased standard reference materials are recorded into a standard logbook or database. The entries include the Pace laboratory's unique identification number, the chemical name, manufacturer name, manufacturers identification numbers, receipt date and expiration date. Vendor's certificates of analysis for all standards, reagents, or chemicals are retained by the lab for future reference.

Subsequent preparations of intermediate or working solutions are also documented in a standard logbook or database. These entries include the stock standard name and lot number, the manufacturer name, the solvents used for preparation, the solvent lot number and manufacturer, the preparation steps, preparation date, preparer's initials, and a unique Pace Analytical lab number. This number is used in any applicable sample preparation or analysis logbook so the standard can be traced back to the standard preparation record.

All prepared standard or reagent containers include the Pace identification number, the standard or chemical name, the date or preparation, the date of expiration, the concentration and units, and the preparer's initials. This ensures traceability back to the standard preparation logbook.

If a second source standard is required to verify an existing calibration or spiking standard, this standard is purchased from a different supplier. If no second source is available, a second standard may be purchased from the same supplier but the lab is required to receive a certificate of warranty noting that both standards were prepared from different raw materials. Obtaining two standards from the same parent material are not acceptable for satisfying this requirement.

6.2 General Calibration Procedures

All types of support equipment and instrumentation are calibrated before use to ensure that they function properly. All calibrations are performed by, or under the supervision of, an experienced analyst at scheduled intervals against either certified standards traceable to recognized national standards, or reference standards whose values have been statistically validated. Instrumentation or support equipment that cannot be calibrated to specifications, or is otherwise defective, are taken out of service. They are clearly labeled as out-of-service until they have been repaired and tested to meet specifications. In the event that recalibration of a piece of test equipment casts doubt on the validity of test results already transmitted to the client, the client is notified promptly by the laboratory. Instrumentation found to be consistently out of calibration is either repaired and positively verified or replaced.

Calibration standards for each parameter are chosen to establish the linear range of the instrument and must bracket the concentrations of those parameters measured in the samples. Samples with analytical results that fall outside the calibration range are either diluted and reanalyzed or reported with an appropriate data qualifier. The lowest calibration standard is normally run at the reporting limit for each analyte.

Calibration standards are prepared at a minimum of three concentration levels for inorganic analyses and a minimum of five concentrations for organic analyses. A calibration blank is also included for

some inorganic analyses. Any specific method requirement for number and type of calibration standards supersedes the general requirement.

Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Curves that do not meet the appropriate criteria require corrective action that may include re-running the initial curve.

During the course of analysis, the calibration curve is verified by the analysis of a calibration verification standard. This verification standard must also pass acceptance criteria for sample analysis to proceed. Concentrations of calibration verification standards must be varied periodically to evaluate the entire range of the initial calibration curve.

6.3 Calibration Procedures for GC/MS (Gas Chromatograph/ Mass Spectrometer)

More detailed calibration information can be obtained from Pace Standard Operating Procedures or other similar documentation.

6.3.1 GC/MS Tuning

The first step in preparing a GC/MS instrument for sample analysis is to tune the instrument. This is accomplished through the analysis of 4-bromofluorobenzene (BFB) for volatile analysis or decafluorotriphenyl-phosphine (DFTPP) for semi-volatile analysis. The tune standard must pass the method acceptance criteria for mass spectral abundance for these compounds before calibration standards are evaluated.

6.3.2 Initial Calibration

The GC/MS system is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. The number of calibration standards used depends on the specific method criteria or client project requirements, although normally a minimum of five standards is used.

The response factor (RF) for each compound at each concentration is calculated and an average RF is obtained for each compound in the initial calibration curve. The percent relative standard deviation (%RSD) is calculated for each compound. This RSD value must be $\leq$ 15% for each reported compound and must be $\leq$ 30% for those compounds in the method identified as calibration check compounds (CCCs). For compounds with an RSD >15%, a least squares regression can be applied (the best fit value must be >0.99 to confirm linearity) or data for these compounds must be reported with the appropriate data qualifiers.

The mean RF from the initial calibration curve is used to calculate the sample concentration of the compound of interest.

6.3.3 Calibration Verification

A calibration verification standard is analyzed with each analytical batch to verify that the initial calibration is still valid. This standard must contain all target analytes and is typically analyzed at a concentration around the midpoint of the initial calibration curve. The RF data from this standard is compared to the average RF from the initial calibration. If the RF from any compound differs from the average RF from the initial calibration by more than 20%, then either the calibration verification standard must be re-analyzed or any data reported for those compounds that exceeded the acceptance criteria are reported with the appropriate data qualifiers.

6.4 Calibration Procedures for GC and HPLC (Gas Chromatograph and High Performance Liquid Chromatograph)

More detailed calibration information can be obtained from Pace Standard Operating Procedures or other similar documentation.

6.4.1 Initial Calibration

The GC or HPLC system is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. The number of calibration standards used depends on the specific method criteria or client project requirements, although normally a minimum of five standards is used.

The initial calibration curve may be evaluated in several different manners. The curve is determined to be linear if the correlation coefficient for each target compound is > 0.99 (unless otherwise stated in the method). Linearity may also be determined using calibration factors or response factors. Response factors are calculated for each compound at each concentration level. These RFs are averaged to generate the mean RF for each compound over the range of the standard curve. The curve is determined to be linear if the RSD of the response factors is ≤ 20% (or as specified by the method).

The mean RF from the initial calibration curve is used to calculate the sample concentration of the compound of interest.

6.4.2 Calibration Verification

A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid (this standard is also run at the end of each batch). This standard must contain all target analytes and is typically analyzed at a concentration around the midpoint of the initial calibration curve. The RF data from this standard is compared to the average RF from the initial calibration. If the RF from any compound differs from the average RF from the initial calibration by more than ±15%, then either the calibration verification standard must be re-analyzed or any data reported for those compounds that exceeded the acceptance criteria are reported with the appropriate data qualifiers. Reported sample results must be bracketed by acceptable calibration verification standards.

6.5 Calibration Procedures for ICP and AAS (Inductively Coupled Plasma and Atomic Absorption Spectrometer)

More detailed calibration information can be obtained from Pace Standard Operating Procedures or other similar documentation.

6.5.1 Initial Calibration

The ICP or AAS system is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. The number of calibration standards used depends on the specific method criteria or client project requirements, although normally a minimum of three standards is used (ICP calibration can be performed with a single standard and a calibration blank if annual linear range studies are conducted).

6.5.2 Calibration Verification

A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid (this standard is also run at the end of each batch). If the response from this standard differs from the initial calibration

standard by more than 10% for ICP or by more than 20% for AAS, then the instrument must be re-calibrated before proceeding with sample analysis. A calibration blank is also run with each calibration verification standard to verify the cleanliness of the system.

Interference check standards are also run per method requirements at the beginning and end of each batch and must pass method acceptance criteria.

6.6 General Equipment Calibration Procedures

6.6.1 Analytical Balances

Each analytical balance is checked and (if necessary) calibrated annually by a qualified service technician. The calibration of each balance is checked each day of use with weights traceable to NIST. Calibration weights are ASTM Class 1 (replaces Class S designation) and are re-certified annually against a NIST traceable reference. Some accrediting agencies may require more frequent checks. If balances are calibrated by an external agency, verification of their weights must be provided. All information pertaining to balance maintenance and calibration is recorded in the individual balance logbook and/or is maintained on file in the Quality department.

6.6.2 Thermometers

Certified, or reference, thermometers are maintained for checking calibration of working thermometers. Reference thermometers are provided with NIST traceability for initial calibration and are re-certified, at a minimum, yearly with equipment directly traceable to NIST.

Working thermometers are compared with the reference thermometers annually according to corporate metrology procedures. Each thermometer is individually numbered. In addition, working thermometers are visually inspected by laboratory personnel prior to use and temperatures are documented.

Laboratory thermometer inventory and calibration data are maintained in the Quality department.

6.6.3 pH/Electrometers

The meter is calibrated before use each day, and once after each four hours of continuous use using fresh buffer solutions.

6.6.4 Spectrophotometers

During use, spectrophotometer performance is checked at established frequencies in analysis sequences against initial calibration verification (ICV) with continuing calibration verification (CCV) standards.

6.6.5 Pipettes

Mechanical hand pipettes are calibrated on a quarterly basis.

6.7 Instrument/Equipment Maintenance

The objectives of the Pace Analytical maintenance program are twofold: to establish a system of instrument care that maintains instrumentation and equipment at required levels of calibration and sensitivity, and to minimize loss of productivity due to repairs.

Equipment

The Laboratory Operations Manager and department manager/supervisors are responsible for providing technical leadership to evaluate new equipment, solve equipment problems and coordinate instrument repair and maintenance. The analysts have a primary responsibility to perform routine maintenance.

To minimize downtime and interruption of analytical work, preventive maintenance is routinely performed on each analytical instrument.

Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that are subject to frequent failure, have limited lifetimes, or cannot be obtained in a timely manner should a failure occur.

All major equipment and instrumentation items are uniquely identified to allow for traceability. Equipment/instrumentation are, unless otherwise stated, identified as a system and not as individual pieces. The laboratory maintains equipment records that include the following:

- The name of the equipment and its software
- The manufacturer's name, type, and serial number
- Approximate date received and date placed into service
- Current location in the laboratory
- Condition when received (new, used, etc.)
- Copy of any manufacturer's manuals or instructions
- Dates and results of calibrations and next scheduled calibration (if known)
- Details of past maintenance activities, both routine and non-routine
- Details of any damage, modification or major repairs

All routine and non-routine instrument maintenance is documented in maintenance logbooks that are assigned to each particular instrument or system.

When maintenance is performed to repair an instrument problem, depending on the initial problem, demonstration of return to control may be satisfied by the successful analysis of a reagent blank or continuing calibration standard. The entry must include a summary of the results of that analysis and verification by the analyst that the instrument has been returned to an in-control status. In addition, each entry must include the initials of the analyst making the entry, the dates the maintenance actions were performed, and the date the entry was made in the maintenance logbook, if different from the date(s) of the maintenance.

Any equipment that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown to be defective is taken out of service and clearly identified. The equipment shall not be used to analyze client samples until it has been repaired and shown to perform satisfactorily.

6.8 Spare Parts

Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that:

- Are subject to frequent failure,
- Have limited useful lifetimes, or
- Cannot be obtained in a timely manner should failure occur.

7.0 CONTROL OF DATA

Analytical results processing, verification and reporting are the processes that result in the delivery of defensible analytical data to the data user. These processes include calculation of raw data into final concentration units, reviewing results for accuracy and assembly of the technical report for delivery to the data user.

All analytical data undergo a well-defined, well-documented multi-tier review process before being reported to the client. The following information describes procedures employed at Pace Analytical for translating raw analytical data into accurate, finished sample reports and describes data storage policies.

7.1 Analytical Results Processing

When "raw data" is manually generated by an analyst, it is recorded in either a bound notebook (run logbook), or copies of the computer printouts are appropriately labeled and filed. Logbooks and other bench records are kept in accordance with each laboratory's Standard Operating Procedure on documentation practices (this may also include the use of electronic logbooks). The primary analyst is responsible for the initial reduction and review of the data. This includes confirming compliance with required methodology; checking the calculations used; checking quality control data against known criteria; noting any discrepancies that occurred both in the necessary logbooks and as a footnote or narrative in LIMS; and entering analytical data into the LIMS system. The primary analyst then compiles the initial data package for data verification. This compilation must include sufficient documentation to review the data. It may include chromatograms or strip-chart recordings, other computer printouts, chain-of-custody copies if available, and logbook copies. Some agencies or clients require different levels of data reporting. For these special levels, the primary analyst may also need to compile additional project information such as initial calibration data or extensive spectral data before the data package goes to the verification step.

7.2 Data Verification

Data verification is the process of examining data and accepting or rejecting it based on pre-defined criteria. This review step is designed to ensure that the reported data are free from calculation and transcription errors, that quality control parameters are evaluated, and that any discrepancies are properly documented.

Analysts performing the analysis and subsequent data reduction have the primary responsibility for the quality of the data produced. The primary analyst initiates the data verification process by reviewing and accepting the data provided QC criteria have been met for the samples being reported. Data review checklists are used to document the data review process.

The completed data package is then sent to the Group Supervisor or designated qualified reviewer (this cannot be the primary analyst). This reviewer provides an independent technical assessment of the data package and technical review for accuracy according to methods employed and laboratory protocols. All data that are manually entered into the LIMS is reviewed at a rate of 100%. This involves a quality control review for use of the proper methodology and detection limits, compliance to quality control protocol and criteria, presence and completeness of required deliverables, and accuracy of calculations and data quantitation. The reviewer also reviews analyst-generated calculations.

For results that are processed via computer, calculations are checked by the analyst (or designee) assigned to this task at a frequency designed to assure that the data reductions are valid. The results are either manually transferred to a standard reporting form or reported via computer generation of forms.

Once the data have been technically reviewed and approved, authorization for release of the data from the analytical section is indicated by initialing and dating the data review checklist or otherwise initialing and dating the data.

The Operations or Project Manager examines the report for method appropriateness, detection limits and QC acceptability. Any deviations from the referenced methods are checked for documentation and validity, and QC corrective actions are reviewed for successful resolution.

Use of checklists ensures that all data are systematically handled and no steps are omitted. Checklists are reviewed, retained, and made accessible should they need to be referenced at a later date.

7.3 Data Reporting

All data segments pertaining to a particular Pace Analytical project number are delivered to the Client Services Department (Project Manager) for assembly into the final report. All points mentioned during technical and QC review is included in a case narrative if it is deemed necessary to explain the impact on the quality of the data.

Final reports are prepared according to the level of reporting required by the client. A standard Pace Analytical final report consists of the following components:

1. A title which designates the report as "Final Report", "Laboratory Results", "Certificate of Results", etc.
2. Name and address of laboratory (or subcontracted laboratories, if used).
3. Phone number and name of laboratory contact where questions can be referred.
4. A unique number for the report (project number). The pages of the report shall be numbered and a total number of pages shall be indicated (usually in the cover letter).
5. Name and address of client and name of project (if applicable).
6. Unique identification of samples analyzed (including client sample numbers).
7. Identification of any sample that did not meet acceptable sampling requirements (from NELAC or other governing agency), such as improper sample containers, holding times missed, sample temperature, etc.
8. Date and time of collection of samples, date of sample receipt by the laboratory, dates of sample preparation and analysis, and times of sample preparation and analysis when the holding time for either is 72 hours or less.
9. Identification of the test methods used.
10. Identification of sampling procedures if sampling was conducted by the laboratory.
11. Deviations from, additions to, or exclusions from the test methods. These can include failed quality control parameters, deviations caused by the matrix of the sample, etc., and can be shown as a case narrative or as defined footnotes to the analytical data.
12. Identification of whether calculations were performed on a dry or wet-weight basis.
13. Reporting limits used.
14. Final results or measurements, supported by appropriate chromatograms, charts, tables, spectra, etc.
15. If required, a statement of the estimated uncertainty of the test results.
16. A signature and title of person accepting responsibility for the content of the report (can be an equivalent electronic identification) and date report was issued.
17. A statement clarifying that the results of the report relate only to the samples tested or to the samples as they were received by the laboratory.
18. If necessary, a statement indicating that the report must not be reproduced except in full, without the written approval of the laboratory.
19. Identification of all test results provided by a subcontracted laboratory or other outside source.
20. Identification of results obtained outside of quantitation levels.

Any changes made to a final report shall be designated as a "Supplement" or equivalent wording. For higher levels of data reporting, a copy of all raw data is sent to the client along with a final report of results. When possible, the Pace Analytical laboratory will provide electronic data deliverables (EDD) as required by contracts or upon client request.

Client data that requires transmission by telephone, telex, facsimile or other electronic means undergoes appropriate steps to preserve confidentiality.

7.4 Data Archiving

All records compiled by Pace Analytical labs are maintained, stored and secured by the Quality Manager or by a designated Data Archivist for a minimum of five years unless superseded by federal, contractual, and/or accreditation requirements. These records can include client data reports, certificates pertaining to calibration and maintenance of equipment, raw data from instrumentation, quality control documents and logbooks. These records are retained in order to provide for possible historical reconstruction of data. Access to archived data is kept to a minimum, with the Data Archivist maintaining the archive documentation in a secure, fireproof (if possible) location. Some laboratories archive their data in an off-site facility and the Data Archivist will keep a record of this archival as well. Records that are computer generated have either a hard copy or electronic backup copy.

In the event of a change in ownership, accountability or liability, reports of analyses performed pertaining to accreditation will be maintained by the acquiring entity for a minimum of five years. In the event of bankruptcy, laboratory reports and/or records will be transferred to the client and/or the appropriate regulatory entity.

8.0 QUALITY SYSTEM AUDITS AND REVIEWS

In an effort to assess the effectiveness of the Quality Systems, all Pace Analytical laboratories are subject to internal and external audits and reviews.

8.1 Internal Audits

8.1.1 Responsibilities

The Quality Manager is responsible for designing and/or conducting internal audits. Since internal audits represent an independent assessment of laboratory functions, the auditor must be functionally independent from laboratory operations to ensure objectivity. The auditor must be familiar enough with the objectives, principles, and procedures of laboratory operations to be able to perform a thorough and effective evaluation. The Quality Manger evaluates audit observations and verifies the completion of corrective actions. In addition, an annually corporate audit is conducted by the Director of Quality, Safety and Training and/or designee.

8.1.2 Scope and Frequency of Internal Audits

Internal systems audits are conducted yearly at a minimum. The scope of these audits includes evaluation of specific analytical department or a specific quality-related system as applied throughout the laboratory.

Examples of system-wide elements that can be audited include:

- Quality Systems documents, such as standard operating procedures and Quality Manual.
- Personnel and training files.
- General laboratory safety protocols.
- Chemical handling practices, such as labeling of reagents, solutions, standards, and associated documentation.
- Documentation concerning equipment and instrumentation, calibration/maintenance records, operating manuals.
- Sample receipt and management practices.
- Analytical documentation, including any discrepancies and corrective actions.
- General procedures for data security, review, documentation, reporting and archiving.

When the operations of a specific department are evaluated, a number of additional functions are reviewed including:

- Method detection limit studies
- Internal chain-of-custody documentation
- Documentation of standard preparations
- Control charts

Certain projects may require an internal audit to ensure laboratory conformance to site work plans, sampling and analysis plans, QAPPs, etc.

A representative number of data audits are completed annually. The report format of any discrepancy is similar to that of other internal audits. Further information on the internal audit process is documented in the applicable SOPs.

8.1.3 Internal Audit Reports and Corrective Action Plans

A full description of the audit, including the identification of the operation audited, the date(s) on which the audit was conducted, the specific systems examined, and the observations noted are summarized in an internal audit report. Although other personnel may assist with the performance of the audit, the Quality Manager writes and issues the internal audit report identifying which audit observations are deficiencies that require corrective action.

Once completed, the internal audit report is issued jointly to the Laboratory General Manager and the manager(s)/supervisor(s) of the audited operation at a minimum. The responsible manager(s)/supervisor(s) responds with a plan to correct all of the deficiencies cited by the due date specified in the audit report. Each response must include timetables for completion of all proposed corrective actions.

The Quality Manager reviews the audit responses. If the response is accepted, the Quality Manager uses the action plan and timetable as a guideline for verifying completion of the corrective action(s). If the Quality Manager determines that the audit response does not adequately address the correction of cited deficiencies, the response will be returned for modification.

To complete the audit process, the Quality Manager performs a re-examination of the areas where deficiencies were found to verify that all proposed corrective actions have been implemented. An audit deficiency is considered closed once implementation of the necessary corrective action has been verified. If corrective action cannot be verified, the associated deficiency remains open until that action is completed.

8.2 External Audits

Pace Analytical laboratories are audited regularly by regulatory agencies, to maintain laboratory certifications, and by clients to maintain appropriate specific protocols.

Audit teams external to the company review the laboratory to assess the existence of systems and degree of technical expertise. The Quality Manager and other QA staff host the audit team and assist in facilitation of the audit process. Generally, the auditors will prepare a formalized audit report listing deficiencies observed and follow-up requirements for the laboratory. In some cases, items of concern are discussed during a debriefing convened at the end of the on-site review process.

The laboratory staff and supervisors develop corrective action plans to address any deficiencies with the guidance of the Quality Manager. The Laboratory General Manager provides the necessary resources for staff to develop and implement the corrective action plans. The Quality Manager collates this information and provides a written report to the audit team. The report contains the corrective action plan and expected completion dates for each element of the plan. The Quality Manager follows-up with the laboratory staff to ensure corrective actions are implemented.

8.3 Quarterly Quality Reports

The Quality Manager is responsible for preparing a quarterly report to management indicating the effectiveness of the laboratory Quality Systems. This status report will include:

- Results of internal systems or performance audits
- Corrective action activities
- Discussion of QA issues raised by clients
- Results of third party or external audits
- Status of laboratory certifications
- Other significant events

Assessment

- Performance Evaluation/Proficiency Test Sample Results
- Results of internal laboratory review activities
- Summary of holding time overruns and data qualification
- Method detection limit study status
- Training activity summary
- SOP revision summary

The Corporate Director of Quality, Safety and Training utilizes the information from each laboratory to make decisions impacting the Quality Systems of the company as a whole. Each General Manager utilizes the quarterly report information to make decisions impacting Quality Systems and operational systems at a local level.

8.4 Annual Managerial Review

A managerial review of Quality Systems is performed on an annual basis at a minimum. This allows for assessing program effectiveness and introducing changes and/or improvements.

The managerial review must include the following topics of discussion:

- Policy and procedure suitability
- Manager/Supervisor reports
- Internal audit results
- Corrective and preventative actions
- External assessment results
- Proficiency testing studies
- Sample capacity and scope of work changes
- Client feedback, including complaints

This managerial review must be documented for future reference by the Quality Manager and copies of the report are distributed to laboratory staff.

9.0 CORRECTIVE ACTION

During the process of sample handling, preparation and analysis, certain occurrences may warrant the necessity of corrective actions. These occurrences may take the form of analyst errors, deficiencies in quality control, method deviations, or other unusual circumstances. The Quality System of Pace Analytical provides systematic procedures for documentation and completion of corrective actions. This can be done using a Corrective Action Tracking Log which lists the deficiency by ID, along with the deficiency source, responsible party, root cause, resolution, due date, and date resolved.

9.1 Corrective Action Documentation

The following items are examples of occurrences that warrant some form of documented corrective action:

- Quality Control data outside of acceptance criteria
- Sample Acceptance Policy deviations
- Missed holding times
- Instrument failures
- Sample preparation or analysis errors
- Errors in client reports
- Audit findings (internal and external)

Documentation of corrective actions may be in the form of a comment or footnote on the final report that explains the deficiency (i.e. matrix spike recoveries outside of acceptance criteria) or it may be a more formal documentation (either paper system or computerized spreadsheet). This will depend on the extent of the deficiency, the impact on the data, and the method or client requirements for documentation.

Documentation of a corrective action is initiated by the person who discovers the deficiency. Regardless of who initiates the corrective action, the documentation must contain the approval of all affected parties.

Each formal corrective action requires the signature or initials of all affected parties (or electronic equivalent) and the date they reviewed the corrective action documentation. This includes all applicable analysts, technicians, supervisors, Project Managers, Operations Managers, General Manager, and eventually the Quality Manager. Any comments or specific corrective actions taken (including steps taken to return the system to control, if possible) must also be included in this documentation. The Quality Manager is responsible for final signoff on all formal corrective action documentation and is responsible for the archival and maintenance of all corrective action documentation, including any follow-up information.

9.2 Corrective Action Completion (Specific Examples)

9.2.1 **Quality Control outside of acceptance criteria:** the analyst that is generating or validating Analytical data is responsible for checking the results against established acceptance criteria (quality control limits). The analyst must immediately address any deficiencies discovered. Method blank, LCS or matrix spike failures are evaluated against method, program, and client requirements and appropriate footnotes are entered into the LIMS system. Some deficiencies may be caused by matrix interferences. Where possible, matrix interferences are confirmed by re-analysis. Quality control deficiencies must be made known to the client on the final report for their review of the data for usability. If appropriate, the supervisor is alerted to the QC

failure and if necessary a formal corrective action can be initiated. This may involve the input of the Quality Manager or the General Manager. The department supervisor and/or Operations Manager are responsible for evaluating the source of the deficiency and for returning the analytical system to control. This may involve instrument maintenance, analytical standard or reagent evaluation, or an internal audit of the analytical procedure.

9.2.2 **Sample Acceptance Policy deviations:** any deviation from the Sample Acceptance Policy listed in this Manual must be documented on the Chain-of-Custody or other applicable form by the sample receiving personnel or by the Project Manager. The client must be notified of these deviations as soon as possible so they can make decisions on whether to continue with the sample analysis or re-sample. Copies of this documentation must be included in the project file. Analysts or supervisors that discover such deviations must contact the sample receiving personnel or appropriate Project Manager so they can initiate the proper documentation and client contact. If a more formalized corrective action must be documented, the Quality Manager should be made aware of the situation.

9.2.3 **Missed holding times:** in the event that a holding time requirement has been missed, the analyst or supervisor must complete a formal corrective action form. The Project Manager and the Quality Manager must be made aware of these hold time exceedances.

The Project Manager must contact the client for appropriate decisions to be made with the resolution documented and included in the client project file. The Quality Manager includes a list of all missed holding times in their Quarterly Report to the corporate office.

9.2.4 **Instrument Failures**: in the event of an instrument failure that either causes the necessity for re-analysis or questions the validity of generated results, a formal corrective action must be initiated. The analyst and supervisor must evaluate any completed data for validity and usability. They are also responsible for returning the instrument to valid operating condition and for documenting that the system is in control (i.e. acceptable calibration verification).

9.2.5 **Sample Preparation or Analysis errors**: whenever there is an error in the preparation or analysis of samples, the analyst evaluates the impact on the usability of the analytical data with the assistance from their supervisor or manager. The effected samples will be re-processed or re-analyzed under acceptable conditions. In the event that no additional sample is available for re-analysis, the client must be contacted for their decision on how to proceed. Documentation may take the form of footnotes or a formal corrective action form.

9.2.6 **Errors in client reports:** when an error on the client report is discovered, the Project Manager is responsible for initiating a formal corrective action form that describes the failure (i.e. incorrect analysis reported, reporting units are incorrect, reporting limits do not meet objectives). The Project Manager is also responsible for revising the final report if necessary and submitting it to the client.

9.2.7 **Audit findings:** the Quality Manager is responsible for documenting all audit findings and their corrective actions. This documentation must include the initial finding, the persons responsible for the corrective action, the due date for reporting back to the auditing body, the root cause of the issue, and the corrective action taken to resolve the findings. The Quality Manager is also responsible for providing any back-up documentation used to prove that a corrective action has been completed.

10.0 GLOSSARY

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.

Aliquot: A measured portion of a sample taken for analysis.

Analyte: The specific entity an analysis seeks to determine.

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) that are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Blind Sample: A sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test analyst or laboratory proficiency in the execution of the measurement process.

CRDL: Contract Required Detection Limit.

CRQL: Contract Required Quantitation Limit.

Calibration: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: The graphical relationship between the known values, such as concentrations, or a series of calibration standards and their instrument response.

Chain-of-Custody (COC): A record that documents the possession of samples from the time of collection to receipt in the laboratory. This record generally includes the number and type of containers, the mode of collection, the collector, the time of collection, the preservation, and the requested analyses.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

- second-column confirmation
- alternate wavelength
- derivitization
- mass spectral interpretation
- alternative detectors
- additional cleanup procedures

Comparability: Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.

Completeness: Measure of the amount of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is:

$$\frac{\text{\# of data points obtained}}{\text{\# of data points expected}} * 100 = \text{\% completeness}$$

Calibration Verification: The process of analyzing standards periodically to verify the maintenance of calibration of the analytical system.

Control Chart: A graphical representation of test results with respect to time or sequence of measurements, together with limits within which they are expected to lie when the system is in a state of statistical control (see Control Limit)

Control Limit: A range within which specified measurement results must fall to signify compliance. Control limits may be mandatory, requiring corrective action if exceeded, or advisory, requiring that nonconforming data be investigated and flagged.

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

Data Quality Objective (DQO) Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more usable form.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy.

Detection Limit (DL): The lowest concentration or amount of the target analyte that can be identified, measured and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit.

Dry Weight: The weight of a sample based on percent solids. The weight after drying in an oven at a specified temperature.

Duplicate (Replicate)Analysis: The measurement of the variable of interest performed identically on two or more sub-samples of the same sample within a short interval of time.

Environmental Sample: A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows:

- Surface Water and Ground Water
- Drinking Water - Delivered (treated or untreated) water designated as potable water.
- Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents.
- Sludge - Municipal sludges and industrial sludges.
- Soil - Predominately inorganic matter ranging in classification from sands to clays.

- Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes.

Equipment Blank: A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.

Field Blank: A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.

Holding Time: The maximum time that samples may be held prior to analysis and still be considered valid or not compromised.

Homogeneity: The degree to which a property or substance is evenly distributed throughout a material.

Initial Calibration: (ICAL) The process of analyzing standards, prepared at specified concentrations, to define the quantitative response, linearity and dynamic range of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a continuing calibration do not conform to the requirements of the method in use or at a frequency specified in the method.

Internal Standards: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.

Laboratory Control Samples (LCS): A blank sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amount of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

LIMS: Laboratory Information Management System

Lot: A quantity of bulk material of similar composition processed or manufactured at the same time.

Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions are used:

- **Aqueous**: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- **Drinking Water**: any aqueous sample that has been designated a potable or potentially potable water source.
- **Saline/Estuarine**: any aqueous sample from an ocean or estuary, or other salt water source.
- **Non-aqueous liquid**: any organic liquid with <15% settleable solids.
- **Biological Tissue**: any sample of a biological origin such as fish tissue, shellfish or plant material. Such sample can be grouped according to origin.
- **Solids**: includes soils, sediments, sludges, and other matrices with >15% settleable solids.
- **Chemical Waste**: a product or by-product or an industrial process that results in a matrix not previously defined.
- **Air**: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Matrix Spike (MS):	A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used to determine the effect of the matrix on a method's recovery efficiency.
Matrix Spike Duplicate (MSD):	A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of precision of the recovery of each analyte.
Method Blank:	A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures: and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.
Method Detection Limit (MDL):	The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
PBMS:	(Performance Based Measurement System) a set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner.
Precision:	A data quality indicator measuring the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.
Preservation:	Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.
Proficiency Testing:	A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.
Protocol:	A detailed written procedure for field and/or laboratory operation that must be strictly followed.
Quality Assurance Project Plan (QAPP):	A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.
Quality Assurance (QA):	An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.
Quality Control(QC):	The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.
Quality Manual:	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

Random Error: The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g. tapes which have been transcribed verbatim, dated and verified accurate by signature), the exact copy or exact transcript may be submitted.

Reagent Grade: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

Reporting Limit (RL): The level at which method, permit, regulatory and client specific objectives are met. The reporting limit may never be lower than the statistically determined MDL, but may be higher based on any of the above considerations. Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting limit and the MDL.

Representativeness: A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.

Sample Delivery Group (SDG): A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently. An SDG is generally defined by one of the following, whichever occurs first: Samples may be assigned to SDGs by matrix (i.e., all soil samples in one SDG, all water samples in another), at the discretion of the laboratory. Clients may establish different SDG classifications to meet project specific requirements. NOTE: The two previous sentences make no sense...what is trying to be defined?

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (concentrations) of a variable of interest.

Standard: A substance or material, the properties of which are known with sufficient accuracy, to permit its use to evaluate the same property in a sample.

Standard Blank: A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.

Standard Operating A written document which details the method of an operation, analysis, or action

Procedure (SOP):	whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.
Surrogates:	A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.
Systems Audit:	An on-site inspection or assessment of a laboratory's quality system.
Traceability:	The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.
Training/Work Processing Doc.:	A more detailed version of a Standard Operating Procedure that is used for training purposes. This document details exact computer keystrokes, specific instrument controls and laboratory-specific equipment and supplies that assist an analyst with the training for their work area.
Trip Blank:	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory pure water; any preservative used in the sample is added and then the blank is stored, shipped, and analyzed with its group of samples.
Validation:	The process of substantiating specified performance criteria.
Verification:	Confirmation by examination and provision of evidence that specified requirements for instruments have been met. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.
Warning Limits:	The limits (typically 2 standard deviations either side of the mean) shown on a control chart within which most results are expected to lie (within a 95% probability) while the system remains in a state of statistical control.

11.0 REFERENCES

ANALYTICAL PROTOCOLS

- "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." Federal Register, 40 CFR Part 136.
- "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846. Most current edition and update.
- "Methods for Chemical Analysis of water and Wastes", EPA 600-4-79-020, 1979 Revised 1983, U.S. EPA.
- U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis
- U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis
- "Standard Methods for the Examination of Water and Wastewater." Current Edition APHA-AWWA-WPCF
- "Annual Book of ASTM Standards", Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society of Testing and Materials.
- "Annual Book of ASTM Standards", Section 11: Water and Environmental Technology, American Society of Testing and Materials.
- "NIOSH Manual of Analytical Methods", Third Edition, 1984, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health.
- "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water", U.S. EPA, Environmental Monitoring and Support Laboratory – Cincinnati (September 1986).

ANALYTICAL REFERENCES

- Handbook for Analytical Quality Control in Water and Wastewater Laboratories, U.S. EPA 600/4-79-019, March, 1979.
- Federal Register, 40 CFR Part 136.
- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.
- Quality Assurance of Chemical Measurements, Taylor, John K.; Lewis Publishers, Inc. 1987.
- Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WPCF: Current Edition.
- NOISH Manual of Analytical Methods, U. S. Department of Health, Education and Welfare; Current Edition.
- Methods for Non-conventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater, Test Methods, EPA-440/1-83/079C.
- Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.
- Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300, US DOE, February, 1992.
- Requirements for Quality Control of Analytical Data, HAZWRAP, DOE/HWP-65/R1, July, 1990.
- Requirements for Quality Control of Analytical Data for the Environmental Restoration Program, Martin Marietta, ES/ER/TM-16, December, 1992.
- Quality Assurance Manual for Industrial Hygiene Chemistry, AIHA, 1988.
- National Environmental Laboratory Accreditation Conference, Constitution, Bylaws, and Standards. Most recent revision.

UPPER MIDWEST REGION
QUALITY MANUAL ADDENDUM

Prepared by Pace Analytical Services, Inc. for

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(Effective date of addendum is the last date signed above)

The Technical Directors and Quality Manager, however named on the front page of this Addenda, nominate the following personnel to act as deputies in case of absence or designee.

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920-321-9454

Phil Scott, Supervisor — Date: 12/14/04
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1.0 INTRODUCTION & ORGANIZATIONAL STRUCTURE

1.1 Introduction to Pace

The Upper Midwest region of Pace Analytical Services has three analytical laboratories, performing a wide variety of tests. Its capabilities include:

- volatiles and semi-volatiles by Gas Chromatography/Mass Spectrometry (GC/MS);
- metals analysis by Inductively Coupled Plasma spectrometry (ICP) and ICP/MS;
- pesticide, polychlorinated biphenyls (PCB), and volatile (BTEX) analyses by gas chromatography (GC);
- dioxin/furan analysis by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS) and LRMS
- volatile and semivolatile air analysis by GC and GCMS
- polyaromatic hydrocarbon analysis by High Pressure Liquid Chromatography (HPLC);
- gasoline, diesel and Total Petroleum Hydrocarbon analyses by Gas Chromatography (GC);
- Biota analyses for all major tests
- mercury by cold vapor analysis
- low level mercury analysis by Method 1631E
- and numerous inorganic wet chemical analyses

(All methods are listed in Attachment III and may be subject to change prior to addenda update. The Quality Assurance Office maintains a complete list of each method and analyte approved by NELAC and pertinent state agencies).

The Upper Midwest region is capable of analyzing a variety of environmental and non-environmental samples from different media including surface, drinking and ground waters, air, biota, soils, sediments, waste products, sludge and concretes. All analyses follow written Standard Operating Procedures that are kept on file in the Quality Assurance office. A listing of the major equipment in each facility is available through the quality assurance office in each facility.

The upper Midwest region holds certifications with approximately 40 state and federal agencies. (A complete listing may be obtained through the quality assurance office.) Pace Minneapolis and Enchem Kimberly laboratories hold accreditation by NELAC, the National Environmental Laboratory Accreditation Conference, through the accrediting authority of the Florida Department of Health. The Enchem Green Bay laboratory holds accreditation by NELAC through the accrediting authority of the Illinois Environmental Protection Agency. Copies of the certificates and fields of testing lists may be forwarded to you from the quality assurance department.

This addendum, combined with the preceding corporate quality manual, comprises the complete Laboratory Quality Manual for Upper Midwest region of Pace Analytical Services. This addendum contains information specific to the Upper Midwest region,

whereas the corporate section details practices and policies that are common to all the member Pace laboratories. The addendum is updated by the Regional Quality Manager when necessary.

1.7 Laboratory Organization

The designation for MN laboratory in Figure 1.1 has been expanded to include the Upper Midwest Region. This region and corresponding reporting structure is defined in Attachment I to this addendum.

1.9 Training and Orientation

Refer to the Training Standard Operating Procedure (MN-Q-211) for specific information on acceptable means of documenting initial and continuing demonstrations of capability.

1.10 Laboratory Safety

The designated safety/chemical hygiene officer is Melanie Ollila for the Minneapolis laboratory and Michael Suha for the Enchem Green Bay and Kimberly laboratories. All specific information on laboratory safety is located in each facilities Safety Manual/Chemical Hygiene Plans.

1.11 Security and Confidentiality

All information pertaining to a particular client and their analytical results will remain confidential including national security concerns. Data will not be released to outside agencies without the written authorization from the client.

2.0 SAMPLE CUSTODY

2.1 Sampling Support

Additions to Table 2.1 through 2.4 include but may not be limited to:

Method/Matrix	Container	Preservative	Maximum Hold Time
SM9221D (Fecal-col)	100mL	4°C, 10% sodium thiosulfate	6 hours
SM9223B (Total-col)	100mL	4°C, 10% sodium thiosulfate	24 hours
1653 Water	2 Liter	4°C, pH<2 H_2SO_4	30 Days to Extraction 30 from Ext. to Analysis
1668 Water	1 Liter	4°C	1 Year to Extraction*
1668 Soil	4 or 8 ounce jar	4°C	1 Year to Extraction*
8280 Water	1 Liter	4°C	30 Days to Extraction*
8280 Soil	4 or 8 ounce	4°C	30 Days to Extraction*

Method/Matrix	Container	Preservative	Maximum Hold Time
8290 Solid	4 or 8 ounce	4°C	30 Days to Extraction*
8290 Water	1 Liter	4°C	30 Days to Extraction*
Method 23/TO9	Sampling Head	4°C	30 Days to Extraction*
8290 Waste	2 ounce	4°C	30 Days to Extraction*
1613 Solid	4 or 8 ounce	4°C	1 Year to Extraction*
1613 Water	1 Liter	4°C, 80 mg sodium thiosulfate (if chlorinated source)	1 Year to Extraction (or per state requirements)*
23 XAD	Sampling Head	NA	30 Days to Extraction*
T09/23 PUF	Sampling Head	NA	30 Days to Extraction*
TO-3	Tedlar Bags	NA	48 hrs (client/state specific)
TO-15	Summa Cans	NA	Not specified
Method 3C	Tedlar Bags	NA	48 hrs (client/state specific)
Method 3810 (Mod)	Headspace vials	NA	28 days
TO-4A	PUF Cartridge	NA	7 days (extraction) 40 days (analysis)
TO-13	PUF Cartridge	NA	7 days (extraction) 40 days (analysis)
Method 29	Filter/Impinger	Various (refer to method)	None listed
Method 26	Impinger	Various (refer to method)	None listed
Method 5	Filter	None	None listed
Method 201A (PM10)	Filter, Probe Wash Cyclone wash	None	None listed
Method 202	Organic and Inorganic Wet Catch	None	None listed
Method 1631E	500mL Glass	None	Oxidized in bottle within 28 days

* 40 Days from Extraction to Analysis. (EPA 1613 and 613)
45 Days from Extraction to Analysis (SW8290, 1668, 8280 and Method 23/TO9)

2.4 Chain of Custody

Clarification: The external chain of custody (COC) is signed by the client for relinquishment of samples. The samples may be transported by the client or through the use of a ground or air carrier (e.g. Fed Ex, UPS, SpeeDee) The carrier will assign a tracking number to each cooler and this number may be traced. When the coolers are received at Pace Analytical Services, Inc., the COC is signed by sample management personnel for sample receipt.

2.5 Sample Receipt

All correspondence pertaining to samples which do not meet the acceptance criteria will be fully documented and retained with the project file. All affected data will be footnoted appropriately in the final report.

2.6 Sample Log-in

The Minneapolis laboratory utilizes an "On-Hold" logbook for samples which require further clarification. The logbooks are associated with each sample refrigerator and freezer. The client ID, date, etc are entered into the book, the samples placed into the corresponding refrigerator or freezer, and the project manager associated with the affected client is contacted.

2.7 Sample Storage/Staging

2.7.2 Temperature Monitoring

The Enchem laboratories take the samples to the storage locations after the sample containers have been labeled and prior to entry in the LIMS.

Refrigerators are at $4^{\circ}C \pm 2^{\circ}C$ unless state or program requirements differ.

Freezer Area Maintenance

All freezers are maintained at $<0^{\circ}C$ unless otherwise denoted in analytical method SOPs. The temperature is monitored and recorded each working day. If the temperature is greater than $0^{\circ}C$, corrective action is taken and appropriately documented.

2.9 Subcontracting Laboratory Services

Unless holding times will be affected and client is not available, the client will be advised in writing prior to shipment of subcontracted samples. All laboratories that perform subcontracted work shall provide documentation regarding certification status with state and federal agencies. This documentation is retained in the Quality Assurance Office.

The chain of custody forms generated will not contain any specific client information to protect client confidentiality.

2.10 Sample Disposal

Air canisters will be retained for 14 days after submission of the analytical report. At that time, the cans will be cleaned and certified per the standard operating procedures unless otherwise stated by the project contract or client request.

3.0 ANALYTICAL CAPABILITIES

3.4 Demonstration of Capability (DOC)

Alternate procedures than those outlined in NELAC Quality System Chapter 5 (most recent version) are referenced in the Minnesota standard operating procedure, MN-Q-211 (*Training Procedures*).

4.0 QUALITY CONTROL PROCEDURES

4.9 Trip Blanks

The collection date of a trip blank is generally the collection date of the associated samples. The closer the collection date of a trip blank is to its preparation date, the more reliable and valuable is the data obtained by analyzing it. In order to ensure the relevancy of trip blank data, Pace confirms that trip blanks are contaminant free prior to shipment to the client and recommends that trip blanks always accompany original bottle orders back to Pace for analysis. Identifications in such trip blanks can probably be ascribed to contamination during collection or transport.

4.10 Limit of Detection

Further information on detection limit studies are outlined in the corporate SOP ALL-P-104 (*Method Detection Limit Studies*) and the relationship to the Limit of Quantitation.

The state of Wisconsin requires a 10/3 relationship between the Limit of Detection (LOD) and the Limit of Quantitation (LOQ).

5.0 DOCUMENT CHANGE CONTROL

The Upper Midwest has no further changes to this section of the corporate quality manual. More detailed information on document change control may be found in MN-Q-229 (*Document Change Control*).

6.0 EQUIPMENT AND CALIBRATION

6.3 Calibration Procedures for GC/MS (Gas Chromatograph/ Mass Spectrometer)

6.3.3 Calibration Verification

Clarification: If the RF from any CCC compound differs from the average RF from the initial calibration by more than 20%, then either the calibration verification standard must be reanalyzed or recalibrate. All non-CCC compounds

should be within 40% from the average RF from the initial calibration unless alternate criteria are specified in the laboratory SOP.

6.4 Calibration Procedures for GC and HPLC (Gas Chromatograph and High Performance Liquid Chromatograph)

6.4.2 Calibration Verification

Method criteria supercede the information in the corporate quality manual.

Table 6.1 Summary of Calibration Requirements

Instrument	Calibration Standard	Acceptance Limit	Corrective Action
Glass Syringes, except autosampler syringes which inject a constant amount.	Prior to use an initial demonstration must be performed, at a minimum	Acceptable based on application	Replace
Automatic Dispensing Devices	Quarterly	Varies	Remove from service and fix, replace
Dial Thermometers	Quarterly	Dependent on Method	Remove from service and fix, replace
Oven	Daily with NIST traceable reference	Acceptable based on application	Remove from service and fix, replace
Refrigerator	Daily with NIST traceable reference	Acceptable based on application	Remove from service and fix, replace
Freezer	Daily with NIST traceable reference	Acceptable based on application	Remove from service and fix, replace
Incubator	Daily with NIST traceable reference	Acceptable based on application	Remove from service and fix, replace
Waterbath	Daily with NIST traceable reference	Acceptable based on application	Remove from service and fix, replace
Bottle Top Dispensers	Biannually when the dispenser is used at variable amounts	Varies, See appropriate SOP	Remove from service and fix, replace

6.6 General Calibration Procedures

6.6.1 Analytical Balances

The Manual for the Certification of Laboratories Analyzing Drinking water specifies that Class 1 or 2 weights may be used in the laboratory.

7.0 CONTROL OF DATA

7.5 Response to Inquiries

The project manager initiates the resolution of customer complaints. A Client Data Review Request Form is used to document complaints, project requests, or comments. The form is forwarded to the laboratory and the actions taken are recorded. When a complaint raises doubt concerning the laboratory policies, procedures, or data quality, the area in question will be internally audited. All records are maintained within the project file or Quality Assurance Office depending on the course of action taken. More detailed information on this process may be found in MN-Q-245 (*Documentation of Client Requests and Complaints*).

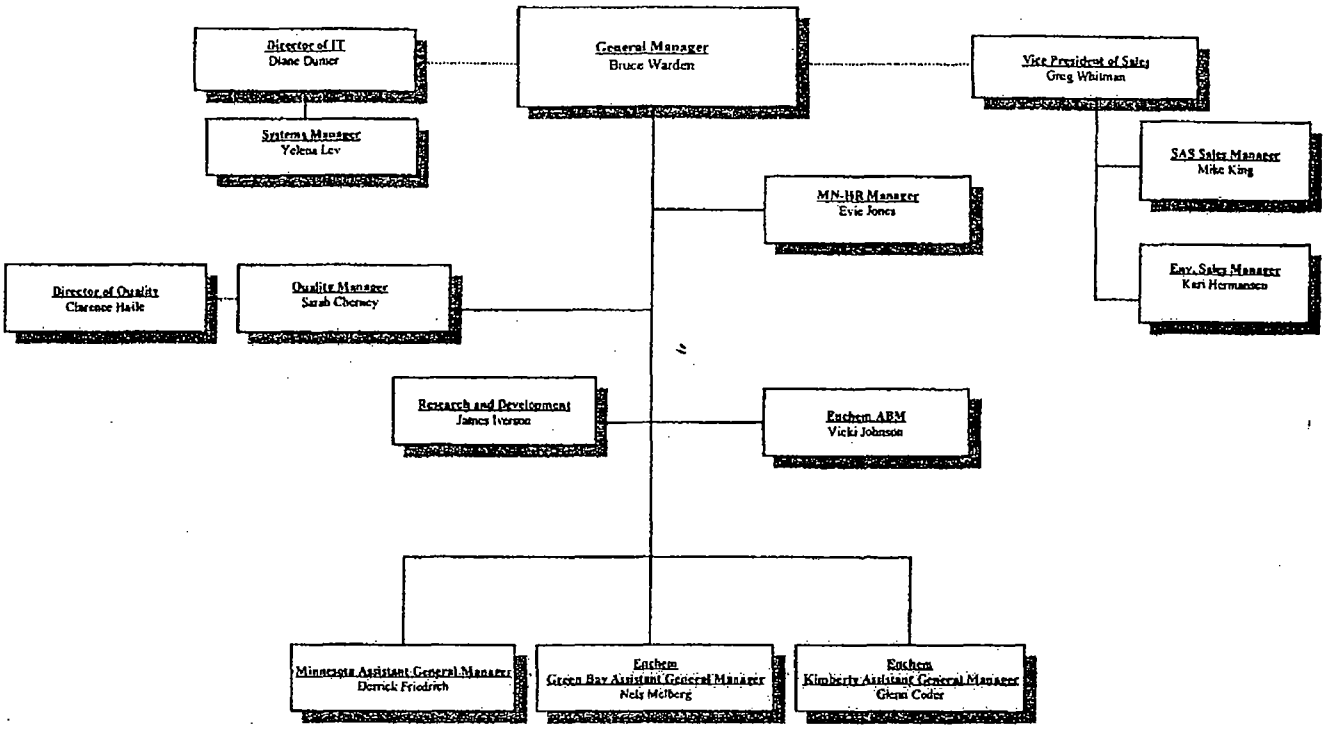
8.0 QUALITY SYSTEM AUDITS AND REVIEWS

The Upper Midwest region has no further changes to this section of the corporate quality manual. More detailed information on internal audits may be found in MN-Q-206 (*Internal Audits and Inspections*) and MN-Q-216 (*Reporting QA Audits*). More detailed information on external audits may be found in MN-Q-223 (*External Audits*).

9.0 CORRECTIVE ACTION

The Upper Midwest region has no further changes to this section of the corporate quality manual. More detailed information on the corrective action and investigation process may be found in MN-L-133 (*Out of Specification Investigation*) and MN-L-136 (*Corrective Action Reports*).

Attachment 1



Attachment 2 (Page 1 of 3)

Pace Analytical™
www.pacelabs.com

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Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612 607 6444

Method ID	Method Name
%MOISTURE	Percent Moisture
Ag-List	Organophosphorus Compounds by Gas Chromatography/Mass Spectrometry: Capillary Column Technique
ASTM D5057	Density by ASTM
CALUFT-D	Determination of Diesel Range Organics in water and soil
CALUFT-G	Gasoline Range Organics in Water and Soil
EPA 120.1	Physical Properties: Conductance, Specific Conductance
EPA 150.1	Physical Properties: pH, Electrometric
EPA 160.1	Physical Properties: Residue, Filterable, Gravimetric, Dried at 180 C o
EPA 160.2	Physical Properties: Residue, Non-Filterable Gravimetric, Dried at 103-105 C o
EPA 160.3	Physical Properties: Residue, Total Gravimetric, Dried at 103-105 C o
EPA 160.4	Physical Properties: Residue, Volatile, Gravimetric, Ignition at 550 C o
EPA 160.5	Physical Properties: Settleable Matter, Volumetric, Imhoff Cone
EPA 1613	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS
EPA 1613B-DW	2,3,7,8-Tetrachlorodibenzo-p-Dioxin in Drinking Water by Isotope Dilution HRGC/HRMS
EPA 1650	Adsorbable Organic Halides
EPA 1653	Chlorinated Phenolics in Wastewater by In Situ Acetylation and GC/MS
EPA 1664, Rev A	N-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons)
EPA 1668	Chlorinated Biphenyl Congeners in Water, Soil, sediment, and Tissue by HRGC/HRMS
EPA 170.1	Physical Properties: Temperature, Thermometric
EPA 180.1	Determination of Turbidity by Nephelometry
EPA 200.7	Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-
EPA 200.8	Determination of Trace Elements in Water and Wastes by Inductively Cuple Plasma-Mass Spectrometry
EPA 245.1	Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectrometry
EPA 300.0	Determination of Inorganic Anions by Ion Chromatography - Revision 2.1
EPA 310.1	Inorganic, Non-Metallics: Alkalinity, Titrimetic (pH 4.5)
EPA 310.2	Alkalinity, Colorimetric, Automated Methyl Orange
EPA 330.2	Inorganic, Non-Metallics: Chlorine, Total Residual, Titrimetric, Back, Iodometric
EPA 335.2	Inorganic, Non-Metallics: Cyanide, Total, Titrimetric, Spectrphotometric
EPA 340.2	Inorganic, Non-Metallics: Fluoride, Potentiometric, Ion Selective Electrode
EPA 350.1	Determination of Ammonia Nitrogen by Semi-Automated Colorimetry -Revision 2.0
EPA 351.2	Determination of Total Kjeldahl Nitrogen by Semi-Automated Colorimetry -Revision 2.0
EPA 353.2	Determination of Nitrate-Nitrite by Automated Colorimetry
EPA 354.1	Inorganic, Non-Metallics: Nitrite, Spectrophotometric
EPA 365.2	Inorganic, Non-Metallics: Phosphorus, All Forms, Colorimetric, Ascorbic Acid, Single Reagent
EPA 376.1	Inorganic, Non-Metallics: Sulfide, Titrimetric, Iodine
EPA 3810 (mod)	Methane,Ethane, Ethene in Water by Headspace Analysis
EPA 405.1	Organics: Biochemical Oxygen Demand, 5 day, 20 C o
EPA 410.2	Organics: Chemical Oxygen Demand, Titrimetric, Low-Level
EPA 410.4	Determination of Chemical Oxygen Demand by Semi-Automated Colorimetry - Revision 2.0
EPA 415.1	Total Organic Carbon
EPA 420.1	Organics: Phenolics, Total Recoverable, Spectrophotometric, Manual 4-AAP with Distillation
EPA 420.4	Phenol
EPA 610	Polynuclear Aromatic Hydrocarbons
EPA 613	2,3,7,8-TetraChlorodibenzo-p-dioxin by Low Resolution GC/MS
EPA 624	Chlorinated Hydrocarbons-Purgeables by Low Resolution GC/MS
EPA 625	Base/Neutrals and Acids by Low Resolution GC/MS

Attachment 2 (Page 2 of 3)

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Fax: 612.607.6444

Method ID	Method Name
Method 23	Determinatin of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air
Method 26	Determination of Anions and Cations from Ambient Air
Method 29	Determination of Metals Emissions from Stationary Sources
Method 308	Methanol and Ethanol from Stationary Sources
Method 3C	Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources
Method 5	EPA5, Air Filter, Cyclone Wash, Wet Catch, Probe Wash
Molds	Various molds identification
NIOSH 7300 (mod)	Metals, ICP, NIOSH 7300 - MOD
NWTPH-Dx	Semi-volatile Petroleum Products Method for Soil and Water
NWTPH-Gx	Volatile Petroleum Products Method for Soil and Water
OA1	Gasoline Range Organics in Water and Soil
OA2	Diesel Products in Water and Soil
PM10	PM 10, Air Filter, Cyclone Wash, Wet Catch, Probe Wash
REDOX	Oxidation/Reduction Potential
SM 2320B	Alkalinity, Water
SM 2340B	Hardness, Ca & Mg as Carbonates by ICP
SM 3500-Cr-D	Chromium, Hexavalent (Colorimetric)
SM 4500	Chloride (Silver Nitrate)
SM 4500-CN-E	Cyanide (Colorimetric Method)
SM 4500-CN-G	Cyanides Amenable to Chlorination after Distillation
SM 4500-CN-I	Weak Acid Dissociable Cyanide
SM 4500-F-C	Fluoride by Ion-Selective Electrode Mode
SM 4500-P-E	Phosphorous- Ascorbic Acid Method
SM 4500-SO3-B	Sulfide
SM 5210B	5-Day Biochemical Oxygen Demand (BOD) Test
SM 5220C	Chemical Oxygen Demand (COD) by Closed Reflux, Titrimetic Method
SM 5220D	Chemical Oxygen Demand (COD) by Closed Reflux, Colorimetric Method
SM 5310C	Total Organic Carbon
SM 9215A	Heterotrophic Plate Count
SM 9222D	Fecal Coliform in Water
SM 9223B	Total Coliform in Water
SM2540C	Total Dissolved Solids
SM2540D	Total Suspended Solids
SPC	Standard Plate Count
SW 1010	Pensky-Martens Closed-Cup Method for Determining Ignitability
SW 1311	Toxicity Characteristic Leaching Procedure
SW 1312	Synthetic Precipitation Leaching Procedure
SW 3010A	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy
SW 3050B	Acid Digestion of Sediments, Sludges, and Soils
SW 3051	Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils
SW 3510C	Separatory Funnel Liquid-Liquid Extraction
SW 3520C	Continuous Liquid-Liquid Extraction
SW 3535	Solid-Phase Extraction (SPE)
SW 3540C	Soxhlet Extraction
SW 3541	Automated Soxhlet Extraction
SW 3550B	Ultrasonic Extraction

Attachment 2 (Page 3 of 3)

Pace Analytical™
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street, Suite 200
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

Method ID	Method Name
SW 3580A	Waste Dilution
SW 5030B	Purge-and-Trap for Aqueous Samples
SW 5035	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
SW 6010B	Inductively Coupled Plasma-Atomic Emission Spectrometry
SW 6020	Determination of Trace Elements in Water and Wastes by Inductively Cuple Plasma-Mass Spectrometry
SW 7196A	Chromium, Hexavalent (Colorimetric)
SW 7470A	Mercury in Liquid Waste (Manual Cold-Vapor Technique)
SW 7471A	Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique)
SW 8015B	Nonhalogenated Organics Using GC/FID
SW 8021B	Aromatic and Halogenated Volatiles by Gas Chromatography Using Photoionization and/or Electrolytic Conductivity Detectors
SW 8081A	Organochlorine Pesticides by Gas Chromatography
SW 8082	Polychlorinated Biphenyls (PCBs) by Gas Chromatography
SW 8260B	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)
SW 8270C	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)
SW 8270C SIM	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-utilizing selective ion monitoring
SW 8280A	The Analysis of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by High Resolution Gas Chromatography/Low Resolution Mass Spectrometry (HRGC/LRMS)
SW 8290	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS)
SW 8310	Polynuclear Aromatic Hydrocarbons
SW 9010	Total and Amenable Cyanide: Distillation
SW 9030B	Acid-Soluble and Acid-Insoluble Sulfides: Distillation
SW 9045C	Soil and Waste pH
SW 9060	Total Organic Carbon
SW 9095A	Paint Filter Liquids Test
TO-13	Determination of Semi-Volalatile Organics in Ambient Air
TO-14	Determination of Volatile Organic Compounds in Ambient Air utilizing a Summa Canister and GC/MS
TO-15	The Determination of Volatile Organic Compounds in Air Collected in Summa Canisters and Analyzed by GC/MS
TO-15 SIM	The Determination of Volatile Organic Compounds in Air Collected in Summa Canisters and Analyzed by GC/MS utilizing selective ion monitoring
TO-3	TO3, in Air Source
TO-4 (PCB)	Determinatin of Polychlorinated Biphenyl in Ambient Air
TO-4 (Pesticides)	Determinatin of Polychlorinated Pesticide in Ambient Air
TO-9A	Determinatin of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air
WIDRO	Determination of Diesel Range Organics in water and soil
WIGRO	Determination of Gasoline Range Organics in water and soil

SEVERN TRENT STL

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Tel: 865 291 3000 Fax: 865 584 4315
www.stl-inc.com

February 17, 2005

Alfredo Sotomayor
Wisconsin Department of Natural Resources
101 South Webster Street
Madison, Wisconsin 53707

Dear Mr. Sotomayor:

This is the STL Knoxville Laboratory response to the Wisconsin Department of Natural Resources audit report dated November 18, 2004.

Analytical Methodology

Deficiency 1: The laboratory does not analyze a combined 209 congener solution, as defined in Method 1668A, at the beginning of each 12-hour shift during which analyses are performed. (The laboratory analyzes a solution containing all the non-toxic congeners each quarter)

STL Knoxville Response: STL Knoxville will modify its standard operating procedure (SOP) to include the analysis of a combined 209 congener solution at the beginning of each 12 hour shift during which analyses are performed. The following summary includes the criteria that we have agreed upon regarding the evaluation of the 1668A toxics and non-toxics calibration.

Perform a 6-point calibration with all 209 congeners present in each level.
Apply a 20 % RSD limit on compounds calibrated by isotope dilution.
Apply a 35% RSD limit on compounds calibrated by internal standard.
Perform a CS-3 verification every 12-hours (containing all 209 congeners).
Apply 70-130 %D acceptance criteria for toxic/locs. (Table 6).
Apply 40-160 %D acceptance criteria for remaining 182 congeners.
Apply 50-150 %D acceptance criteria for labeled congeners. (Table 6).
Apply 60-130 %D acceptance criteria for cleanup standards. (Table 6).
If any VER acceptance criterion is not met, take corrective action and reanalyze the VER or recalibrate.
Apply the CCAL RF if non-toxic/loc is <70 and >/= 40 %D.
Apply the CCAL RF if non-toxic/loc is >130 and </= 160 %D.
This change to the SOP is expected to be completed and implemented by April 30, 2005.

Quality Assurance

Deficiency 1: At the time of the evaluation, two solutions that had not been documented as approved for use were used by the extraction laboratory to fortify quality control samples.

(No response is required for this item. The two solutions had been verified to be accurate and suitable for use, but their labels were not noted accordingly be the preparation chemists. Extraction personnel neglected to review the label and assumed that the solutions were properly verified.)

STL Knoxville Response: The preparation chemists are verifying the QC check is complete prior to use of the spiking solutions.

Deficiency 2: Existing records pertinent to the verification of new solutions do not always indicate the resulting differences between the new and the older solutions quantitatively. (Summary sheets sometimes included notations such as "QC checked", but did not quantify the degree of agreement between the two solutions. Raw data records were available to compute the difference between an older and a newer solution, but they did not document the evaluation criteria used for certifying the new solutions.)

STL Knoxville Response: This deficiency was noted for the GC analysis of PCB Congeners by Method 8082. A summary report indicating the differences between the new solution and the reference solution has been generated that clearly documents the acceptable agreement of the newly prepared solution with the reference. Please see Attachment A for an example report.

Deficiency 3: The laboratory does not always analyze a continuing calibration verification standard after performing maintenance on the HRGC/HRMS instrument used to analyze PCB congeners.

STL Knoxville Response: This may have been a misunderstanding related to the periodic analysis of the 209 congener standard. STL Knoxville does perform continuing calibration following all maintenance events and always analyzes a continuing calibration prior to sample analysis. Please see Attachment B for an excerpt from the instrument maintenance logbook along with the associated run log that documents the analysis of a continuing calibration on January 19, 2005 following a maintenance event.

Records and Data Reporting:

Deficiency 1: The laboratory's procedure for quantitating PCB congeners based on method 8082 incorrectly states that the laboratory uses the grand mean of all average response factors to quantitate congeners when the relative standard deviations (RSDs) of any response factor exceeds 15%. (Currently, the laboratory does not use the grand mean option for enabling average response factors having RSDs that exceed15%. The laboratory uses the average response factor when RSDs of the corresponding congener responses are less than or equal to 15%, and uses other options outlined in Method 8000 when RSDs exceed 15%).

STL Knoxville Response: STL Knoxville has updated the 8082 PCB Congener SOP to remove the unused option of the "grand mean" for evaluating calibrations. Please see Attachment C for the revised SOP for Method 8082 Congeners and the summary of changes for this revision.

Deficiency 2: The certificate detailing the source, purity, lot number, and expiration date of one of the PCB congener cleanup standards used by the isotope dilution laboratory could not be located at the time of the evaluation. (The congener in question was 32L. The method specifies using congeners 28L, 111L, and 178L as cleanup standards.)

STL Knoxville Response: STL Knoxville has received from Cambridge Isotope Labs a copy of the certificate for the 32L standard. A sequential system for filing the certificates has been defined and implemented. Please see Attachment D for the certificate for this cleanup standard.

Deficiency 3: The laboratory's protocols for verifying the accuracy of the solutions used in HRGC/HRMS dioxin and furan analyses are not adequately or accurately described in existing documents or SOPs.

STL Knoxville Response: As clarified in our phone conversation on December 20, 2004 regarding this issue, STL Knoxville is not providing certified values for either calibration or spike solutions to vendors that are then subsequently used by STL Knoxville for calibration or analysis. The accuracy of our calibration standards is verified as described in the analytical SOPs. Please see Attachment E for SOP KNOX-ID-0004 Revision 5 Section 10.2.9 which describes the analysis of the initial calibration verification standard. The same verification is performed for the PCB congeners by Method 1668A as described in our SOP KNOX-ID-0013 Section 10.2.8 which is also included in Attachment E.

Deficiency 4: The composition of the PCB HRGC/HRMS congener continuing calibration verification and initial calibration verification standards is not completely documented in the laboratory's SOP.

STL Knoxville Response: The PCB HRGC/HRMS congener SOP will be modified to clearly describe the composition of the continuing and initial calibration verification standards. This revision will be made in concert with the changes described in the first deficiency discussed in this report. This is scheduled to be completed by April 30, 2005.

Please feel free to call Chris Rigell or David Thal at (865) 291-3000 if you have any questions or need additional information.

Sincerely,

Tom Yoder
Laboratory Director

and

Chris Rigell
Quality Assurance Manager

Attachment A

Software Version: 4.1<2F12>
Sample Name : spike check
Sample Number: A12147/10
Operator : Analyst

Time : 1/6/2005 10:59 AM
Study : 1/10 dilution

Instrument : GGH
AutoSampler :
Rack/Vial : 0/0

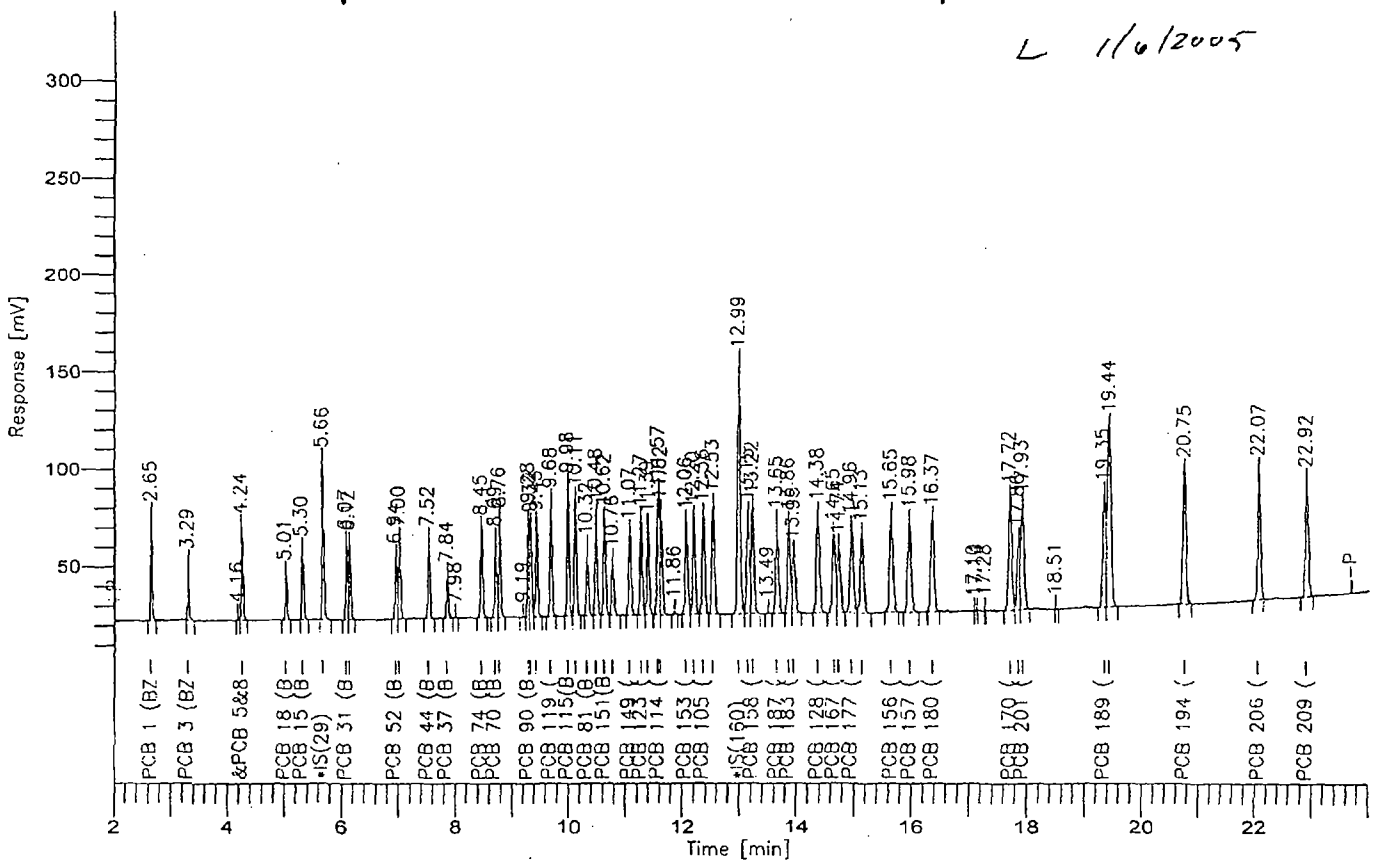
Channel : A A/D mV Range : 1000

Interface Serial # : 2120574787 Data Acquisition Time: 12/13/2004 01:51 PM
Delay Time : 0.00 min.
End Time : 30.00 min.
Sampling Rate : 5.0000 pts/sec

Raw Data File : K:\#GGH\#SEQ\K05G4\G#A5041.RAW
Result File : K:\#GGH\#SEQ\K05G4\G#A5041.RST
Inst Method : K:\#GGH\#MTHINST\#INST from K:\#GGH\#SEQ\K05G4\G#A5041.RST
Proc Method : K:\#GGH\#MTHINST\#PROCG.mth
Calib Method : K:\#GGH\#MTHCALB\K05Grt.mth
Sequence File : K:\#GGH\#SEQ\K05G4.SEQ

Sample Volume : 1.0000 ul Area Reject : 0.000000
Sample Amount : 1.0000 Dilution Factor : 1.00

verification of new MS spike solution.
L 1/6/2005



PCB CCV REPORT

Time [min]	Delta RT [%]	Component Name	Area [µV·s]	Height [µV]	Std. Conc. (ppb)	Calc. Conc. (ppb)	Component Name	Percent Difference	IS %Rec
2.648	0.3717	PCB 1 (BZ)	88882	54239	200.00000	213.33141	PCB 1 (BZ)	6.6657	------
3.292	0.3631	PCB 3 (BZ)	52833	29325	200.00000	215.17147	PCB 3 (BZ)	7.5857	------
3.517	-------	TCX	0	0	----------	0.00000	TCX	----------	------
4.243	0.3146	&PCB 5&8 (BZ)	100638	47590	20.00000	22.86851	&PCB 5&8 (BZ)	14.3426	------
5.008	0.2824	PCB 18 (BZ)	49978	23510	10.00000	11.32901	PCB 18 (BZ)	13.2901	------
5.304	0.2852	PCB 15 (BZ)	78029	35428	50.00000	50.86544	PCB 15 (BZ)	1.7309	------
5.661	0.2632	*IS(29)	178022	80777	0.00000	25.00000	*IS(29)	----------	84.86
6.074	0.2500	PCB 31 (BZ)	86878	38694	10.00000	10.90524	PCB 31 (BZ)	9.0524	------
6.122	0.2548	PCB 28 (BZ)	83821	38386	10.00000	11.00879	PCB 28 (BZ)	10.0879	------
6.937	0.2226	PCB 52 (BZ)	74541	31613	10.00000	10.91226	PCB 52 (BZ)	9.1226	------
6.998	0.2166	PCB 49 (BZ)	96918	40293	10.00000	11.11160	PCB 49 (BZ)	11.1160	------
7.516	0.2199	PCB 44 (BZ)	97778	39858	10.00000	10.85948	PCB 44 (BZ)	8.5948	------
7.841	0.2065	PCB 37 (BZ)	57149	21803	10.00000	11.06897	PCB 37 (BZ)	10.6897	------
8.445	0.1975	PCB 74 (BZ)	115094	45626	10.00000	11.10080	PCB 74 (BZ)	11.0080	------
8.691	0.1841	PCB 70 (BZ)	99842	39526	10.00000	11.03972	PCB 70 (BZ)	10.3972	------
8.764	0.1868	PCB 66 (BZ)	121512	49271	10.00000	11.45848	PCB 66 (BZ)	14.5848	------
9.284	0.1648	PCB 90 (BZ)	123435	51509	10.00000	11.43923	PCB 90 (BZ)	14.3923	------
9.322	0.1601	PCB 101 (BZ)	109768	46719	10.00000	11.23541	PCB 101 (BZ)	12.3541	------
9.430	0.1586	PCB 99 (BZ)	121531	47220	10.00000	10.97828	PCB 99 (BZ)	9.7828	------
9.683	0.1605	PCB 119 (BZ)	152549	58623	10.00000	10.83145	PCB 119 (BZ)	8.3145	------
9.982	0.1424	PCB 115(BZ)	168587	66629	10.00000	11.24881	PCB 115(BZ)	12.4881	------
10.114	0.1641	PCB 87 (BZ)	154305	59461	10.00000	10.97181	PCB 87 (BZ)	9.7181	------
10.319	0.1473	PCB 81 (BZ)	92655	34270	10.00000	10.76973	PCB 81 (BZ)	7.6973	------
10.477	0.1505	PCB 110 (BZ)	138444	51339	10.00000	10.84824	PCB 110 (BZ)	8.4824	------
10.620	0.1634	PCB 151(BZ)	134666	48701	10.00000	10.75276	PCB 151(BZ)	7.5276	------
10.762	0.1477	PCB 77 (BZ)	81916	27404	10.00000	10.87102	PCB 77 (BZ)	8.7102	------
11.065	0.1575	PCB 149 (BZ)	121365	42097	10.00000	11.14173	PCB 149 (BZ)	11.4173	------
11.266	0.1341	PCB 123 (BZ)	139102	48527	10.00000	11.25844	PCB 123 (BZ)	12.5844	------
11.387	0.1403	PCB 118 (BZ)	133284	45039	10.00000	11.05032	PCB 118 (BZ)	10.5032	------
11.573	0.1440	PCB 114 (BZ)	188305	62955	10.00000	11.31311	PCB 114 (BZ)	13.1311	------
11.616	0.1531	PCB 184 (BZ)	134066	52234	10.00000	11.17298	PCB 184 (BZ)	11.7298	------
11.756	-------	Surr(165)	0	0	----------	0.00000	Surr(165)	----------	------
12.060	0.1341	PCB 153 (BZ)	145533	46814	10.00000	11.25649	PCB 153 (BZ)	12.5649	------
12.196	0.1316	PCB 168 (BZ)	163469	49426	10.00000	10.96158	PCB 168 (BZ)	9.6158	------
12.358	0.1356	PCB 105 (BZ)	161109	50233	10.00000	11.28794	PCB 105 (BZ)	12.8794	------
12.532	0.1437	PCB 141 (BZ)	181926	55414	10.00000	11.33422	PCB 141 (BZ)	13.3422	------
12.985	0.1419	*IS(160)	453124	129267	0.00000	25.00000	*IS(160)	----------	88.84
13.145	0.1419	PCB 138 (BZ)	175689	50734	10.00000	11.20879	PCB 138 (BZ)	12.0879	------
13.224	0.1478	PCB 158 (BZ)	191627	54243	10.00000	10.96706	PCB 158 (BZ)	9.6706	------
13.654	0.1424	PCB 187 (BZ)	172652	46841	10.00000	11.21571	PCB 187 (BZ)	12.1571	------
13.858	0.1358	PCB 183 (BZ)	174872	45748	10.00000	11.07231	PCB 183 (BZ)	10.7231	------
13.949	0.1254	PCB 126 (BZ)	116509	30590	10.00000	11.13946	PCB 126 (BZ)	11.3946	------
14.375	0.1359	PCB 128 (BZ)	198690	50716	10.00000	11.10901	PCB 128 (BZ)	11.0901	------
14.651	0.1346	PCB 167 (BZ)	157036	40137	10.00000	11.31836	PCB 167 (BZ)	13.1836	------
14.736	0.1379	PCB 202 (BZ)	138559	33726	10.00000	10.93346	PCB 202 (BZ)	9.3346	------
14.958	0.1326	PCB 177 (BZ)	181844	43565	10.00000	11.23078	PCB 177 (BZ)	12.3078	------
15.134	0.1331	PCB 200 (BZ),2	174303	39956	10.00000	10.91487	PCB 200 (BZ),2	9.1487	------
15.652	0.1449	PCB 156 (BZ)	198142	49561	10.00000	11.35273	PCB 156 (BZ)	13.5273	------
15.975	0.1356	PCB 157 (BZ)	188534	46465	10.00000	11.29089	PCB 157 (BZ)	12.9089	------
16.370	0.1358	PCB 180 (BZ)	193911	47138	10.00000	10.91670	PCB 180 (BZ)	9.1670	------
17.720	0.1256	PCB 170 (BZ)	230252	58143	10.00000	11.28117	PCB 170 (BZ)	12.8117	------
17.863	0.0999	PCB 169 (BZ)	125819	35774	10.00000	11.18764	PCB 169 (BZ)	11.8764	------
17.932	0.1156	PCB 201 (BZ),1	216215	53007	10.00000	11.49481	PCB 201 (BZ),1	14.9481	------
19.353	0.0841	PCB 189 (BZ)	212425	57802	10.00000	11.58121	PCB 189 (BZ)	15.8121	------
19.441	0.0654	&PCB 195&207 (	449512	92437	20.00000	22.43569	&PCB 195&207 (	12.1785	------
20.754	0.0683	PCB 194 (BZ)	255194	67770	10.00000	11.35102	PCB 194 (BZ)	13.5102	------
22.069	0.0433	PCB 206 (BZ)	240507	66399	10.00000	11.49504	PCB 206 (BZ)	14.9504	------
22.918	0.0699	PCB 209 (BZ)	221327	59277	10.00000	11.36791	PCB 209 (BZ)	13.6791	------

173.70

Criteria for %D = 20%

L 1/6/2005

Software Version: 4.1<2F12>
Sample Name : spike check
Sample Number: AI2147/10
Operator : Analyst

Time : 1/6/2005 10:59 AM
Study : 1/10 dilution

Instrument : GGH
AutoSampler :
Rack/Vial : 0/0

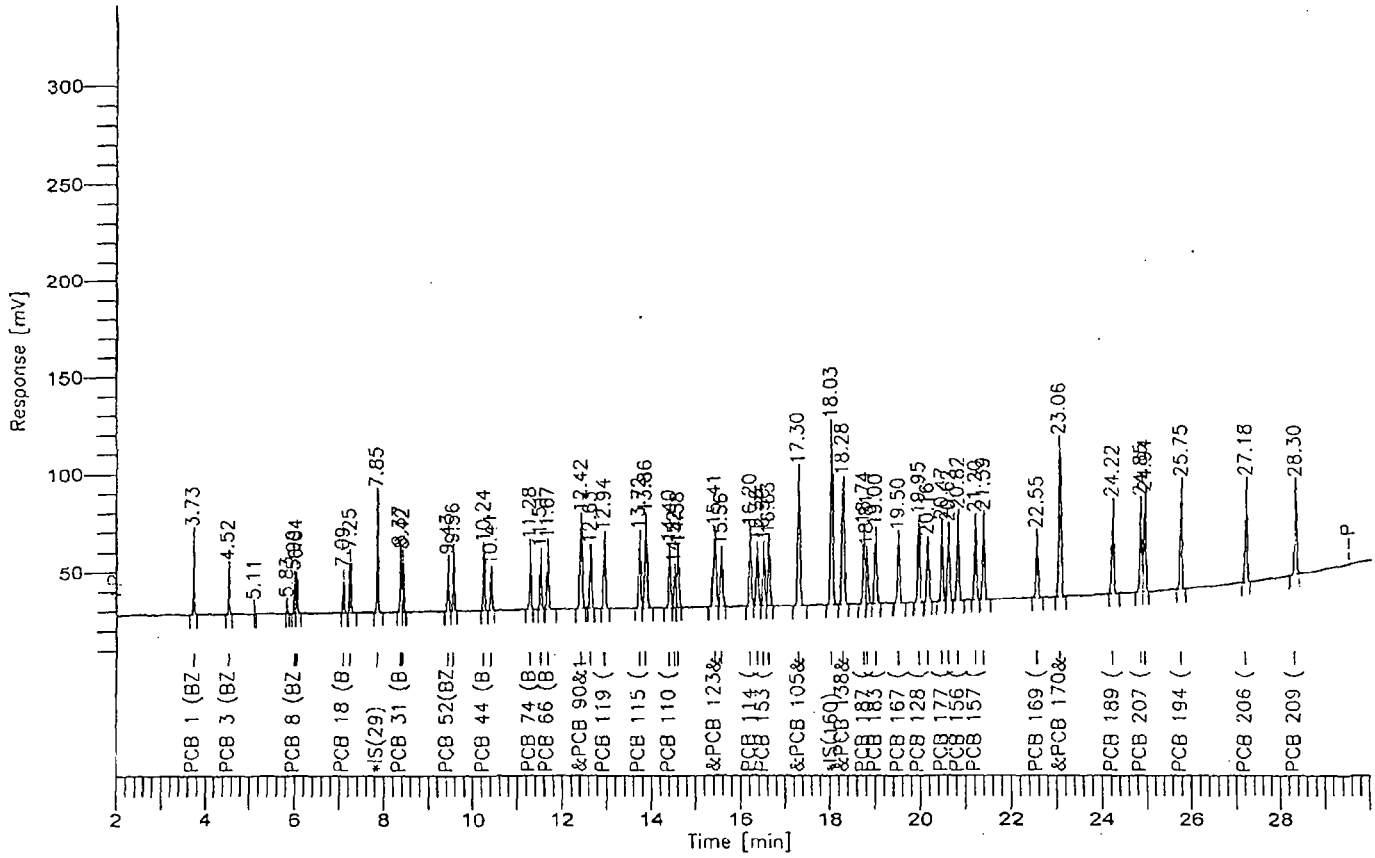
Channel : B A/D mV Range : 1000

Interface Serial # : 2120574787 Data Acquisition Time: 12/13/2004 01:51 PM
Delay Time : 0.00 min.
End Time : 30.00 min.
Sampling Rate : 5.0000 pts/sec

Raw Data File : K:\#GGH\#SEQ\K05G4\G#B5041.RAW
Result File : K:\#GGH\#SEQ\K05G4\G#B5041.RST
Inst Method : K:\#GGH\#MTHINST\#INST from K:\#GGH\#SEQ\K05G4\G#B5041.RST
Proc Method : K:\#GGH\#MTHINST\#PROCH.mth
Calib Method : K:\#GGH\#MTHCALB\K05Hrt.mth
Sequence File : K:\#GGH\#SEQ\K05G4.SEQ

Sample Volume : 1.0000 ul
Sample Amount : 1.0000

Area Reject : 0.000000
Dilution Factor : 1.00



PCB CCV REPORT

Time [min]	Delta RT [%]	Component Name	Area [µV·s]	Height [µV]	Std. Conc. (ppb)	Calc. Conc. (ppb)	Component Name	Percent Difference	IS %Rec
3.727	0.0160	PCB 1 (BZ)	64840	37749	200.00000	221.43646	PCB 1 (BZ)	10.7182	------
4.523	0.0162	PCB 3 (BZ)	39070	20582	200.00000	213.64466	PCB 3 (BZ)	6.8223	------
4.737	-------	TCX	0	0	----------	0.00000	TCX	----------	------
5.990	0.0037	PCB 8 (BZ)	30157	15127	10.00000	11.08015	PCB 8 (BZ)	10.8015	------
6.038	0.0030	PCB 5 (BZ)	41175	20731	10.00000	11.45448	PCB 5 (BZ)	14.5448	------
7.094	-0.0117	PCB 18 (BZ)	34052	16170	10.00000	11.39876	PCB 18 (BZ)	13.9876	------
7.247	-0.0019	PCB 15 (BZ)	55862	25717	50.00000	51.03284	PCB 15 (BZ)	2.0657	------
7.851	0.0061	*IS(29)	121166	57032	0.00000	25.00000	*IS(29)	----------	83.55
8.372	0.0067	PCB 31 (BZ)	59078	26730	10.00000	11.21821	PCB 31 (BZ)	12.1821	------
8.420	0.0120	PCB 28 (BZ)	54054	25425	10.00000	10.99272	PCB 28 (BZ)	9.9272	------
9.430	-0.0072	PCB 52(BZ)	50475	22316	10.00000	11.19565	PCB 52(BZ)	11.9565	------
9.556	0.0131	PCB 49 (BZ)	62455	27646	10.00000	11.18593	PCB 49 (BZ)	11.8593	------
10.239	0.0027	PCB 44 (BZ)	63631	28084	10.00000	11.30735	PCB 44 (BZ)	13.0735	------
10.406	0.0077	PCB 37 (BZ)	37330	15891	10.00000	10.95552	PCB 37 (BZ)	9.5552	------
11.275	0.0008	PCB 74 (BZ)	74392	28843	10.00000	11.13639	PCB 74 (BZ)	11.3639	------
11.511	0.0066	PCB 70 (BZ)	65844	24824	10.00000	11.28725	PCB 70 (BZ)	12.8725	------
11.669	0.0078	PCB 66 (BZ)	79365	29019	10.00000	11.20780	PCB 66 (BZ)	12.0780	------
12.417	0.0086	&PCB 90&101 (B	153375	42351	20.00000	23.59337	&PCB 90&101 (B	17.9669	------
12.633	0.0081	PCB 99 (BZ)	78084	25999	10.00000	10.59223	PCB 99 (BZ)	5.9223	------
12.939	0.0165	PCB 119 (BZ)	101213	32821	10.00000	11.43106	PCB 119 (BZ)	14.3106	------
13.722	0.0055	PCB 115 (BZ)	108760	33375	10.00000	10.96415	PCB 115 (BZ)	9.6415	------
13.861	0.0153	&PCB 81&87 (BZ	165241	41760	20.00000	22.57079	&PCB 81&87 (BZ	12.8539	------
14.396	0.0147	PCB 110 (BZ)	92084	26450	10.00000	10.88856	PCB 110 (BZ)	8.8856	------
14.516	0.0099	PCB 77 (BZ)	52414	15762	10.00000	10.86160	PCB 77 (BZ)	8.6160	------
14.584	-0.0053	PCB 151(BZ)	91284	25433	10.00000	10.76801	PCB 151(BZ)	7.6801	------
15.414	0.0111	&PCB 123&149 (	170088	34408	20.00000	22.19762	&PCB 123&149 (	10.9881	------
15.559	0.0070	PCB 118 (BZ)	87660	24034	10.00000	10.75195	PCB 118 (BZ)	7.5195	------
15.894	-------	Surr(165)	0	0	----------	0.00000	Surr(165)	----------	------
16.199	0.0063	PCB 114 (BZ)	117889	33741	10.00000	11.15522	PCB 114 (BZ)	11.5522	------
16.357	0.0042	PCB 184 (BZ)	91773	25671	10.00000	10.66015	PCB 184 (BZ)	6.6015	------
16.503	0.0098	PCB 153 (BZ)	93624	26158	10.00000	10.68727	PCB 153 (BZ)	6.8727	------
16.625	0.0105	PCB 168 (BZ)	103639	29435	10.00000	10.89044	PCB 168 (BZ)	8.9044	------
17.299	0.0124	&PCB 105&141 (	232255	65086	20.00000	22.42604	&PCB 105&141 (	12.1302	------
18.028	0.0107	*IS(160)	304698	88426	0.00000	25.00000	*IS(160)	----------	89.30
18.278	0.0231	&PCB 138&158 (	240961	59066	20.00000	22.89477	&PCB 138&158 (	14.4738	------
18.736	0.0124	PCB 187 (BZ)	115706	33984	10.00000	11.39290	PCB 187 (BZ)	13.9290	------
18.807	0.0013	PCB 126 (BZ)	77687	22683	10.00000	10.80565	PCB 126 (BZ)	8.0565	------
18.995	0.0123	PCB 183 (BZ)	112105	32499	10.00000	10.93733	PCB 183 (BZ)	9.3733	------
19.501	0.0024	PCB 167 (BZ)	103506	30052	10.00000	11.00186	PCB 167 (BZ)	10.0186	------
19.953	0.0105	PCB 128 (BZ)	129144	38089	10.00000	11.22655	PCB 128 (BZ)	12.2655	------
20.156	0.0239	PCB 202 (BZ)	91858	26885	10.00000	11.08033	PCB 202 (BZ)	10.8033	------
20.472	0.0155	PCB 177 (BZ)	116235	34463	10.00000	11.13172	PCB 177 (BZ)	11.3172	------
20.617	0.0078	PCB 200 (BZ)/2	111119	33038	10.00000	11.14203	PCB 200 (BZ)/2	11.4203	------
20.819	0.0139	PCB 156 (BZ)	132493	39681	10.00000	11.13174	PCB 156 (BZ)	11.3174	------
21.203	0.0119	PCB 157 (BZ)	122726	37517	10.00000	11.34525	PCB 157 (BZ)	13.4525	------
21.386	0.0090	PCB 180 (BZ)	126128	38694	10.00000	11.41688	PCB 180 (BZ)	14.1688	------
22.549	0.0034	PCB 169 (BZ)	91542	28180	10.00000	11.48633	PCB 169 (BZ)	14.8633	------
23.064	0.0130	&PCB 170&201 (	272140	75767	20.00000	22.24685	&PCB 170&201 (	11.2342	------
24.222	0.0178	PCB 189 (BZ)	135369	42370	10.00000	11.36375	PCB 189 (BZ)	13.6375	------
24.845	0.0101	PCB 207 (BZ)	139237	42313	10.00000	11.29081	PCB 207 (BZ)	12.9081	------
24.938	0.0109	PCB 195 (BZ)	146648	44395	10.00000	11.01440	PCB 195 (BZ)	10.1440	------
25.750	0.0179	PCB 194 (BZ)	155098	50290	10.00000	11.80879	PCB 194 (BZ)	18.0879	------
27.184	0.0096	PCB 206 (BZ)	149113	47202	10.00000	11.54639	PCB 206 (BZ)	15.4639	------
28.303	0.0140	PCB 209 (BZ)	136364	42666	10.00000	11.31798	PCB 209 (BZ)	13.1798	------
									172.85

STL KNOXVILLE
PREPARATION OF INTERMEDIATE STANDARDS - GC

DATE 12/10/04 CHEMIST mop SOLVENT MeOH LOT # [illegible] EXP.DATE 5/21/05

ID NUMBER	COMPOUND	PARENT ID NAME	CONC. OF PAR. SOL'N. ppm	ALIQUOT VOLUME (ml)	DILUTION VOLUME (ml)	FINAL CONC. ppm
AI2146	Oxychlordane	Cert 1819	100.6	0.994	50	2.000
↓	Chlorobenzilate	Cert 1804	100.2	0.998	↓	2.000
	A-Chlordane	Cert 1815	100.3	0.249		0.500
	G-Chlordane	Cert 1816	100.1	0.250		↓
	A-BHC	Cert 1806	98.7	0.253		
↓	B-BHC	Cert 1807	100.0	0.250	↓	↓

mop 12/10/04

OCld J12C.502 CHA2037 CHA2038

DATE 12/10/04 CHEMIST L SOLVENT Hex LOT# A31586 EXP.DATE 2/2/05 (mix 3 exp.)

ID NUMBER	COMPOUND	PARENT ID NAME	CONC. OF PAR. SOL'N. ng/ul	ALIQUOT VOLUME (ml)	DILUTION VOLUME (ml)	FINAL CONC. ng/ul
AI2147	Mix 3 + 1	(AI2065+) AI2067	0.50	2	10	0.10
↓	PCB 1	Cert 1839	100	0.200	↓	2.0
	PCB 3	↓ 1848	↓	↓		2.0
↓	PCB 15	↓ 1845	↓	0.05	↓	0.5

L 12/10/04

QCd 12/13/04 K0504 G#A5041 Against ICAL

Reviewed by/Date:_____

Attachment B

STL KNOXVILLE
SPECIALTY ORGANICS GROUP PREVENTIVE MAINTENANCE SCHEDULE

Month: Jan 2005 Instrument: MAT95

Pinhole change 1/20/05

Initial the date column when maintenance is performed	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
GC Maintenance																																
1. Replace septum	A			BW	BW	BW	BW	BW	BW		BW	BW	Pmp					BW		BW	20	BW			BW		BW	BW	BW			BW
2. Replace injection port liner	A			BW	BW	BW	BW	BW	BW		BW	BW	Pmp					BW		BW	20	BW			BW		BW	BW	BW			BW
3. Perform column maintenance	A											XT																				
4. Replace carrier gas filter	A																															
5. Check carrier gas pressure (record)	B			BW							BW							BW							BW						BW
6. Install column (type and ID No.)	A																								BW			BW				
7. Evaluate air spectrum, masses 28,32	B			BW							BW							BW							BW						BW
8. Check tray chiller and water level.	C			BW																												
9. Replace inlet seal.	A			BW	BW							BW													BW			BW				
10. Clean injection port body.	A																															
11. Replace interface ferrule on xfer line.	A																															
Ion Source Maintenance																																
1. Clean ion source	A																			DC												
2. Install clean ion volume	A			BW								BW													BW							
3. Install new filament	A																															
4. Replace PFK reservoir septum (HRMS)	A																				DC											
MS Vacuum System Maintenance																																
1. Change mechanical pump oil	E																															
2. Change diffusion pump oil (HP)	D																															
3. Check coolant level and temp	D																															
MS Electronic Maintenance																																
1. Check cooling fans	B			BW							BW							BW							BW						BW
2. Check PCB seating and alignment	D																															
3. Check power supply voltages	D																															
4. Check 5 volt card cage power supply	C																															
Other Maintenance																																
1. Clean Printer	C																															
2. Replace printer ribbon and/or toner	A																															
3. Other (specify)																																
Instrument Down Time (hours)																																

Frequency
(A) As Needed
(B) Weekly
(C) Monthly
(D) Biannually (Jan, July)
(E) Annually (Jan)

Carrier Gas:

Date	In	Out
1/3/05	67	75
1/10/05	67	72
1/17/05	67	72
1/24/05	67	72
1/31/05	67	74

GC Columns:

Installation Date	Phase	Length	ID No.	Serial No.
12/30/04	SPB-octyl	30m	0.25	1378194
1/24/05	DB-5	60m	0.32	659108
1/27/05	SPB-octyl	30m	0.25	1378191

Reviewed by/Date: _____

STL KNOXVILLE
SPECIALTY ORGANICS INSTRUMENT MAT 95 RUN LOG

Date	Time	Opr	Sample ID	Filename	Code	Matrix	Type	Tape	Lot#/Comments
1-19-05	20:54	PMP	PFK	—	OK	—	Res		Mass Res Chk
1-19-05	20:56	PMP	2296:64CS3	a05011951	OK	—	Ver		1668 Ver
1-19-05	22:14	PMP	G17P41AC	apg17p4c	OK	H_2O	QC		HSA060000-285C
1-19-05	23:17	PMP	Nonane	spbr	OK	—	QC		flush
1-19-05	23:32	PMP	"	spbr	OK	—	QC		"
1-19-05	23:47	PMP	"	spbr	OK	—	QC		"
1-20-05	00:03	PMP	G0QJC1AA	apg20jka	DS	—	QC		^{13}C Spike
1-20-05	02:33	PMP	G08AV1AC	apg08av	IF LOCK up OK	Air	SAM		H4L160264-001
1-20-05	03:38	PMP	G08DH1AC	apg08dh	OK	Air	SAM		" -002
1-20-05	07:19	PMP	G08DK1AC	apg08dk	IF LOCK up OK	Air	SAM		" -003
1-20-05	—	PMP	G08DP1AC	apg08dp	DR	Air	SAM		" -004
1-20-05	—	PMP	G08DT1APC PMP 1-19-05	apg08dt	DR	Air	SAM		" -005
1-12-05	—	PMP	G0TXW1AC	apg0txwq	DR	Air	SAM		H4L100477-005
1-2005	—	PMP	G0TXV1AC	apg0txvq	DR	Air	SAM		" 004
1/20/05	08:23	BMW	PFK	—	OK	—	Res		Mass Res Check

Read and Understood by:

_____ Date: _____

Attachment C

STL Knoxville
Summary of changes to KNOX-GC-0011, Revision 3 to create Revision 4

Section	Summary of Change
10.11.5	Deleted: If any individual %D is greater than 15% and less than 30%, but the average of the %D for all analytes is within 15%, then the calibration has been verified. The average must include all analytes in the calibration, regardless of whether they are target analytes for a specific project, and the data user must be provided with the calibration verification data or a list of those analytes that exceeded the 15% limit.
15.2	Updated the waste stream information.

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Implementation Date: 1/11/05

SOP No.: KNOX-GC-0011
Revision No.: 3 4 mod 1/12/05
Revision Date: 11/29/04

STL KNOXVILLE

STANDARD OPERATING PROCEDURE

TITLE: Analysis of Polychlorinated Biphenyl Congeners Based on SW-846 Method 8082

(SUPERSEDES: KNOX-GC-0011, Rev. 3

Prepared By: _____

Reviewed By: Michael S. Patty 11/30/04
Technical Specialist

Approved By: _____ 12/06/04
Quality Assurance Manager

Approved By: _____ 12-6-04
Environmental, Health and Safety Coordinator

Approved By: _____ 12-6-04
Laboratory Director

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1. Scope and Application

1.1. This SOP describes procedures to be used when SW-846 Method 8082 is applied to the analysis of polychlorinated biphenyl (PCB) congeners by gas chromatography/electron capture detection (GC/ECD). It is applicable to extracts derived from any matrix which are prepared according to the sample extraction SOP, KNOX-OP-0014, current revision.

1.2. Table 1 lists compounds that are routinely determined by this method and gives the reporting limits (RL) for each matrix. RLs given are based on the low-level standard and the sample preparation concentration factors. Matrix interferences may result in higher RLs than those listed.

2. Summary of Method

2.1. This method presents conditions for the analysis of prepared extracts for PCB congeners. The congeners are separated by dual fused silica capillary columns and detected by electron capture detection. Quantitation is performed using the internal standard method.

2.1.1. Aqueous samples are extracted with methylene chloride using continuous liquid / liquid extraction. Solid samples are extracted with methylene chloride/acetone using Soxhlet extraction. Waste dilution is used for samples that are miscible with the solvent.

2.1.2. Extracts are dried and concentrated to a volume of 10 ml. The extracts are then cleaned using a sulfuric acid wash. When necessary, extracts are cleaned using mercury treatment or tetrabutyl ammonium (TBA) sulfite treatment to remove elemental sulfur. Extracts are washed with a 5% NaCl solution, dried and concentrated to final volume using nitrogen evaporation.

2.1.3. After the initial preparation step, the sample is introduced into the GC and concentrations of target analytes are measured by the detector response, within a defined retention time window, relative to the response to standard concentrations.

3. Definitions

3.1. Definitions of terms used in this SOP may be found in the glossary of the Laboratory Quality Manual (LQM).

4. Interferences

4.1. Contamination by carryover can occur when a low concentration sample is analyzed after a high concentration sample. Co-elution of target analytes with non-targets can occur, resulting in false positives or biased high results.

4.2. Interferences in the GC analysis arise from many compounds amenable to gas chromatography that give a measurable response on the electron capture detector. Phthalate esters, which are common plasticizers, can pose a major problem in the determinations. Interferences from phthalates are minimized by avoiding contact with any plastic materials.

4.3. Elemental sulfur, often associated with sediments from sites with anaerobic conditions, may result in analytical signal suppression. Sulfur is removed using mercury cleanup or treatment with TBA sulfite.

4.4. Interferences co-extracted from samples will vary considerably from source to source. The presence of interferences may raise quantitation limits for individual samples. Specific cleanups may be performed on the sample extracts, including Florisil® cleanup (Method 3620), Gel Permeation Chromatography (Method 3640), and sulfur cleanup (Method 3660).

5. Safety

5.1. Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

5.2. Specific Safety Concerns or Requirements

5.2.1. The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.2.2. There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.3. Primary Materials Used: The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the

MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Acetone	Flammable	1000 ppm-TWA	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
Hexane	Flammable Irritant	500 ppm-TWA	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
Mercury	Oxidizer Corrosive Poison	0.1 Mg/M3 Ceiling (Mercury Compounds)	Extremely toxic. Causes irritation to the respiratory tract. Causes irritation. Symptoms include redness and pain. May cause burns. May cause sensitization. Can be absorbed through the skin with symptoms to parallel ingestion. May affect the central nervous system. Causes irritation and burns to eyes. Symptoms include redness, pain, and blurred vision; may cause serious and permanent eye damage.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

5.3.1. PCBs have been classified as potential carcinogens under OSHA. Concentrated solutions of PCBs must be handled with extreme care to avoid excess exposure. Contaminated gloves and clothing must be removed immediately. Contaminated skin surfaces must be washed thoroughly.

5.4. Exposure to chemicals will be maintained **as low as reasonably achievable**, therefore, unless they are known to be non-hazardous, all samples will be opened, transferred and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

5.5. Opened containers of neat standards will be handled in a fume hood.

5.6. Sample extracts and standards that are in a flammable solvent shall be stored in an explosion-proof refrigerator.

5.7. When using hydrogen gas as a carrier, all precautions listed in the STL Corporate Safety Manual shall be observed.

6. Equipment and Supplies

6.1. An analytical system complete with a gas chromatograph and a ^{63}Ni electron capture detector is required. A data system capable of measuring peak area and/or height is required.

6.2. Refer to Table 2 for analytical columns.

6.3. Microsyringes, various sizes, for standards preparation, sample injection, and extract dilution.

7. Reagents and Standards

7.1. Calibration Standards: A calibration curve with at least five points is prepared at nominal concentrations ranging from 1 to 50 ng/ml for each compound of interest in hexane. Some compounds may be prepared at higher levels due to chromatographic performance, stability, and sensitivity. Refer to Table 3 for analytes and calibration levels.

7.2. Surrogate Standards: A 100 ng/mL surrogate spiking solution is prepared in methanol. Tetrachloro-m-xylene and 2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165) are used as surrogate standards. Refer to Table 3 for the calibration levels for surrogate standards and to Table 4 for the typical spiking levels.

7.3. Internal Standards: A 250 ng/mL internal standard (IS) solution is prepared in hexane. Compounds in the IS solution are 2,4,5-Trichlorobiphenyl (BZ 29) and 2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160). Internal standards are added to all standards and extracts at 25 ng per mL of extract. For example, if the volume of an extract used is 100 µL, 10 µL of the 250 ng/mL internal standard solution would be added. Refer to Table 3.

7.4. Quality Control (QC) Standards: The LCS and MS/MSD spiking solution is prepared to contain a final concentration of 100 ng/mL for all analytes except BZ1, BZ3 and BZ15. The concentrations of BZ1 and BZ3 are 2000 ng/mL and the concentration of BZ15 is 500 ng/mL. Refer to Table 4 for typical spiking levels.

7.5. Initial Calibration Verification Standard (2nd Source Standard): The mid level ICV standard includes all analytes. The standard is prepared from a stock independent from the calibration standards.

7.6. The standards listed in sections 7.1 to 7.5 are stored at $\leq 6^{\circ}C$. All standards must be protected from light. Standard solutions must be brought to room temperature before using.

7.6.1. Expiration times for all standards are measured from the time the standard is prepared or one year from the time that the standard ampoule is opened, if the standard is supplied in a sealed ampoule. If a vendor supplied standard has an earlier expiration date, then that date is used.

7.6.2. Stock standards are purchased as certified solutions or prepared from pure solutions. Stock standard solutions must be replaced or demonstrated to be valid by comparison to a second source standard after one year.

7.6.3. Calibration standards, ICV standards and spiking solutions are prepared as dilutions of the stock standards. The standards must be replaced or demonstrated to be valid by comparison to a second source standard after six months.

8. Sample Collection, Preservation and Storage

8.1. Extracts must be refrigerated at $\leq 6^{\circ}C$ and should be stored in suitable glass containers with Teflon lined caps. (Extracts will normally be stored for 30 days after invoicing.)

8.2. Water samples are extracted within seven days of sampling and the extracts are analyzed within 40 days of the end of the extraction.

8.3. Solids and waste samples are extracted within fourteen days of sampling and the extracts are analyzed within 40 days of the end of the extraction.

9. Quality Control

9.1. Initial Demonstration of Capability: The initial demonstration and method detection limit (MDL) studies described in section 13 must be acceptable before analysis of samples may begin.

9.2. Batch Definition: Batches are defined at the sample preparation stage. Batches should be kept together through the entire analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence. Refer to the QC Program document (QA-003) for further details of the batch definition.

9.2.1. Quality Control Batch: The batch is a set of up to 20 samples of the same matrix processed using the same procedures and reagents within the same time period. The Quality Control batch must contain a matrix spike/matrix spike duplicate (MS/MSD), a laboratory control sample (LCS) and a method blank. Laboratory generated QC samples (blank, LCS, MS/MSD) do not count towards the maximum 20 samples in a batch. Field QC

samples are included in the batch count. Upon client request, the MS/MSD may be replaced with a matrix spike and a sample duplicate. If insufficient sample is available for a MS/MSD, a LCS duplicate may be substituted.

9.3. Control Limits: In-house historical control limits must be determined for surrogates, matrix spikes, and laboratory control samples. These limits must be determined at least annually. The recovery limits are mean recovery +/- 3 standard deviations, unless those limits are tighter than the calibration criteria, in which case limits may be widened. Refer to policy QA-003 for more details.

9.3.1. These limits do not apply to dilutions greater than 5X. Surrogate and matrix spike recoveries will be reported unless the dilution is more than 5X.

9.3.2. All surrogate, LCS, and MS recoveries must be entered into QuantIMS so that accurate historical control limits can be generated.

9.3.3. Refer to the QC Program document (QA-003) for further details of control limits.

9.4. Surrogates

9.4.1. Every sample, blank and QC sample is spiked with surrogate standards. Surrogate spike recoveries must be evaluated by determining whether the concentration (measured as percent recovery) falls within the required recovery limits. The compounds routinely included in the surrogate spiking solution, along with recommended standard concentrations, are listed in Table 4.

9.4.2. If only one surrogate in a sample extract is outside the control limit, and all of the method blank and LCS surrogates and spikes are in control, the outlier may be attributed to matrix effects.

9.4.3. If both sample surrogates are outside limits, the following corrective actions must take place (except for dilutions greater than 5X):

9.4.4. Check all calculations for error.

9.4.5. Ensure that instrument performance is acceptable.

9.4.6. Recalculate the results and/or reanalyze the extract if either of the above checks reveal a problem.

9.4.7. If none of the above resolves the problem, reprepare and reanalyze the sample or flag the data as "Estimated Concentration". Repreparation is not necessary if there is an obvious chromatographic interference.

Note: The decision to reanalyze or flag the data should be made in consultation with the client. It is only necessary to reprepare / reanalyze a sample once to demonstrate that poor surrogate recovery is due to a matrix effect (unless the analyst believes that the repeated out of control results are not due to a matrix effect).

9.4.8. If dual column analysis is used, the choice of which result to report is made in the same way as for the samples (Section 12.1.2) unless one column is out of control, in which case the in-control result is reported.

9.4.9. If the surrogates are out of control for the original sample, MS and MSD, then a matrix effect has been demonstrated for that sample and repreparation is not necessary. If the sample is out of control and the MS and/or MSD is in control, then repreparation or flagging of the data is required.

9.4.10. Refer to the QC Program document (QA-003) for further details of the corrective actions.

9.5. Method Blanks

9.5.1. For each batch of samples, analyze a method blank. The method blank consists of reagent water for aqueous samples, and reagent sand and sodium sulfate for soil samples (refer to SOP KNOX-OP-0014 for details). Surrogates are added and the method blank is carried through the entire analytical procedure. The method blank must meet the following acceptance criteria:

9.5.1.1. If the concentration of a target analyte in the method blank is greater than the MDL but less than the reporting limit, corrective action is required, but the associated data may be reported. The corrective action must include the addition of "B" qualifiers to the results for the associated samples with the corresponding analytes detected in the method blank above the MDL.

9.5.1.2. If the concentration of a target analyte in the method blank is above the reporting limit and the associated sample values are more than 20 times the concentration present in the method blank, corrective action is required, but the associated data may be reported. The corrective action must include the addition of "B" qualifiers to the results for the

associated samples with the corresponding analytes detected in the method blank above the reporting limit.

9.5.1.3. If the concentration of a target analyte in the method blank is greater than the reporting limit, and the concentration of that analyte in an associated sample is less than 20 times the method blank concentration, the sample batch must be reextracted and reanalyzed.

9.5.1.4. If there is no target analyte greater than the RL in the samples associated with an unacceptable method blank, the data may be reported with a narrative statement that describes the issue.

9.6. Instrument Blanks

9.6.1. An instrument blank must be analyzed prior to sample analysis during any 12 hour period of analysis that does not contain a method blank.

9.6.2. An instrument blank consists of the appropriate solvent with internal standards added.

9.6.3. Control criteria are the same as for the method blank, except that only reanalysis of affected samples would be required, not re-extraction.

9.7. Laboratory Control Samples

9.7.1. A laboratory control sample (LCS) is prepared and analyzed with every batch of samples. The LCS contains the analytes shown in Table 4 and must contain the same analytes as the matrix spike.

9.7.2. If any control analyte or surrogate is outside established control limits, the system is out of control and corrective action must occur. Corrective action will normally be repreparation and reanalysis of the batch.

9.7.3. Refer to the QC Program document (QA-003) for further details of the corrective action.

9.7.4. If dual column analysis is used, the choice of which result to report is made in the same way as for samples (Section 12.1.2) unless one column is out of control, in which case the in-control result is reported.

9.8. Matrix Spikes/Matrix Spike Duplicates: A matrix spike and matrix spike duplicate (MS/MSD) is prepared and analyzed with every batch of samples. Spiking compounds and levels are given in Table 4. Compare the percent recovery and relative percent difference (RPD) to the laboratory control limits.

9.8.1. If any individual recovery or RPD falls outside the acceptable range, corrective action must occur. The initial corrective action will be to check the recovery of that analyte in the LCS. Generally, if the recovery of the analyte in the LCS is within limits, then the laboratory operation is in control and analysis may proceed.

9.8.2. If the recovery for any component is outside QC limits for both the matrix spike/matrix spike duplicate and the LCS, the laboratory is out of control and corrective action must be taken. Corrective action will normally include repreparation and reanalysis of the batch.

9.8.3. If a matrix spike/matrix spike duplicate is not possible due to limited sample, then a laboratory control sample duplicate should be analyzed.

9.8.4. The matrix spike/matrix spike duplicate must be analyzed at the same dilution as the unspiked sample.

9.8.5. If dual column analysis is used, the choice of which result to report is made in the same way as for samples (Section 12.1.2) unless one column is out of control, in which case the in-control result is reported.

9.9. STL QC Program: Further details of QC and corrective action guidelines are presented in the QC Program document (QA-003). Refer to this document if in doubt regarding corrective actions.

10. Calibration and Standardization

10.1. Refer to Table 2 for details of GC operating conditions. The conditions listed should result in resolution of all analytes listed in Table 7. Chromatographic resolution is defined in section 10.9.

10.2. Refer to Table 5 for initial calibration and continuing calibration analytical sequences.

10.3. Refer to Appendix II for a calibration and spike summary.

10.4. Internal standard calibration is recommended unless the sample matrix is likely to interfere with the quantitation of the internal standard. Prepare standards containing each analyte of interest at a minimum of five concentration levels. The low level standard should be at or below the reporting limit. The other standards define the working range of the detector. Recommended calibration levels are given in Table 3.

10.5. A new calibration curve must be generated after major changes to the system or when the continuing calibration criteria cannot be met. Major changes include new columns or replacing the electron capture detector. A new calibration is not required after clipping the column, replacing the septum or syringe or other minor maintenance.

10.6. With the exception of Section 10.7, it is not acceptable to remove points from a calibration curve for the purpose of meeting criteria, unless the points are the highest or lowest on the curve and the reporting limit and/or linear range is adjusted accordingly. In any event, at least 5 points must be included in the calibration curve.

10.7. A level may be removed from the calibration if the reason can be clearly documented, for example a broken vial. A minimum of five levels must remain in the calibration. The documentation must be retained with the initial calibration. Alternatively, if the analyst believes that a point on the curve is inaccurate, the point may be reanalyzed and the reanalysis used for the calibration. All initial calibration points must be analyzed without any changes to instrument conditions, and all points must be analyzed within 24 hours.

10.8. Internal standard calibration

10.8.1. The internal standard approach assumes that variations in instrument sensitivity, amount injected, etc., can be corrected by determining the ratio of the response of the analyte to the response of an internal standard that has been added to the extract. The internal standards are similar in analytical behavior to the compounds of interest. Typical internal standards are listed in Table 3. The analyst must demonstrate that the measurement of the internal standard is not affected by method or matrix interferences (i.e., the magnitude of the internal standard area or height must be within 50 to 150% of the response in the mid-level of the initial calibration). If the sample matrix interferes with quantitation of the internal standard, then the external standard approach must be used instead. (Refer to SOP KNOX-GC-0015 for the external standard calculations.) In this event, use the response factors from the previous continuing calibration to quantitate the analytes in the sample with the interference (applies only to the sample with the interference).

10.8.2. Introduce each calibration standard into the GC using the technique that will be used for samples. Response factors (RF) for each compound are calculated as follows:

$$RF = \frac{H_s \times C_{is}}{H_{is} \times C_s}$$

Where:
H_s = Response for the analyte to be measured, height
H_{is} = Response for the internal standard, height
C_{is} = Concentration of internal standard
C_s = Concentration of the analyte to be determined in the standard

10.8.3. Average response factor

The average response factor may be used if the percent relative standard deviation (%RSD) of the response factors is $\leq$ 20%.

The equation for average response factor is:

$$\textit{Average response factor} = \overline{RF} = \frac{\sum_{i=1}^{n} RF_i}{n}$$

Where: n = Number of calibration levels

$\sum_{i=1}^{n} RF_i$ = Sum of response factors for each calibration level

10.9. The following requirements must be met for any calibration to be used:

- All analytes must be adequately resolved chromatographically to perform separate integrations for compounds shown as resolved in Table 7. The resolution must be achieved on the highest level standard used in the most recent calibration. Chromatographic resolution is defined as having at least 0.04 minutes between all retention times, and with a distinguishable valley between the two peaks.
- Response must increase with increasing concentration.

10.10. Initial Calibration Verification Standard (2nd Source Standard)

10.10.1. A mid-level standard from a second source is analyzed as the initial calibration verification (ICV). The ICV shall be analyzed with each initial calibration.

10.10.2. The ICV must be within +/- 25% of its expected value with allowance for up to two analytes within +/- 35%.

10.11. Calibration Verification (CCV)

10.11.1. 12 Hour Calibration

10.11.1.1. The RF is verified by the analysis of a mid-level calibration standard at the beginning, after every 12 hours and at the end of the analysis sequence. The center of each retention time window is updated with each 12-hour calibration at the discretion of the analyst.

10.11.1.2. The analytical shift starts with the injection of the mid-level standard. The data associated with any sample that is injected > 12 hours after the start of the analytical shift is not valid. The extract must be reanalyzed within a valid shift.

10.11.2. Continuing Calibration

10.11.2.1. It may be appropriate to analyze a mid point standard more frequently than every 12 hours. If these calibration verification standards are analyzed, requirements are the same as the 12 hour calibration with the exception that retention times need not be updated.

10.11.2.2. The mid-level calibration mix (CS-4 or CS-5 in Table 3) is analyzed as the continuing calibration standard. At a minimum, this is analyzed after every 20 samples, including matrix spikes, LCS, and method blanks. If 12 hours elapse, analyze the 12-hour standard sequence instead. If instrument drift is expected due to sample matrix or other factors, it may be advisable to analyze the continuing calibration standard more frequently.

10.11.3. % Drift calculation

% Drift is used for evaluating calibration verification.

$$\%\ Drift = \frac{Calculated\ Conc. - Theoretical\ Conc.}{Theoretical\ Conc.} \times 100\%$$

10.11.4. Any individual compounds with %D $\leq$15% meet the calibration criteria.

10.11.5. Closing calibration standards are not necessary for internal standard methods.

10.11.6. The internal standard response in a calibration verification standard must be within 50 to 150% of the response in the mid-level of the initial calibration.

10.11.7. If the analyst notes that a CCV failed and can document the reason for failure (e.g., broken vial, carryover from the previous sample, etc.), then a second CCV may be analyzed without any adjustments to the instrument.

10.11.8. If routine corrective action procedures fail to produce a second consecutive (immediate) calibration verification within acceptance criteria, then the laboratory has to demonstrate performance after corrective action with two consecutive successful calibration verifications. If the laboratory has not demonstrated acceptable performance, sample analyses must not occur until a new initial calibration curve is established and verified. However, sample data associated with an unacceptable calibration verification may be reported as qualified data under the following special conditions:

10.11.8.1. When the acceptance criteria for the continuing calibration verification is exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

10.11.9. If highly contaminated samples are expected, it is acceptable to analyze blanks or primers at any point in the run.

10.11.10. Corrective Action for Samples: For this internal standard method, any samples injected after a standard not meeting the calibration criteria must be reinjected.

11. Procedure

11.1. Extraction: The extraction procedure is described in SOP KNOX-OP-0014.

11.2. Cleanup: Appendix III contains instructions for sulfur removal using elemental mercury. Other cleanup procedures are described in SOP KNOX-OP-0014.

11.3. Gas Chromatography: Typical gas chromatographic conditions are given in Table 2.

11.4. Sample Introduction: Analytes are introduced by direct injection of the extract. Samples, standards, and QC must be introduced using the same procedure. Allow extracts to warm to ambient temperature before injection. Add the internal standard solution to the extract (1:10 ratio).

11.5. Analytical Sequence: An analytical sequence starts with an initial calibration or CCV. The typical analytical sequence is given in Table 5. If there is a break in the analytical sequence of greater than 12 hours, a 12-hour calibration verification standard must be analyzed before proceeding with the sequence.

11.6. Retention Time Windows

11.6.1. Retention time windows must be determined for all analytes. Make three injections of all analytes of interest over the course of a 72 hour period. Calculate the standard deviation of the three retention times for each analyte (relative retention times may also be used). Plus or minus three times the standard deviation of the retention times of each analyte defines the retention time window.

11.6.2. The centers of the windows are updated with the mid-point of the initial calibration. The windows may also be updated at the discretion of the analyst, on the basis of the12-hour calibration verification.

11.6.3. If the retention time window as calculated above is less than +/- 0.03 minutes, use +/- 0.03 minutes as the retention time window. This allows for slight variations in retention times caused by sample matrix.

11.6.4. The laboratory must calculate new retention time windows each time a new column is installed. The new windows must be generated within one week of the installation of the new column. Until these standards have been run on the new column, the retention time windows from the old column may be used, updated with the retention times from the new initial calibration.

11.6.5. Corrective Action for Retention Times: The retention times of all compounds in each continuing calibration must be within the most recently updated retention time windows. If this condition is not met, all samples analyzed after the last compliant standard must be reanalyzed *unless the following conditions are met for any compound that elutes* outside the retention time window:

- The retention time of that compound in the standard must be within a retention time range equal to twice the original window.
- No peak that would be reportable may be present on the sample chromatogram within an elution time range equal to three times the original retention time window.

11.7. Percent Moisture: Analytical results are reported as dry weight. Percent moisture must be determined if results will be reported as dry weight. Refer to SOP KNOX-WC-0012 for determination of percent moisture.

11.8. Procedural Variations: Procedural variations are allowed only if deemed necessary in the professional judgment of the supervisor to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a Nonconformance Memo and approved by a Technical Specialist and QA manager. If contractually required, the client shall be notified. The nonconformance is also addressed in the case narrative. Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

12. Data Analysis and Calculations

12.1. Qualitative Identification

12.1.1. Tentative identification occurs when a peak is found within the retention time window for an analyte, at a concentration above the reporting limit, or above the MDL if J flags are required. Identification is confirmed if a peak is also present in the retention time window for that analyte on the confirmation column, at a concentration greater than the reporting limit (MDL if J flag confirmation is required by the client).

Note: All NFESC or Navy samples must be reported to the MDL unless otherwise specified by the client.

12.1.2. Dual column quantitation: The lower of the two results is normally reported. The lower result is considered better because the higher result is generally higher because of chromatographic interference. However, the higher result is reported if any of the following three bulleted possibilities are true:

- There is obvious chromatographic interference on the column with the lower result.
- The continuing calibration on the column with the lower result fails. (If the higher result is > 40% higher and the calibration on the column with the lower result fails, then the sample must be evaluated for reanalysis.)
- There is no interference and the RPD between the two results is >40%.

12.1.3. If the RPD between the response on the two columns is greater than 40%, the confirmation is suspect and the results are qualified. RPD is calculated using the following formula:

$$RPD = \frac{R1 - R2}{\frac{1}{2}(R1 + R2)} \times 100$$

Where: R=Result

12.2. Surrogate recovery results are calculated and reported as described in Section 9.4.

12.3. Calibration Range: If concentrations of any analytes exceed the working range as defined by the calibration standards, then the sample must be diluted and reanalyzed. Dilutions should target the most concentrated analyte in the upper half (over 50% of the mid-level standard) of the calibration range. It may be necessary to dilute samples due to matrix.

12.4. Dilutions: Samples may be screened to determine the appropriate dilution for the initial run. If the initial diluted run has no hits above 20% of the calibration range and the matrix allows for analysis at a lesser dilution, then the sample should be reanalyzed at a dilution targeted to bring the largest hit into the upper half of the calibration range.

12.4.1. Guidance for Dilutions Due to Matrix: If the sample is initially run at a dilution and only minor matrix peaks are present, then the sample should be reanalyzed at a more concentrated dilution. Analyst judgment is required to determine the most concentrated dilution that will not result in instrument contamination.

12.4.2. Reporting Dilutions: The most concentrated dilution with no target compounds above the calibration range will be reported. Other dilutions will only be reported at client request.

12.5. Interferences: If peak detection is prevented by interferences, further cleanup should be attempted. If no further cleanup is reasonable, then elevation of reporting levels and/or lack of positive identification must be addressed in the case narrative.

12.6. Calculations

12.6.1. Internal Standard Calculations Using Calibration Factors

12.6.1.1. Aqueous Samples

$$\text{Concentration (ug/L)} = \frac{H_x \times C_{is} \times V_f \times D_f}{H_{is} \times RF \times V_s} \times \text{Split Factor}$$

Where:

H_x = Response for the analyte in the sample, height
C_{is} = Concentration of internal standard added, ng/mL
V_f = Final volume of extract, mL
D_f = Bench dilution factor
H_{is} = Response of the internal standard, height
RF = Response factor for analyte
V_s = Volume of sample extracted, mL

$$\text{Split Factor} = \frac{\text{Total volume of extract prior to final concentration, mL}}{\text{Volume of extract taken for final concentration, mL}}$$

Example 1: TCX in Aqueous Sample (1000 mL sample extracted and concentrated to 10 mL; no split taken)

H_x = 351,469
C_{is} = 25 ng/mL
V_f = 10 mL
D_f = 2
H_{is} = 151,548
RF = 1.706843
V_s = 1000 mL
Split Factor = 1

$$\frac{351{,}469 \times 25\,\text{ng/mL} \times 10\,\text{mL} \times 2}{151{,}548 \times 1.706843 \times 1000\,\text{mL}} \times 1 = 0.679\ \text{ng/mL (ppb)}$$

Example 2: TCX in Low-level Aqueous Sample (1000 mL sample extracted and concentrated to 10 mL; 5 mL taken and concentrated to 0.5 mL)

H_x = 272,035
C_{is} = 25 ng/mL
V_f = 0.5 mL
D_f = 2
H_{is} = 153,024
RF = 1.706843
V_s = 1000 mL
Split Factor = 10 mL/5 mL

$$\frac{272{,}035 \times 25\,\text{ng/mL} \times 0.5\,\text{mL} \times 2}{153{,}024 \times 1.706843 \times 1000\,\text{mL}} \times \frac{10\,\text{mL}}{5\,\text{mL}} = 0.052\ \text{ng/mL (ppb)}$$

12.6.1.2. Non-aqueous Samples

$$\text{Concentration (ug/kg)} = \frac{H_x \times C_{is} \times V_f \times D_f}{H_{is} \times RF \times W_s} \times \text{Split Factor}$$

Where:

W_s = Weight of sample extracted, g

Example 3: TCX in Soil (18.2 g sample extracted and concentrated to 10 mL; no split is taken)

H_x = 59,321
C_{is} = 25 ng/mL
V_f = 10 mL
D_f = 1
H_{is} = 152,301
RF = 1.706843
V_s = 18.2 g
Split Factor = 1

$$\frac{59{,}321 \times 25\,ng/mL \times 10\,mL \times 1}{152{,}301 \times 1.706843 \times 18.2\,g} \times 1 = 3.13\ ng/g\ (ppb)$$

Note: RLs and MDLs in the QuantIMS reference data are based on extracting 10 g of soil. Therefore, the QuantIMS dilution factor must be used to adjust the RLs and MDLs when a sample weight other than 10 g is extracted.

$$\text{QuantIMS Dilution Factor (DF)} = \frac{10\,g,\ \text{nominal weight}}{\text{Actual Weight Extracted, g}} \times \text{Bench dilution factor}$$

Example 4: Actual weight of sample extracted = 18.2 g
Bench dilution factor = 1

$$\text{QuantIMS DF} = \frac{10\,g}{18.2\,g} \times 1 = 0.549$$

QuantIMS will only accept two decimal places in the dilution factor field, therefore, 0.55 must be entered.

12.6.2. The internal standard response in the samples must be within 50%-150% of the response in the mid-point of the previous ICAL. If the internal standard response is within acceptance criteria on one column, but outside criteria on the second column, the sample results will be reported using the column with acceptable results. If the internal standard response

exceeds this criteria on both columns, the following corrective action must be taken:

- Verify that the instrument is working properly.
- Reinject the sample extract.

12.6.3. Surrogate Recovery: Concentrations of surrogate compounds are calculated using the same equations as for the target compounds. The response factors from the initial calibration are used. Surrogate recovery is calculated using the following equation:

$$\%\,\text{Recovery} = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

13. Method Performance

13.1. Method Detection Limit: Each laboratory must generate a valid method detection limit for each analyte of interest. The MDL must be below the reporting limit for each analyte. The procedure for determination of the method detection limit is given in 40 CFR Part 136, Appendix B, and further defined in QA Policy # QA-005.

13.2. Initial Demonstration: Each analyst must complete a successful initial demonstration of capability (IDOC). This requires analysis of QC check samples containing all of the standard analytes for the method.

13.2.1. Four aliquots of the QC check sample are analyzed using the same procedures used to analyze samples, including sample preparation. The concentration of the QC check sample should be equivalent to a mid-level calibration.

13.2.2. Calculate the average recovery and standard deviation of the recovery for each analyte of interest. Compare these results with the acceptance criteria given in Table 6.

13.2.3. If any analyte does not meet the acceptance criteria, the test must be repeated. Only those analytes that did not meet criteria in the first test need to be evaluated. Repeated failure for any analyte indicates the need for the laboratory to evaluate the analytical procedure and take corrective action.

13.3. Training Qualification: The group/team leader has the responsibility to ensure that this procedure is performed by an analyst who has been properly trained in its use and has the required experience.

14. Pollution Prevention

14.1. This method does not contain any specific modifications that serve to minimize or prevent pollution.

15. Waste Management

15.1. All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

15.2. Waste Streams Produced by the Procedure: The following waste streams are produced when this method is carried out.

- Expired primary and working PCB standards are stored in metal closed-top containers.
- Vials containing sample extracts are stored in plastic or metal containers resistant to solvents.

16. References

16.1. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition, Final Update III, December 1996, Section 8000B.

16.2. SW846, Update III, December 1996, Method 8082.

17. Miscellaneous

17.1. Modifications from Reference Method: None

17.2. Appendix I: Tables

17.2.1. Table 1 - Standard Analyte List

17.2.2. Table 2 - Gas Chromatographic Conditions

17.2.3. Table 3 – Typical Calibration Levels

17.2.4. Table 4 - Typical OPR, LCS, MS & MSD Spiking Levels

17.2.5. Table 5 - Typical Analytical Sequence

17.2.6. Table 6 - Performance Criteria for Four Replicate Initial Demonstrations of Capability

17.2.7. Table 7 - Resolution with Typical Chromatographic Conditions

17.3. Appendix II: Calibration and Spike Summary

17.4. Appendix III: Sulfur Removal using Elemental Mercury

17.5. Appendix IV: Example Data Review Checklist

Table 1 Standard Analyte List

Analyte			Reporting Limit				
CAS Number	BZ[1]	Compound Name	Aqueous ug/L	Low-level Aqueous (ug/L)	Solid ug/kg (Dry)	Tissue ug/kg (Total)	Waste ug/kg
2051-60-7	1	2-Chlorobiphenyl	0.2	0.02	20	20	2000
2051-62-9	3	4-Chlorobiphenyl	0.2	0.02	20	20	2000
16605-91-7	5	2,3-dichlorobiphenyl	0.01	0.001	1	1	100
34883-43-7	8	2,4'-Dichlorobiphenyl	0.01	0.001	1	1	100
2050-68-2	15	4,4'-Dichlorobiphenyl	0.05	0.005	5	5	500
37680-65-2	18	2,2',5-Trichlorobiphenyl	0.01	0.001	1	1	100
7012-37-5	28	2,4,4'-Trichlorobiphenyl	0.01	0.001	10	10	100
16606-02-3	31	2,4',5-trichlorobiphenyl	0.01	0.001	10	10	100
38444-90-5	37	3,4,4'-Trichlorobiphenyl	0.01	0.001	1	1	100
41464-39-5	44	2,2',3,5'-Tetrachlorobiphenyl	0.01	0.001	1	1	100
41464-40-8	49	2,2',4,5'-Tetrachlorobiphenyl	0.01	0.001	1	1	100
35693-99-3	52	2,2',5,5'-Tetrachlorobiphenyl	0.01	0.001	1	1	100
32598-10-0	66	2,3',4,4'-Tetrachlorobiphenyl	0.01	0.001	1	1	100
32598-11-1	70	2,3',4',5-Tetrachlorobiphenyl	0.01	0.001	1	1	100
32690-93-0	74	2,4,4',5-Tetrachlorobiphenyl	0.01	0.001	1	1	100
32598-13-3	77	3,3',4,4'-Tetrachlorobiphenyl	0.01	0.001	1	1	100
70362-50-4	81	3,4,4',5-Tetrachlorobiphenyl	0.01	0.001	1	1	100
38380-02-8	87	2,2',3,4,5'-Pentachlorobiphenyl	0.01	0.001	1	1	100
68194-07-0	90	2,2',3,4',5-Pentachlorobiphenyl	0.01	0.001	1	1	100
38380-01-7	99	2,2',4,4',5-Pentachlorobiphenyl	0.01	0.001	1	1	100
37680-73-2	101	2,2',4,5,5'-Pentachlorobiphenyl	0.01	0.001	1	1	100
32598-14-4	105	2,3,3',4,4'-Pentachlorobiphenyl	0.01	0.001	1	1	100
38380-03-9	110	2,3,3',4',6-Pentachlorobiphenyl	0.01	0.001	1	1	100
74472-37-0	114	2,3,4,4',5-Pentachlorobiphenyl	0.01	0.001	1	1	100
74472-38-1	115	2,3,4,4',6-Pentachlorobiphenyl	0.01	0.001	1	1	100
31508-00-6	118	2,3',4,4',5-Pentachlorobiphenyl	0.01	0.001	1	1	100
56558-17-9	119	2,3',4,4',6-Pentachlorobiphenyl	0.01	0.001	1	1	100
65510-44-3	123	2,3',4,4',5'-Pentachlorobiphenyl	0.01	0.001	1	1	100
57465-28-8	126	3,3',4,4',5-Pentachlorobiphenyl	0.01	0.001	1	1	100
38380-07-3	128	2,2',3,3',4,4'-Hexachlorobiphenyl	0.01	0.001	1	1	100
35065-28-2	138	2,2',3,4,4',5'-Hexachlorobiphenyl	0.01	0.001	1	1	100
52712-04-6	141	2,2',3,4,5,5'-hexachlorobiphenyl	0.01	0.001	1	1	100
38380-04-0	149	2,2',3,4',5',6-Hexachlorobiphenyl	0.01	0.001	1	1	100
52663-63-5	151	2,2',3,5,5',6-Hexachlorobiphenyl	0.01	0.001	1	1	100
35065-27-1	153	2,2',4,4',5,5'-Hexachlorobiphenyl	0.01	0.001	1	1	100
38380-08-4	156	2,3,3',4,4',5-Hexachlorobiphenyl	0.01	0.001	1	1	100
69782-90-7	157	2,3,3',4,4',5'-Hexachlorobiphenyl	0.01	0.001	1	1	100
74472-42-7	158	2,3,3',4,4',6-Hexachlorobiphenyl	0.01	0.001	1	1	100
52663-72-6	167	2,3',4,4',5,5'-Hexachlorobiphenyl	0.01	0.001	1	1	100
59291-65-5	168	2,3',4,4',5',6-Hexachlorobiphenyl	0.01	0.001	1	1	100
32774-16-6	169	3,3',4,4',5,5'-Hexachlorobiphenyl	0.01	0.001	1	1	100
35065-30-6	170	2,2',3,3',4,4',5-Heptachlorobiphenyl	0.01	0.001	1	1	100
52663-70-4	177	2,2',3,3',4,5',6'-Heptachlorobiphenyl	0.01	0.001	1	1	100
35065-29-3	180	2,2',3,4,4',5,5'-Heptachlorobiphenyl	0.01	0.001	1	1	100
52663-69-1	183	2,2',3,4,4',5',6-Heptachlorobiphenyl	0.01	0.001	1	1	100
74472-48-3	184	2,2',3,4,4',6,6'-Heptachlorobiphenyl	0.01	0.001	1	1	100
52663-68-0	187	2,2',3,4',5,5',6-Heptachlorobiphenyl	0.01	0.001	1	1	100
39635-31-9	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	0.01	0.001	1	1	100
35694-08-7	194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl	0.01	0.001	1	1	100
52663-78-2	195	2,2',3,3',4,4',5,6-Octachlorobiphenyl	0.01	0.001	1	1	100
40186-71-8	200	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	0.01	0.001	1	1	100
52663-75-9	201	2,2',3,3',4,5,5',6'-Octachlorobiphenyl	0.01	0.001	1	1	100
2136-99-4	202	2,2',3,3',5,5',6,6'-Octachlorobiphenyl	0.01	0.001	1	1	100
40186-72-9	206	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	0.01	0.001	1	1	100
52663-79-3	207	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	0.01	0.001	1	1	100
2051-24-3	209	2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	0.01	0.001	1	1	100

[1] PCB congener number originally assigned by Ballschmiter & Zell ("BZ Number"), 1980. (K. Ballschmiter and M. Zell. Analysis of polychlorinated biphenyls (PCB) by glass capillary gas chromatography. Fresenius Z. Anal. Chem. 302:20-31, 1980.)

Table 2 Gas Chromatographic Conditions

Parameter	Recommended Conditions
Injection Port Mode	Pulse Split: 40 psi for 0.25 min
Injection Port Temperature	250°C
Detector Temperature	330°C
Column Temperature Program	160°C for 0.25 min, 5°C/min to 210°C, 1°C/min to 215°C, 4°C/min to 270°C, 1 min hold.
Column 1	RTX-CLPesticides, 30m x 0.25mm id, 0.25 µm df, or equivalent
Column 2	RTX-CLPesticides II, 30m x 0.25 mm id, 0.20 µm df, or equivalent
Gas Flow Split Ratio	1/25
Split Vent Flow Rate	20 mL/min
Linear Velocity	50 cm/sec
Column Flow	1.5 mL/min
Injection	1 µL
Carrier Gas	Hydrogen
Make-up Gas	Nitrogen
Y Splitter Type	Restek or J&W or Supelco glass tee

Table 3 Typical Calibration Levels

CAS Number	BZ-1993	Compound Name	CS1 ng/mL	CS2 ng/mL	CS3 ng/mL	CS4 ng/mL	CS5 ng/mL	CS6 ng/mL
2051-60-7	1	2-Chlorobiphenyl	20	40	100	200	500	1000
2051-62-9	3	4-Chlorobiphenyl	20	40	100	200	500	1000
16605-91-7	5	2,3-dichlorobiphenyl	1	2	5	10	25	50
34883-43-7	8	2,4'-Dichlorobiphenyl	1	2	5	10	25	50
2050-68-2	15	4,4'-Dichlorobiphenyl	5	10	25	50	125	250
37680-65-2	18	2,2',5-Trichlorobiphenyl	1	2	5	10	25	50
7012-37-5	28	2,4,4'-Trichlorobiphenyl	1	2	5	10	25	50
16606-02-3	31	2,4',5-trichlorobiphenyl	1	2	5	10	25	50
38444-90-5	37	3,4,4'-Trichlorobiphenyl	1	2	5	10	25	50
41464-39-5	44	2,2',3,5'-Tetrachlorobiphenyl	1	2	5	10	25	50
41464-40-8	49	2,2',4,5'-Tetrachlorobiphenyl	1	2	5	10	25	50
35693-99-3	52	2,2',5,5'-Tetrachlorobiphenyl	1	2	5	10	25	50
32598-10-0	66	2,3',4,4'-Tetrachlorobiphenyl	1	2	5	10	25	50
32598-11-1	70	2,3',4',5-Tetrachlorobiphenyl	1	2	5	10	25	50
32690-93-0	74	2,4,4',5-Tetrachlorobiphenyl	1	2	5	10	25	50
32598-13-3	77	3,3',4,4'-Tetrachlorobiphenyl	1	2	5	10	25	50
70362-50-4	81	3,4,4',5-Tetrachlorobiphenyl	1	2	5	10	25	50
38380-02-8	87	2,2',3,4,5'-Pentachlorobiphenyl	1	2	5	10	25	50
68194-07-0	90	2,2',3,4',5-Pentachlorobiphenyl	1	2	5	10	25	50
38380-01-7	99	2,2',4,4',5-Pentachlorobiphenyl	1	2	5	10	25	50
37680-73-2	101	2,2',4,5,5'-Pentachlorobiphenyl	1	2	5	10	25	50
32598-14-4	105	2,3,3',4,4'-Pentachlorobiphenyl	1	2	5	10	25	50
38380-03-9	110	2,3,3',4',6-Pentachlorobiphenyl	1	2	5	10	25	50
74472-37-0	114	2,3,4,4',5-Pentachlorobiphenyl	1	2	5	10	25	50
74472-38-1	115	2,3,4,4',6-Pentachlorobiphenyl	1	2	5	10	25	50
31508-00-6	118	2,3',4,4',5-Pentachlorobiphenyl	1	2	5	10	25	50
56558-17-9	119	2,3',4,4',6-Pentachlorobiphenyl	1	2	5	10	25	50
65510-44-3	123	2,3',4,4',5'-Pentachlorobiphenyl	1	2	5	10	25	50
57465-28-8	126	3,3',4,4',5-Pentachlorobiphenyl	1	2	5	10	25	50
38380-07-3	128	2,2',3,3',4,4'-Hexachlorobiphenyl	1	2	5	10	25	50
35065-28-2	138	2,2',3,4,4',5'-Hexachlorobiphenyl	1	2	5	10	25	50
52712-04-6	141	2,2',3,4,5,5'-hexachlorobiphenyl	1	2	5	10	25	50
38380-04-0	149	2,2',3,4',5',6-Hexachlorobiphenyl	1	2	5	10	25	50
52663-63-5	151	2,2',3,5,5',6-Hexachlorobiphenyl	1	2	5	10	25	50
35065-27-1	153	2,2',4,4',5,5'-Hexachlorobiphenyl	1	2	5	10	25	50
38380-08-4	156	2,3,3',4,4',5-Hexachlorobiphenyl	1	2	5	10	25	50
69782-90-7	157	2,3,3',4,4',5'-Hexachlorobiphenyl	1	2	5	10	25	50
74472-42-7	158	2,3,3',4,4',6-Hexachlorobiphenyl	1	2	5	10	25	50
52663-72-6	167	2,3',4,4',5,5'-Hexachlorobiphenyl	1	2	5	10	25	50
59291-65-5	168	2,3',4,4',5',6-Hexachlorobiphenyl	1	2	5	10	25	50
32774-16-6	169	3,3',4,4',5,5'-Hexachlorobiphenyl	1	2	5	10	25	50
35065-30-6	170	2,2',3,3',4,4',5-Heptachlorobiphenyl	1	2	5	10	25	50
52663-70-4	177	2,2',3,3',4,5',6-Heptachlorobiphenyl	1	2	5	10	25	50
35065-29-3	180	2,2',3,4,4',5,5'-Heptachlorobiphenyl	1	2	5	10	25	50
52663-69-1	183	2,2',3,4,4',5',6-Heptachlorobiphenyl	1	2	5	10	25	50
74472-48-3	184	2,2',3,4,4',6,6'-Heptachlorobiphenyl	1	2	5	10	25	50
52663-68-0	187	2,2',3,4',5,5',6-Heptachlorobiphenyl	1	2	5	10	25	50
39635-31-9	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	1	2	5	10	25	50
35694-08-7	194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl	1	2	5	10	25	50
52663-78-2	195	2,2',3,3',4,4',5,6-Octachlorobiphenyl	1	2	5	10	25	50
40186-71-8	200	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	1	2	5	10	25	50
52663-75-9	201	2,2',3,3',4,5,5',6'-Octachlorobiphenyl	1	2	5	10	25	50
2136-99-4	202	2,2',3,3',5,5',6,6'-Octachlorobiphenyl	1	2	5	10	25	50
40186-72-9	206	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	1	2	5	10	25	50
52663-79-3	207	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	1	2	5	10	25	50
2051-24-3	209	2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	1	2	5	10	25	50
Surrogates								
877-09-8	TCMX	Tetrachloro-m-xylene	1	2	5	10	25	50
74472-46-1	165	2,3,3',5,5',6-Hexachlorobiphenyl	1	2	5	10	25	50
Internal Stds								
15862-07-4	29	2,4,5-Trichlorobiphenyl	25	25	25	25	25	25
41411-62-5	160	2,3,3',4,5,6-Hexachlorobiphenyl	25	25	25	25	25	25

Table 4 Typical LCS, MS/MSD and Surrogate Spiking Levels

CAS Number	BZ	Compound Name	Control Analytes	Aqueous ug/L	Low-level Aqueous ug/L	Solid ug/kg dry	Tissue ug/kg	Waste ng/kg
2051-60-7	1	2-Chlorobiphenyl		2.0	0.5	200	200	20000
2051-62-9	**3**	**4-Chlorobiphenyl**	Y	2.0	0.5	200	200	20000
16605-91-7	5	2,3-dichlorobiphenyl		0.10	0.025	10	10	1000
34883-43-7	8	2,4'-Dichlorobiphenyl		0.10	0.025	10	10	1000
2050-68-2	**15**	**4,4'-Dichlorobiphenyl**	Y	0.50	0.125	50	50	5000
37680-65-2	**18**	**2,2',5-Trichlorobiphenyl**	Y	0.10	0.025	10	10	1000
7012-37-5	28	2,4,4'-Trichlorobiphenyl		0.10	0.025	10	10	1000
16606-02-3	31	2,4',5-trichlorobiphenyl		0.10	0.025	10	10	1000
38444-90-5	37	3,4,4'-Trichlorobiphenyl		0.10	0.025	10	10	1000
41464-39-5	44	2,2',3,5'-Tetrachlorobiphenyl		0.10	0.025	10	10	1000
41464-40-8	49	2,2',4,5'-Tetrachlorobiphenyl		0.10	0.025	10	10	1000
35693-99-3	**52**	**2,2',5,5'-Tetrachlorobiphenyl**	Y	0.10	0.025	10	10	1000
32598-10-0	**66**	**2,3',4,4'-Tetrachlorobiphenyl**	Y	0.10	0.025	10	10	1000
32598-11-1	70	2,3',4',5-Tetrachlorobiphenyl		0.10	0.025	10	10	1000
32690-93-0	74	2,4,4',5-Tetrachlorobiphenyl		0.10	0.025	10	10	1000
32598-13-3	77	3,3',4,4'-Tetrachlorobiphenyl		0.10	0.025	10	10	1000
1000	81	3,4,4',5-Tetrachlorobiphenyl		0.10	0.025	10	10	1000
1000	87	2,2',3,4,5'-Pentachlorobiphenyl		0.10	0.025	10	10	1000
1000	90	2,2',3,4',5-Pentachlorobiphenyl		0.10	0.025	10	10	1000
1000	99	2,2',4,4',5-Pentachlorobiphenyl		0.10	0.025	10	10	1000
1000	101	2,2',4,5,5'-Pentachlorobiphenyl		0.10	0.025	10	10	1000
32598-14-4	105	2,3,3',4,4'-Pentachlorobiphenyl		0.10	0.025	10	10	1000
38380-03-9	110	2,3,3',4',6-Pentachlorobiphenyl		0.10	0.025	10	10	1000
74472-37-0	114	2,3,4,4',5-Pentachlorobiphenyl		0.10	0.025	10	10	1000
74472-38-1	115	2,3,4,4',6-Pentachlorobiphenyl		0.10	0.025	10	10	1000
31508-00-6	**118**	**2,3',4,4',5-Pentachlorobiphenyl**	Y	0.10	0.025	10	10	1000
56558-17-9	119	2,3',4,4',6-Pentachlorobiphenyl		0.10	0.025	10	10	1000
65510-44-3	123	2,3',4,4',5'-Pentachlorobiphenyl		0.10	0.025	10	10	1000
57465-28-8	126	3,3',4,4',5-Pentachlorobiphenyl		0.10	0.025	10	10	1000
38380-07-3	**128**	**2,2',3,3',4,4'-Hexachlorobiphenyl**	Y	0.10	0.025	10	10	1000
35065-28-2	138	2,2',3,4,4',5'-Hexachlorobiphenyl		0.10	0.025	10	10	1000
52712-04-6	141	2,2',3,4,5,5'-hexachlorobiphenyl		0.10	0.025	10	10	1000
38380-04-0	149	2,2',3,4',5',6-Hexachlorobiphenyl		0.10	0.025	10	10	1000
52663-63-5	151	2,2',3,5,5',6-Hexachlorobiphenyl	Y	0.10	0.025	10	10	1000
35065-27-1	**153**	**2,2',4,4',5,5'-Hexachlorobiphenyl**		0.10	0.025	10	10	1000
38380-08-4	156	2,3,3',4,4',5-Hexachlorobiphenyl		0.10	0.025	10	10	1000
69782-90-7	157	2,3,3',4,4',5'-Hexachlorobiphenyl		0.10	0.025	10	10	1000
74472-42-7	158	2,3,3',4,4',6-Hexachlorobiphenyl		0.10	0.025	10	10	1000
52663-72-6	167	2,3',4,4',5,5'-Hexachlorobiphenyl		0.10	0.025	10	10	1000
59291-65-5	168	2,3',4,4',5',6-Hexachlorobiphenyl		0.10	0.025	10	10	1000
32774-16-6	169	3,3',4,4',5,5'-Hexachlorobiphenyl		0.10	0.025	10	10	1000
35065-30-6	170	2,2',3,3',4,4',5-Heptachlorobiphenyl		0.10	0.025	10	10	1000
52663-70-4	177	2,2',3,3',4,5',6'-Heptachlorobiphenyl		0.10	0.025	10	10	1000
35065-29-3	**180**	**2,2',3,4,4',5,5'-Heptachlorobiphenyl**	Y	0.10	0.025	10	10	1000
52663-69-1	183	2,2',3,4,4',5',6-Heptachlorobiphenyl		0.10	0.025	10	10	1000
74472-48-3	184	2,2',3,4,4',6,6'-Heptachlorobiphenyl		0.10	0.025	10	10	1000
52663-68-0	**187**	**2,2',3,4',5,5',6-Heptachlorobiphenyl**	Y	0.10	0.025	10	10	1000
39635-31-9	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl		0.10	0.025	10	10	1000
35694-08-7	194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl		0.10	0.025	10	10	1000
52663-78-2	**195**	**2,2',3,3',4,4',5,6-Octachlorobiphenyl**	Y	0.10	0.025	10	10	1000
40186-71-8	200	2,2',3,3',4,5',6,6'-Octachlorobiphenyl		0.10	0.025	10	10	1000
52663-75-9	201	2,2',3,3',4,5,5',6'-Octachlorobiphenyl		0.10	0.025	10	10	1000
2136-99-4	202	2,2',3,3',5,5',6,6'-Octachlorobiphenyl		0.10	0.025	10	10	1000
40186-72-9	**206**	**2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl**	Y	0.10	0.025	10	10	1000
52663-79-3	207	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl		0.10	0.025	10	10	1000
2051-24-3	**209**	**2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl**	Y	0.10	0.025	10	10	1000
Surrogates								
877-09-8	TCMX	Tetrachloro-m-xylene		0.10	0.025	10	10	1000
74472-46-1	165	2,3,3',5,5',6-Hexachlorobiphenyl		0.10	0.025	10	10	1000

Table 5 Typical Analytical Sequence

Step Number	Action
1	Initial Calibration
2	Initial Calibration Verification
3	Solvent blank (optional)
4	Instrument or Method Blank
5	Up to 20 samples (unless 12 hours comes first)
6	Solvent blank (optional)
7	Continuing calibration
8	Instrument or Method Blank
9	Up to 20 samples (unless 12 hours comes first)
	Repeat steps 7-9 as needed
10	Instrument or Method Blank
11	Up to 20 samples (unless 12 hours comes first)
12	Solvent blank (optional)
13	Continuing calibration
14	Instrument or Method Blank
15	Up to 20 samples unless 12 hours comes first)
	Repeat steps 13-15 as needed

Table 6 Performance Criteria for Four Replicate Initial Demonstrations of Capability

CAS Number	BZ	Compound Name	Mean Recovery Limits	RSD Limit
2051-60-7	1	2-Chlorobiphenyl	50-130	30
2051-62-9	3	4-Chlorobiphenyl	60-140	30
16605-91-7	5	2,3-dichlorobiphenyl	60-140	30
34883-43-7	8	2,4'-Dichlorobiphenyl	60-140	30
2050-68-2	15	4,4'-Dichlorobiphenyl	60-140	30
37680-65-2	18	2,2',5-Trichlorobiphenyl	60-140	30
7012-37-5	28	2,4,4'-Trichlorobiphenyl	60-140	30
16606-02-3	31	2,4',5-trichlorobiphenyl	60-140	30
38444-90-5	37	3,4,4'-Trichlorobiphenyl	60-140	30
41464-39-5	44	2,2',3,5'-Tetrachlorobiphenyl	60-140	30
41464-40-8	49	2,2',4,5'-Tetrachlorobiphenyl	60-140	30
35693-99-3	52	2,2',5,5'-Tetrachlorobiphenyl	60-140	30
32598-10-0	66	2,3',4,4'-Tetrachlorobiphenyl	60-140	30
32598-11-1	70	2,3',4',5-Tetrachlorobiphenyl	60-140	30
32690-93-0	74	2,4,4',5-Tetrachlorobiphenyl	60-140	30
32598-13-3	77	3,3',4,4'-Tetrachlorobiphenyl	60-140	30
70362-50-4	81	3,4,4',5-Tetrachlorobiphenyl	60-140	30
38380-02-8	87	2,2',3,4,5'-Pentachlorobiphenyl	60-140	30
68194-07-0	90	2,2',3,4',5-Pentachlorobiphenyl	60-140	30
38380-01-7	99	2,2',4,4',5-Pentachlorobiphenyl	60-140	30
37680-73-2	101	2,2',4,5,5'-Pentachlorobiphenyl	60-140	30
32598-14-4	105	2,3,3',4,4'-Pentachlorobiphenyl	60-140	30
38380-03-9	110	2,3,3',4',6-Pentachlorobiphenyl	60-140	30
74472-37-0	114	2,3,4,4',5-Pentachlorobiphenyl	60-140	30
74472-38-1	115	2,3,4,4',6-Pentachlorobiphenyl	60-140	30
31508-00-6	118	2,3',4,4',5-Pentachlorobiphenyl	60-140	30
56558-17-9	119	2,3',4,4',6-Pentachlorobiphenyl	60-140	30
65510-44-3	123	2,3',4,4',5'-Pentachlorobiphenyl	60-140	30
57465-28-8	126	3,3',4,4',5-Pentachlorobiphenyl	60-140	30
38380-07-3	128	2,2',3,3',4,4'-Hexachlorobiphenyl	60-140	30
35065-28-2	138	2,2',3,4,4',5'-Hexachlorobiphenyl	60-140	30
52712-04-6	141	2,2',3,4,5,5'-hexachlorobiphenyl	60-140	30
38380-04-0	149	2,2',3,4',5',6-Hexachlorobiphenyl	60-140	30
52663-63-5	151	2,2',3,5,5',6-Hexachlorobiphenyl	60-140	30
35065-27-1	153	2,2',4,4',5,5'-Hexachlorobiphenyl	60-140	30
38380-08-4	156	2,3,3',4,4',5-Hexachlorobiphenyl	60-140	30
69782-90-7	157	2,3,3',4,4',5'-Hexachlorobiphenyl	60-140	30
74472-42-7	158	2,3,3',4,4',6-Hexachlorobiphenyl	60-140	30
52663-72-6	167	2,3',4,4',5,5'-Hexachlorobiphenyl	60-140	30
59291-65-5	168	2,3',4,4',5',6-Hexachlorobiphenyl	60-140	30
32774-16-6	169	3,3',4,4',5,5'-Hexachlorobiphenyl	60-140	30
35065-30-6	170	2,2',3,3',4,4',5-Heptachlorobiphenyl	60-140	30
52663-70-4	177	2,2',3,3',4,5',6'-Heptachlorobiphenyl	60-140	30
35065-29-3	180	2,2',3,4,4',5,5'-Heptachlorobiphenyl	60-140	30
52663-69-1	183	2,2',3,4,4',5',6-Heptachlorobiphenyl	60-140	30
74472-48-3	184	2,2',3,4,4',6,6'-Heptachlorobiphenyl	60-140	30
52663-68-0	187	2,2',3,4',5,5',6-Heptachlorobiphenyl	60-140	30
39635-31-9	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	60-140	30
35694-08-7	194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl	60-140	30
52663-78-2	195	2,2',3,3',4,4',5,6-Octachlorobiphenyl	60-140	30
40186-71-8	200	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	60-140	30
52663-75-9	201	2,2',3,3',4,5,5',6'-Octachlorobiphenyl	60-140	30
2136-99-4	202	2,2',3,3',5,5',6,6'-Octachlorobiphenyl	60-140	30
40186-72-9	206	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	60-140	30
52663-79-3	207	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	60-140	30
2051-24-3	209	2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	60-140	30
Surrogates				
877-09-8	TCMX	Tetrachloro-m-xylene	NA	30
74472-46-1	165	2,3,3',5,5',6-Hexachlorobiphenyl	NA	30

Table 7 Resolution with Typical Chromatographic Conditions

CAS Number	BZ	Compound Name	Resolved on Column A	Resolved on Column B
2051-60-7	1	2-Chlorobiphenyl	Y	Y
2051-62-9	3	4-Chlorobiphenyl	Y	Y
16605-91-7	5	2,3-dichlorobiphenyl	N (8)	Y
34883-43-7	8	2,4'-Dichlorobiphenyl	N (5)	Y
2050-68-2	15	4,4'-Dichlorobiphenyl	Y	Y
37680-65-2	18	2,2',5-Trichlorobiphenyl	Y	Y
7012-37-5	28	2,4,4'-Trichlorobiphenyl	Y	Y
16606-02-3	31	2,4',5-trichlorobiphenyl	Y	Y
38444-90-5	37	3,4,4'-Trichlorobiphenyl	Y	Y
41464-39-5	44	2,2',3,5'-Tetrachlorobiphenyl	Y	Y
41464-40-8	49	2,2',4,5'-Tetrachlorobiphenyl	Y	Y
35693-99-3	52	2,2',5,5'-Tetrachlorobiphenyl	Y	Y
32598-10-0	66	2,3',4,4'-Tetrachlorobiphenyl	Y	Y
32598-11-1	70	2,3',4',5-Tetrachlorobiphenyl	Y	Y
32690-93-0	74	2,4,4',5-Tetrachlorobiphenyl	Y	Y
32598-13-3	77	3,3',4,4'-Tetrachlorobiphenyl	Y	Y
70362-50-4	81	3,4,4',5-Tetrachlorobiphenyl	Y	N (87)
38380-02-8	87	2,2',3,4,5'-Pentachlorobiphenyl	Y	N (81)
68194-07-0	90	2,2',3,4',5-Pentachlorobiphenyl	Y	N (101)
38380-01-7	99	2,2',4,4',5-Pentachlorobiphenyl	Y	Y
37680-73-2	101	2,2',4,5,5'-Pentachlorobiphenyl	Y	N (90)
32598-14-4	105	2,3,3',4,4'-Pentachlorobiphenyl	Y	N (141)
38380-03-9	110	2,3,3',4',6-Pentachlorobiphenyl	Y	Y
74472-37-0	114	2,3,4,4',5-Pentachlorobiphenyl	Y	Y
74472-38-1	115	2,3,4,4',6-Pentachlorobiphenyl	Y	Y
31508-00-6	118	2,3',4,4',5-Pentachlorobiphenyl	Y	Y
56558-17-9	119	2,3',4,4',6-Pentachlorobiphenyl	Y	Y
65510-44-3	123	2,3',4,4',5'-Pentachlorobiphenyl	Y	N (149)
57465-28-8	126	3,3',4,4',5-Pentachlorobiphenyl	Y	Y
38380-07-3	128	2,2',3,3',4,4'-Hexachlorobiphenyl	Y	Y
35065-28-2	138	2,2',3,4,4',5'-Hexachlorobiphenyl	Y	N (158)
52712-04-6	141	2,2',3,4,5,5'-hexachlorobiphenyl	Y	N (105)
38380-04-0	149	2,2',3,4',5',6-Hexachlorobiphenyl	Y	N (123)
52663-63-5	151	2,2',3,5,5',6-Hexachlorobiphenyl	Y	Y
35065-27-1	153	2,2',4,4',5,5'-Hexachlorobiphenyl	Y	Y
38380-08-4	156	2,3,3',4,4',5-Hexachlorobiphenyl	Y	Y
69782-90-7	157	2,3,3',4,4',5'-Hexachlorobiphenyl	Y	Y
74472-42-7	158	2,3,3',4,4',6-Hexachlorobiphenyl	Y	N (138)
52663-72-6	167	2,3',4,4',5,5'-Hexachlorobiphenyl	Y	Y
59291-65-5	168	2,3',4,4',5',6-Hexachlorobiphenyl	Y	Y
32774-16-6	169	3,3',4,4',5,5'-Hexachlorobiphenyl	Y	Y
35065-30-6	170	2,2',3,3',4,4',5-Heptachlorobiphenyl	Y	N (201)
52663-70-4	177	2,2',3,3',4,5',6'-Heptachlorobiphenyl	Y	Y
35065-29-3	180	2,2',3,4,4',5,5'-Heptachlorobiphenyl	Y	Y
52663-69-1	183	2,2',3,4,4',5',6-Heptachlorobiphenyl	Y	Y
74472-48-3	184	2,2',3,4,4',6,6'-Heptachlorobiphenyl	Y	Y
52663-68-0	187	2,2',3,4',5,5',6-Heptachlorobiphenyl	Y	Y
39635-31-9	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	Y	Y
35694-08-7	194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl	Y	Y
52663-78-2	195	2,2',3,3',4,4',5,6-Octachlorobiphenyl	N (207)	Y
40186-71-8	200	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	Y	Y
52663-75-9	201	2,2',3,3',4,5,5',6'-Octachlorobiphenyl	Y	N (170)
2136-99-4	202	2,2',3,3',5,5',6,6'-Octachlorobiphenyl	Y	Y
40186-72-9	206	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	Y	Y
52663-79-3	207	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	N (195)	Y
2051-24-3	209	2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	Y	Y
Surrogates				
877-09-8	TCMX	Tetrachloro-m-xylene	Y	Y
74472-46-1	165	2,3,3',5,5',6-Hexachlorobiphenyl	Y	Y

Appendix II: Calibration and Spike Summary

	CS1 ng/mL	CS2 ng/mL	CS3 ng/mL	CS4 ng/mL	CS5 ng/mL	CS6 ng/mL
All BZ except 1,3,15	1	2	5	10	25	50
BZ 15	5	10	25	50	125	250
BZ 1, 3	20	40	100	200	500	1000
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Aqueous	0.01	0.02	0.05	0.10	0.25	0.50
Initial Sample Volume=1000mL	0.05	0.10	0.25	0.50	1.25	2.50
Final Extract Volume=10mL	0.20	0.40	1.00	2.00	5.00	10.00
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Low-Level Aqueous	0.001	0.002	0.005	0.010	0.025	0.050
Initial Sample Volume=1000mL	0.005	0.010	0.025	0.050	0.125	0.250
Final Extract Volume=1mL	0.020	0.040	0.100	0.200	0.500	1.000
	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Soil 10 g dry weight	1	2	5	10	25	50
Initial Sample Weight=10g dry	5	10	25	50	125	250
Final Extract Volume=10mL	20	40	100	200	500	1000
	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Waste	100	200	500	1000	2500	5000
Initial Sample Weight=0.1g	500	1000	2500	5000	12500	25000
Final Extract Volume=10mL	2000	4000	10000	20000	50000	100000

LCS, MS/MSD Spike Concentration (ng/mL)

All BZ except 1,3,15	100
BZ 15	500
BZ 1, 3	2000

Aqueous 1.0 mL x (100/500/2000 ng/mL) / 1000 mL = 0.10/0.50/2.0 ng/mL
Low-Level Aqueous 0.25 mL x (100/500/2000 ng/mL) / 1000 mL = 0.025/0.125/0.50 ng/mL
Soil 10 g dry weight 1.0 mL x (100/500/2000 ng/mL) / 10.0 g = 10/50/200 ng/g dry weight
Waste 1.0 mL x (100/500/2000 ng/mL) / 0.1 g = 1000/5000/20000 ng/g

Surrogate Standard Concentration (ng/mL)

BZ 165	100
Tetrachloro-m-xylene	100

Surrogate Spike Concentration (ng/mL)

Aqueous 1.0 mL x 100 ng/mL / 1000 mL = 0.10 ng/mL
Low-Level Aqueous 0.25 mL x 100 ng/mL / 1000 mL = 0.025 ng/mL
Soil 10 g dry weight 1.0 mL x 100 ng/mL / 10.0 g = 10 ng/g dry weight
Waste 1.0 mL x 100 ng/mL / 0.1 g = 1000 ng/g

Appendix III: Sulfur Removal using Elemental Mercury

Sulfur Removal: Sulfur can be removed using mercury. If the sulfur concentration is such that crystallization occurs in the concentrated extract, centrifuge the extract to settle the crystals, and carefully draw off the sample extract with a disposable pipet, leaving the excess sulfur in the centrifuge tube. Transfer the extract to a clean concentrator tube before proceeding with further sulfur cleanup.

Sulfur Removal with Elemental Mercury:

- **Note**: Use Mercury sparingly in order to minimize exposure and disposal costs.
- Transfer 500-1000 uL of sample extract into a clean Teflon sealed vial.
- Add one to three drops of mercury to the extract vial and seal.
- Shake well for 15-30 seconds, then swirl in a Vortex-Genie™.
- Remove the extract from the mercury using a disposable pipette and transfer to a clean vial.
- If black precipitate forms, sulfur was present. Shake again, then swirl. Transfer the supernate to a clean test tube and repeat. Do this until relatively little precipitate remains, or screening indicates that the cleanup is complete.
- Properly dispose of the mercury waste.

Appendix IV: Example Data Review Checklist

STL Knoxville GC PCB Congeners Initial Calibration Data Review / Narrative Checklist
Method 8082, SOP KNOX -GC-0011, Rev. 3
Page 1 of 1

Analysis Date:		Instrument/File ID:	
2nd Source Verification Filename:			

Review Items A. Continuing Calibration	Yes	No	N/A	2nd Level	If No, why is data reportable?
1. Were at least 5 levels analyzed?					
2. Were all ICAL standards used for calibration?					
3. Is low level standard concentration ≤ RL?					
4. Are all %RSDs ≤ 20% ?					
5. Was the response factor for each analyte calculated using the correct internal standard?					
6. Was each run checked for saturation?					
7. Are all analytes in the highest calibration standard adequately resolved? (≥0.04 min & a distinguishable valley between all peaks)					
8. Is integration acceptable and were all manual integrations clearly identified, initialed, dated and reason given?					Reasons: 1) Corrected split peak; 2) Unresolved peak; 3) Tailing; 4) RT shift; 5) Wrong peak selected; 6) Other
9. Was ICAL method file processed using the correct result files? (Compare peak heights-areas in method file to heights-areas of calibration standards.)					
10. Is the 2nd source standard within +/- 25 % of the expected value?					☐ ≤2 analytes within +/- 35 % of the expected value: _____

Analyst:	Date:	2nd Level Reviewer :	Date:
Comments:		*Comments:*	

Appendix IV: Example Data Review Checklist, continued

STL Knoxville GC PCB Congeners Continuing Calibration Data Review / Narrative Checklist
Method: 8082 - KNOX-GC-0011 Rev 3
Page 1 of 1

Analysis Date:		Sequence ID:		ICAL File ID:		Scanned file verified as correct ____

Review Items A. Continuing Calibration	Yes	No	NA	2nd ✔	If No, why is data reportable?
1. Was the *correct ICAL* used for quantitation?					
2. Were the *same process parameters* used for the CCAL standards and the ICAL?					
3. Were *CCAL standards* run at proper frequency *(before all samples and after no more than 20 injections/12 hrs of sample analysis)* ?					
4. Were RTs within *RT windows (+/- 0.03 minutes)* ?					
5. Is *%D* for each analyte ≤ *15%* for each CCAL?					❑ [Avg] Average %D ≤15% and all individual %D's 30% for _____
6. Are *internal standards* within 50-150% of ICAL midpoint?					
7. Is integration acceptable and were all manual integrations clearly identified, initaled, dated and reason given?					Reasons: 1) Corrected split peak; 2) Unresolved peak; 3) Tailing; 4) RT shift; 5) Wrong peak selected; 6) Other

Analyst:	Date:	2nd Level Reviewer :	Date:
Comments:		Comments:	

Appendix IV: Example Data Review Checklist, continued

STL Knoxville GC PCB Congeners Data Review / Narrative Checklist **LOT #**_____
Method: 8082, SOP: KNOX-GC-0011 Rev. 3 **Page 1 of 1**

Sequence No.:						
Scanned File:						

Review Items **A. Continuing Calibration (CCAL)**	Yes	No	N/A	2nd √	If No, why is data reportable?
1. CCAL Checklist completed for each analytical batch?					
B. Client Sample and QC Sample Results					
1. Were all special project requirements met?					
2. Were Turbochrom sample IDs, DFs, prep factors verified?					
3. Sample analyses done within preparation and analytical holding time (HT)? *If no, list samples and NCM#:* _____					☐ *[ht1] HT expired upon receipt.* ☐ *[ht2] Client requested analysis after HT expired.** ☐ **Re-extraction done after HT expired.**
4. Same process file used for samples and ICAL? (2nd Level - Check 1-2 compounds for batch by manually calculating concentration using the ICAL avg. RF or curve.)					
5. Are sample and MS/MSD surrogates within QC limits?					☐ [sur1] MS/MSD surr.%R showed same effect. ☐ [sur2] Re-extraction demonstrated same effect. ☐ **[sur3] Not enough sample for re-extraction.** ☐ [sur7] Obvious matrix interference. ☐ **[sur12] Surr.%R high and all targets ND.** ☐ **[sur16] 1 Surr. out, but blank & LCS surrogates in control - matrix effect.**
6. Are internal standards within 50-150% of ICAL midpoint?					
7. Do positive hits meet identification criteria? (RT and 2nd column confirmation for single peak analytes)					
8. Are positive results within calibration range?					
9. Were peaks checked for saturation?					
10. Were integrations acceptable and are all manual integrations clearly identified, initialed, dated and reason given?					Reasons: 1) Corrected split peak; 2) Unresolved peak; 3) Tailing; 4) RT shift; 5) Wrong peak selected; 6) Other
11. Is largest analyte diluted to 20-100% of the calibration range?					☐ [dil1] Dilution required to prevent contamination of instrument due to non-target compounds.
12. Were runs checked for carryover?					
13. Were soil results calculated using the dry sample weight?					
13. Final report acceptable? (Results correct, RLs calculated correctly, units correct, surrogate %R correct, appropriate flags used, deviations noted in narrative, dilution factor correct, and extraction/ analysis dates correct.)					
C. Preparation/Matrix QC					
1. LCS done per prep batch and all analytes and surrogates within laboratory established QC limits?					☐ **[lcs2] Insufficient sample for reanalysis.*** ☐ **[lcs3] LCS %R high and all analyte(s) were <RL in associated samples.**
2. Method blank done per prep batch, method blank or instrument blank run with each sequence, and all analytes <RL?					☐ **[mb3] No analyte > RL in associated samples.*** ☐ **[mb4] Sample results > 20x higher than blank.** ☐ **[mb5] Insufficient sample for reanalysis.***
3. Method blank surrogate recoveries within QC limits?					☐ **[mb1] Sample surrogates OK and there is no analyte >RL in samples associated with blank.***
4. MS/MSD done per batch?					☐ [lcsd] Insufficient sample. LCS/LCSD analyzed.
4. MS/MSD recoveries and RPDs within laboratory generated control limits?					☐ [ms1] LCS acceptable - sample matrix effects. ☐ [ms2] LCS acceptable. High native analyte concentration relative to spike level. ☐ [ms3] Spikes diluted out. LCS acceptable. ☐ [rpd] LCS acceptable. RPD out due to lack of sample homogeneity.
5. Were MS run #'s assigned correctly?					
D. Other					
1. Are all nonconformances documented appropriately?					

Analyst:	**Date:**	**2nd Level Reviewer:**	**Date:**
Comments:		**Comments:**	

* Such action must be taken in consultation with client. GC033R5.DOC, 2/5/04

NOTE: Nonconformance memos are required for bold and *italicized* autotext statements: **Bold** = deficiency, *italicized* = anomaly.

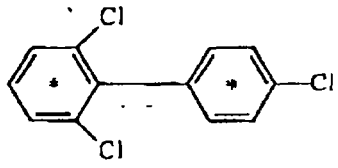
Attachment D

Cambridge Isotope Laboratories, Inc.

50 Frontage Road, Andover, MA 01810-5413 USA
PH: 800.322.1174 (USA) PH: 978.749.8000
FAX: 978.749.2768 URL: http://www.isotope.com

Technical Data Sheet

Compound:	2,4',6-Trichlorobiphenyl
	(IUPAC #32)
Isotope:	$^{13}C_{12}$, 99%
Catalog Number:	EC-4163
Structure:	



$^{13}C_{12}H_7Cl_3$ (MW = 269.46)

Chemical Purity:	98+%
Concentratión:	40 ± 4 micrograms/milliliter
Amount:	3 milliliters
Solvent:	Nonane
Date Prepared:	05/99

Attachment E

STL KNOXVILLE

STANDARD OPERATING PROCEDURE

TITLE: Analysis of Polychlorinated Dioxins/Furans by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) Based on Methods 8290, 1613B, 23, 0023A, and TO-9A

(SUPERSEDES: KNOX-ID-0004, Rev. 4)

Prepared By: Susan Austin Mills III June 18, 2004

Reviewed By: 6/18/04
Technical Specialist

Approved By: 06/18/04
Quality Assurance Manager

Approved By: 6-21-04
Environmental, Health and Safety Coordinator

Approved By: 06/18/04
Laboratory Director

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calibration is not achieved, identify the root cause, perform corrective action, and repeat the initial calibration. If the root cause can be traced to problems with an individual analysis within the calibration series, follow the procedure in STL Policy P-T-001(see reference section 16.9).

10.2.8.1 The percent relative standard deviation (RSD) for the mean relative response factors must be within the acceptance criteria listed in Table 5 for methods 1613B and 8290 or in Table 6 for methods 23, 0023A, and TO-9A.

10.2.8.2 The peaks representing the PCDDs/PCDFs and labeled compounds in the calibration standards must have signal-to-noise ratios (S/N) ≥ 10.

10.2.8.3 The ion abundance ratios must be within the specified control limits in Table 22.

10.2.8.4 For method 1613B the absolute retention time of $^{13}C_{12}$-1234-TCDD must exceed 25.0 minutes on the DB/Rtx-5 column and 15.0 minutes on the DB/Rtx-225 column.

10.2.9 Analyze 2µL of the Initial Calibration Verification (ICV) Standard in section 7.9.2. Calculate the concentration of the ICV using the RRF's from the CS3 standard analyzed in section 10.2.6. Calculate the percent difference (%D) between the expected and the calculated ICV concentration using the following formula.

$$\%D = \frac{(C_{Exp} - C_{Calc})}{C_{Exp}} \times 100$$

Where:

C_{Exp} = The expected concentration of the ICV Standard.
C_{Calc} = The calculated concentration of the ICV Standard.

10.2.9.1 The general criteria for percent difference acceptance limits is less than or equal to ±35% for all native and labeled compounds. The warning limits for percent difference is ±35 - 55%.

10.2.9.2 All data associated with compounds with percent differences in the warning limits must be reviewed before acceptance.

10.2.9.3 All data associated with compounds with percent differences outside the warning limits shall be documented as an NCM. Corrective action must be taken and may include the following

- Reanalyze the ICV Standard
- Replace and reanalyze the ICV Standard
- Evaluate the instrument performance
- Evaluate the Initial Calibration Standards

10.3 Continuing Calibration

10.3.1 Continuing calibration is performed at the beginning of a 12 hour period after successful mass resolution and GC resolution performance checks. A calibration check is also required at the end of a 12 hour period when performing method 8290 or 0023A.

STL KNOXVILLE

STANDARD OPERATING PROCEDURE

TITLE: Analysis of Polychlorinated Biphenyl (PCB) Isomers by Isotope Dilution HRGC/HRMS

(SUPERSEDES: Revision 1)

Prepared By: Samuel Austin Mills III Feb 14, 2002

Reviewed By: 2/14/02
Technical Specialist

Approved By: 02/14/02
Quality Assurance Manager

Approved By: 2-14-02
Environmental, Health and Safety Coordinator

Approved By: 2/14/02
Laboratory Director

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RT_{WIN} = Absolute RT window in seconds from Table 2

10.2.7 Criteria for Acceptable Calibration - The criteria listed below for acceptable calibration must be met before sample analyses are performed. If acceptable initial calibration is not achieved, identify the root cause, perform corrective action, and repeat the initial calibration. If the root cause can be traced to problems with an individual analysis within the calibration series, repeat the individual analysis and recalculate the percent relative standard deviation. If the calibration is acceptable, document the problem and proceed, otherwise repeat the initial calibration. The mean RF's will be used for all calculations of the nineteen PCB in the standards until the continuing calibration criteria in section 10.3.4 are no longer met. At such time, new mean RF's will be calculated from a new set of injections of the calibration solutions.

10.2.7.1 The percent relative standard deviation (RSD) for the mean relative response factors from the unlabeled native analytes must not exceed ± 20 percent, and those for the labeled internal standards must not exceed ± 35 percent.

10.2.7.2 The S/N for the GC signals present in every SICP must be ≥ 10 for calibration solutions CS1 through CS5. If the S/N ratio is ≤ 2.5 for any target analyte in CS0.2, a five point initial calibration is used for that analyte (section 10.2.5) omitting the RRF for CS0.2.

10.2.7.2.1 An exception to the requirement that S/N ≥ 10 on all SICPs is the secondary ion for dichlorinated biphenyls (m/z 223.9974). High background from PFK fragments at 223.9974 results in noise levels which exceed 10% of the signal height at levels that are reliably quantifiable.

10.2.7.3 The ion abundance ratios for all signals in CS1-CS5 must be within the control limits specified in Table 9.

10.2.7.4 Isomer specificity

When analyzing the 209 PCB congener mix:

10.2.7.4.1 Evaluate and document the percent valley between PCBs 34 and 23. The valley height must be less than 40 percent of the height of the shorter of the two peaks.

10.2.7.4.2 Evaluate and document the percent valley between PCBs 187 and 182. The valley height must be less than 40 percent of the height of the shorter of the two peaks.

10.2.8 Analyze 2µL of the Initial Calibration Verification (ICV) Standard in section 7.12.13. Calculate the concentration of the ICV using the RRF's from the CS3 standard analyzed in section 10.2.4. Calculate the percent difference (%D) between the expected and the calculated ICV concentration using the following formula.

$$\%D = \frac{(C_{Exp} - C_{Calc})}{C_{Exp}} \times 100$$

Where:

C_{Exp} = The expected concentration of the ICV Standard.
C_{Calc} = The calculated concentration of the ICV Standard.

10.2.8.1 The general criteria for percent difference acceptance limits is less than or equal to ±35% for all native and labeled compounds. The warning limits for percent difference is ±35 - 55%.

10.2.8.2 All data associated with compounds with percent differences in the warning limits must be reviewed before acceptance.

10.2.8.3 All data associated with compounds with percent differences outside the warning limits shall be documented as an NCM. Corrective action must be taken and may include the following

- Reanalyze the ICV Standard
- Replace and reanalyze the ICV Standard
- Evaluate the instrument performance
- Evaluate the Initial Calibration Standards

10.3 Continuing Calibration

10.3.1 Continuing calibration is performed at the beginning of a 12-hour period after successful mass resolution check.

10.3.2 Document the mass resolution performance as specified in section 10.2.2 at both the beginning and end of the 12-hour period.

10.3.3 Analyze 2µL of the Daily Calibration Standard Solution (CS3). Calculate the concentration (C) of the compounds of interest (target analytes, internal standards, cleanup standards, and surrogate standards) vs. the appropriate reference standard (as specified in Table 2) using the following equation:

$$C = \frac{As \times Cis}{Ais \times RRF}$$

where:

As = sum of the areas of the quantitation ions of the compound of interest
Ais = sum of the areas of the quantitation ions of the appropriate reference standard
Cis = concentration of the appropriate reference standard
RRF= mean relative response factor from section 10.2.5

10.3.4 Criteria for Acceptable Calibration - The criteria listed below for acceptable

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary

101 S. Webster St.
Box 7921
Madison, Wisconsin 53707-7921
Telephone 608-266-2621
FAX 608-266-5226
TTY 608-267-6897

February 25, 2005

FID: 998044300

Mr. Christopher Rigell
STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

rec'd 03/07/05 cm

Subject: Conclusion of Evaluation Process

Dear Chris:

Thank you for submitting a response to the report of the evaluation I performed at STL Knoxville in September 2004. I appreciated the care you took to formulate your response and assemble supporting documentation.

The documents and information you submitted demonstrated that you have resolved or have sound plans for resolving the deficiencies identified in the report. Based on the strength your response, I am closing your evaluation case.

The Department will verify your continued compliance with Chapter NR 149 and the effectiveness of your corrective actions during your next on-site evaluation, which barring any applications you may submit, is scheduled to be performed in or around September 2007.

It has been a pleasure to interact with you and Dave Thal during the resolution process. As usual, feel free to contact me at (608) 266-9257 or 'Alfredo.Sotomayor@dnr.state. wi.us' if you should have any questions about the Laboratory Certification and Registration Program.

Sincerely,

Alfredo Sotomayor, Jr.

Alfredo Sotomayor, Senior Audit Chemist
Bureau of Integrated Science Services

WISCONSIN
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November 18, 2004

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Mr. Christopher Rigell
STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

rec'd 11/22/04 ur

Subject: Report of On-Site Evaluation

Dear Chris:

Enclosed you will find a report of the on-site evaluation that I performed at STL - Knoxville on September 20 - 22, 2004 to determine the laboratory's continued compliance with Chapter NR 149, Laboratory Certification and Registration, Wisconsin Administrative Code, and to determine the laboratory's eligibility for certification to perform additional analyses.

The report summarizes the observations I made during the visit. You must address all the items listed as deficiencies and present a written plan to resolve them. You must submit your written plan within 30 days of this date.

I will call you in approximately two weeks to ensure that you understand the enclosed information, to discuss your plan to resolve the deficiencies, and to agree on what records and data you will need to submit to document your efforts.

It was truly a pleasure to revisit your laboratory. Please do not hesitate to contact me at (608) 266-9257 or 'Alfredo.Sotomayor@dnr.state.wi,us', should you have any questions before we discuss the specifics of your action plan.

Sincerely,

Alfredo Sotomayor

Alfredo Sotomayor, Senior Audit Chemist
Bureau of Integrated Science Services

REPORT OF ON-SITE EVALUATION
FOR
COMPLIANCE WITH CHAPTER NR 149,
LABORATORY CERTIFICATION AND REGISTRATION,
WISCONSIN ADMINISTRATIVE CODE

OF

STL Knoxville
FID: 998044300
5815 Middlebrook Pike
Knoxville, TN 37921

BY

ALFREDO SOTOMAYOR
SENIOR AUDIT CHEMIST
BUREAU OF INTEGRATED SCIENCE SERVICES
WISCONSIN DEPARTMENT OF NATURAL RESOURCES
BOX 7921
MADISON, WISCONSIN 53707-7921

September 20 - 22, 2004

INTRODUCTION

On September 20 - 22, 2004, I performed an evaluation of STL - Knoxville to determine its continued compliance with Chapter NR 149, Laboratory Certification and Registration, and to determine the laboratory's eligibility for certification to perform analyses of polychlorinated biphenyl (PCB) congeners by high resolution gas chromatography (HRGC)/high resolution mass spectrometry (HRMS). This was the second evaluation of the laboratory under this program.

STL - Knoxville is certified or accredited to perform environmental analyses in various states across the nation. The laboratory is accredited by the National Environmental Laboratory Accreditation Program (NELAP) through the State of Florida and maintains reciprocal NELAC accreditations in New Jersey, Louisiana, Illinois, Kansas, Pennsylvania, New York, and Utah. The laboratory is also certified by the California Environmental Laboratory Accreditation Program, and the States of Colorado, North Carolina, and South Carolina.

STL - Knoxville had maintained a set of comprehensive certifications in the Wisconsin Laboratory Certification Program. Before my visit, the laboratory determined that it had only analyzed a single laboratory regulatory sample, for dioxin, from Wisconsin and decided to drop all its certifications except for those in category 16 for PCBs and category 17 for dioxin and furans. On site, I limited my evaluation to the test categories that the laboratory wished to retain and to the test category under application.

Although this report focuses on deficiencies, I noted many positive practices while on site. Among those were:

- The experience the laboratory has in all analytical areas. All essential personnel at the laboratory have been employed at the facility for at a minimum, ten years.
- The maturity of the laboratory's quality system, which has institutionalized many of the best industry quality practices.
- The ability the laboratory has to assemble data packages and to deliver them in various media.
- The instrumentation, knowledge, and expertise of the laboratory's isotope dilution analytical section. The laboratory has participated in several validation studies of national methods by HRGC/HRMS.
- The commitment the laboratory has to its Quality Assurance section.
- The procedures and policies employed by the laboratory in the sample receipt area.
- The systems for traceability of standards and reagents employed by the laboratory.

Unless otherwise indicated in the report, the laboratory must respond in writing within 30 days with a plan to resolve all the items identified in the "Deficiencies" subsections. Failure to do so or to respond satisfactorily may result in enforcement action by the Department. Another on-site evaluation may be required to assess the efficacy of the laboratory's corrective actions.

The deficiencies identified here were those I observed at the time of the on-site evaluation. The deficiencies may have been corrected or otherwise addressed in the intervening time between the evaluation and the receipt of this report. Because this type of evaluation can only provide an overview of compliance with Code requirements, other deficiencies may exist in the laboratory; their omission from this report does not imply acceptance by the Department. At times, a deficiency identified in an area or test could extend to other sections or methods. I urge the laboratory to correct the same type of deficiency in all areas where a similar deficiency may exist, even when the scope of the deficiency is cited narrowly.

I thank Christopher Rigell, David Thal, Mary Tyler, Thomas Yoder, and the entire analytical staff of STL - Knoxville for the courtesy and cooperation they extended me during the evaluation.

Alfredo Sotomayor, Jr.
Alfredo Sotomayor, Senior Audit Chemist
Bureau of Integrated Science Services

November 18, 2004
Date

Approved:

David Webb
David Webb, Chief
Environmental Science Services

11-18-04
Date

CERTIFICATIONS HELD ON SEPTEMBER 20, 2004

5 General I*
   a. Hardness
6. General II*
   a. Cyanide
   b. Sulfate
7. General III*
   a. Toxicity Characteristic Leaching Procedure (TCLP)
8. Metals*
   a. Silver
   b. Arsenic
   c. Boron
   d. Barium
   e. Beryllium
   f. Calcium
   g. Cadmium
   h. Cobalt
   i. Chromium (Total)
   j. Copper
   k. Iron
   l. Mercury
   m. Potassium
   n. Magnesium
   o. Manganese
   p. Molybdenum
   q. Sodium
   r. Nickel
   s. Lead
   t. Antimony
   u. Selenium
   v. Tin
   w. Strontium
   x. Thallium
   y. Vanadium
   z. Zinc
10. Organics; Purgeable by Gas Chromatography (GC) or Gas Chromatography/Mass Spectrometry (GC/MS)*
   a. Purgeable Aromatics
   b. Purgeable Halocarbons
   c. Volatile Organic Compounds (VOC)
12. Organics; Semivolatiles by GC/MS*
   a. Base/Neutral and Acid Extractable Compounds
16. Organics; Organochlorine Compounds
   a. Polychlorinated Biphenyls (PCBs)
   b. Organochlorine Pesticides)*
17. Organics; Polychlorinated Dibenzo-p-Dioxins
   a. Polychlorinated Dibenzo-p-Dioxin (PCDD)
   b. Polychlorinated Dibenzo-p-Furan (PCDF)

CERTIFICATIONS UNDER APPLICATION

19. Any Single Analyte or Group of Analytes**
   a. PCB Congeners by High Resolution Gas Chromatography (HRGC)/High Resolution Mass Spectrometry (HRMS)

* The laboratory requested to drop these certifications on September 1, 2004.
** Certification granted on November 15, 2004.

I. LABORATORY FACILITIES, EQUIPMENT, SUPPLIES, AND GENERAL PRACTICES

Laboratory facilities are spacious and generally well designed. Extractions and determinations by HRGC/HRMS by isotope dilution for dioxins, furans, and PCBs are performed in a separate building adjacent, but not contiguous with the main laboratory facility. Analyses of PCBs as Aroclors and as congeners using the electron capture detector are performed in the main laboratory facility. The laboratory employs approximately 61 full-time equivalent personnel.

The laboratory applied to perform HRGC/HRMS PCB congener analyses in Wisconsin with the expectation that it would be analyzing, directly or under subcontract, sediment samples from the most recent Fox River remediation project under joint management by the Department and Shaw Environmental and Infrastructure.

During my visit I determined that the laboratory had the physical facilities, equipment, and expertise to perform all aspects of HRGC/HRMS PCB congener analyses competently and would recommend the laboratory for certification in test category. However, the laboratory must perform an initial demonstration of capability study (IDC) on a selected Fox River sediment sample before analyzing any sediment samples for this project.

The laboratory relies extensively on the electronic media for communicating internally and within the STL family. All standard operating procedures (SOPs) are available electronically.

Before solvents are used, they are verified for impurities. Only solvent lots meeting cleanliness criteria are approved for use in analyses. Several laboratories in the STL family share the responsibility of testing solvents and disseminating the results of those analyses. The high resolution laboratory uses a separate system for tracking the purity of the solvents used for dioxin, furan, and PCB congener extractions.

The laboratory analyzes aqueous samples, soils, and other solid matrices. Lately, the laboratory has increased the number of air analyses it performs.

The single laboratory sample analyzed by the laboratory during this compliance period was one described as a drinking water. Since STL - Knoxville is not certified to perform drinking water analyses for the Department, I asked the laboratory to determine whether the drinking water sample originated in a water supply in Wisconsin. After some investigation, the laboratory was able to verify that the sample in question was not collected to determine compliance with the Safe Drinking Water Act. This case, however, alerted the laboratory that although it is certified by the Department to perform analyses of dioxins and furans, this certification does not extend to the analysis of the regulated tetra-dioxin in drinking water. The laboratory should review its sample acceptance policies to ensure it possesses the required certifications before accepting Wisconsin regulatory samples.

II. SAMPLE COLLECTION, HANDLING, AND PRESERVATION

The laboratory's sample receipt procedures are consistent with regulations and acceptable practices. Each sample is identified uniquely and its location is indicated unambiguously in the laboratory information management system (LIMS). Sample collection bottles used by the laboratory are certified to be free of contaminants by their manufacturers. The sample storage areas are maintained in good order and are aptly segregated to prevent cross contamination.

I did not note significant deficiencies in this area.

III. ANALYTICAL METHODOLOGY

While I was on site, I discussed with laboratory personnel the Department's expectations for the analyses of the Fox River sediment samples, including air drying the samples before extraction, and the feasibility of several clean-up techniques aimed at reducing possible interferences. The laboratory showed a willingness to accommodate any of the clean-up options suggested but felt that a reduced number of them would be sufficient to eliminate the great majority of interferences.

The Department made available to the laboratory two Fox River sediment samples to allow performing an initial demonstration of capability (IDC) on the project matrix. After discussion with the laboratory, I agreed to have the laboratory perform an IDC on one of the sediment samples. The laboratory felt that a silica gel clean-up followed by Florisil would be sufficient to achieve this, but would consider sulfuric acid treatment, gel permeation chromatography (GPC), and tetrabutyl ammonium (TBA) sulfite cleanup if necessary to remove interferences.

The laboratory's procedure for analyzing PCB congeners by isotope dilution is based on EPA's Method 1668A. The laboratory can also analyze selected (56 out of 209) PCB congeners following the options available in Method 8082. The laboratory's procedure for analyzing dioxins and furans by isotope dilution consolidates in a single document aspects of Method 8290 and 1613B.

Aqueous samples to be analyzed for Aroclors and Method 8082 congeners are extracted by continuous liquid-liquid extraction. To avoid having to adjust reporting limits in solid samples to be analyzed by Method 8082, the laboratory determines the moisture content of all samples before selecting aliquots for analysis. A LIMS program then adjusts the nominal weight of a sample (usually 10g) by its moisture content to render comparable detection or reporting limits for all analyzed samples.

The final volume of organics extracts is determined in screw cap vials by filling each vial to the same level indicated by another vial filled with an aliquot of water delivered with a pipette of the same nominal volume. While at the laboratory, I questioned the accuracy and defensibility of this practice. The laboratory provided data, during my visit, suggesting that the error contributed by the practice was less than the 1% tolerance of accuracy for graduated class A glassware. I accepted this information and removed my objections to the laboratory's practice, but cautioned the laboratory that the same validation should be performed each time the source and lot of the vials used for storing extracts changed.

The laboratory takes extraordinary measures to ensure that the PCB HRGC/HRGMS instrument conditions are maintained as constant as is possible. Consequently, calibration factors or curves used to quantitate the toxic PCB congeners remain valid at times for more than a year.

Deficiencies

1. The laboratory does not analyze a combined 209 congener solution, as defined in Method 1668A, at the beginning of each 12-hour shift during which analyses are performed. [See supplemental information below.]

Supplementary Information for Deficiencies

[1.] The laboratory analyzes a solution containing all the non-toxic congeners each quarter.

IV. QUALITY ASSURANCE

The laboratory's Quality Manual follows a format used by all STL laboratories. The manual also incorporates all elements required by the National Environmental Laboratory Conference (NELAC) Standard and satisfies the requirements of Chapter NR 149.

The laboratory tends to analyze matrix spikes and matrix spike duplicates from solid matrices because for these, additional sample is generally available to perform quality control analyses.

The conventional organics extraction laboratory uses colored indicators to verify that a spiking solution has been added to an aqueous sample. The conventional and the high-resolution organic extraction laboratories both require that the fortification of any sample be documented and witnessed by another analyst.

New calibration and fortification solutions are verified for accuracy against existing solutions before they are allowed to be used. Generally, the laboratory requires at least a 10% agreement in concentrations before accepting a new solution.

The laboratory has established defensible procedures for data review by peers and supervisors. Checklists are used to document the review of, among others, initial calibrations, continuing calibrations, sample preparation, and reporting documents.

The laboratory has established defensible policies and procedures for performing and documenting organic chromatographic manual integrations. These practices are detailed in an SOP ("Acceptable Manual Integration Practices"). For isotope dilution analyses it is necessary to qualify possible detects by signal to noise ratios and therefore, manual integrations are performed routinely. For these analyses, the laboratory does not provide copies of chromatograms generated before a manual integration event, but labels all peaks integrated manually. The manual integration policy notes this specific practice for the isotope dilution group.

Deficiencies

1. At the time of the evaluation, two solutions that had not been documented as approved for use where used by the extraction laboratory to fortify quality control samples. [See supplemental information below.]
2. Existing records pertinent to the verification of new solutions do not always indicate the resulting difference between the new and the older solutions quantitatively. [See supplemental information below.]
3. The laboratory does not always analyze a continuing calibration verification standard after performing maintenance on the HRGC/HRMS instrument used to analyze PCB congeners.

Supplementary Information for Deficiencies

[1.] No response is required for this item. The two solutions had been verified to be accurate and suitable for use, but their labels were not noted accordingly by the preparation chemists. Extraction personnel neglected to review the label and assumed that the solutions were properly verified.

[2.] Summary sheets sometimes included notations such as "QC checked", but did not quantify the degree of agreement between the two solutions. Raw data records were available to compute the difference between an older and a newer solution, but they did not document the evaluation criteria used for certifying the new solutions.

V. RECORDS AND DATA REPORTING

During the evaluation, I made available to the laboratory the Department's protocol for reporting dioxin and furan results. Laboratory personnel indicated that they would be able to comply with the reporting protocol.

The laboratory's electronic files for the perfluorokerosene (PFK) resolution checks performed for PCB isotope dilution congener analyses are over-written without archiving after several weeks. The laboratory retains paper copies of the resolution checks. During my visit, I reminded the laboratory that when dual systems are used to contain the same type of information, both systems should mirror each other.

The laboratory offers several standard report formats, from simple certificates of analysis to complete data packages.

Deficiencies

1. The laboratory's procedure for quantitating PCB congeners based on method 8082 incorrectly states that the laboratory uses the grand mean of all average response factors to quantitate congeners when the relative standard deviations (RSDs) of any response factor exceeds 15%. [See supplemental information below.]
2. The certificate detailing the source, purity, lot number, and expiration date of one of the PCB congener cleanup standards used by the isotope dilution laboratory could not be located at the time of the evaluation. [See supplemental information below.]
3. The laboratory's protocols for verifying the accuracy of the solutions used in HRGC/HRMS dioxin and furan analyses are not adequately or accurately described in existing documents or SOPs.
4. The composition of the PCB HRGC/HRMS congener continuing calibration verification and initial calibration verification standards is not completely documented in the laboratory's SOP.

Supplementary Information for Deficiencies

[1.] Currently, the laboratory does not use the grand mean option for enabling average response factors having RSDs that exceed 15%. The laboratory uses average response factors when the RSDs of the corresponding congener responses are less than or equal to 15%, and uses other options outlined in Method 800 when RDSs exceed 15%.

[2.] The congener in question was 32L. The method specifies using congeners 28L, 111L, and 178L as cleanup standards.

ACRONYMS OR ABBREVIATIONS THAT MAY BE USED IN THIS REPORT

AA	Atomic Absorption
BFB	p-Bromofluorobenzene
BNA	Base/Neutral/Acid Extractables
BOD	Biochemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
°C	Degrees Celsius (temperature)
CCC	Calibration Check Compounds
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
CVAA	Cold Vapor Atomic Absorption
DFTPP	Decafluorotriphenylphosphine
DO	Dissolved Oxygen
DRO	Diesel Range Organics
ECD	Electron Capture Detector
ELCD	Electrolytic Conductivity Detector
EP	Extraction Procedure
EPA	Environmental Protection Agency
EPTOX	Extraction Procedure Toxicity Characteristic
FIA	Flow Injection Analysis (Analyzer)
FID	Flame Ionization Detector
FLAA	Flame Atomic Absorption
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption
GRO	Gasoline Range Organics
HEM	Hexane Extractable Materials
HPLC	High Performance Liquid Chromatography
HRGC	High Resolution Gas Chromatography
HRMS	High Resolution Mass Spectrometry
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
ICV	Initial Calibration Verification
ID	Identification
IDC	Initial Demonstration of Capability
IEC	Interelement Correction
IR	Infrared
IS	Internal Standard
LC	Liquid Chromatography
LCS	Laboratory Control Sample
LDR	Linear Dynamic Range
LFB	Laboratory Fortified Blank
LIMS	Laboratory Information Management System
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUST	Leaking Underground Storage Tank
MDL	Method Detection Limit
mL	milliliter
MS	Matrix Spike or Mass Spectrometer
MSA	Method of Standard Additions
MSD	Matrix Spike Duplicate
mV	millivolts
N. B.	Note (Nota Bene)
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NON	Notice of Non-Compliance
NOV	Notice of Violation
N/P	Nitrogen/Phosphorus (detector for pesticides)
NPDES	National Pollutant Discharge Elimination System
NR 140	Groundwater Quality; Wisconsin Administrative Code Chapter
NR 149	Laboratory Certification and Registration Code; Wisconsin Administrative Code Chapter
NTU	Nephelometric Turbidity Units
oz	ounce; approximately 30 mL
PAH	Polynuclear Aromatic Hydrocarbon
PAL	Preventive Action Limit
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzo-p-Dioxin
PCDF	Polychlorinated Dibenzo-p-Furan
PFK	Perfluorokerosene
PID	Photoionization Detector
ppb	part per billion
ppm	part per million
PVOC	Petroleum Volatile Organic Compounds
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RF	Response Factor
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
rpm	rotations per minute
SIM	Selective Ion Monitoring
SICP	Selected Ion Current Profile
SDWA	Safe Drinking Water Act
SPCC	System Performance Check Compounds
SOP	Standard Operating Procedures
SOW	Statement of Work
SPE	Solid Phase Extraction
SPLP	Synthetic Precipitation Leaching Procedure
SRM	Standard Reference Material
SS	Surrogate Standard
SW-846	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
TCDD	Tetrachlorinated dibenzodioxin
TCDF	Tetrachlorinated dibenzofuran
TCLP	Toxicity Characteristic Leaching Procedure
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TOX	Total Organic Halides
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UST	Underground Storage Tank
UV	Ultraviolet (an HPLC detector)
VOC	Volatile Organic Compound
WPDES	Wisconsin Pollution Discharge Elimination System
WWTP	Wastewater Treatment Plant
ZHE	Zero Headspace Extractor

Laboratory Quality Manual
for
STL Knoxville

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Approved by:

3/14/05
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Purpose and Scope

The purpose of this Laboratory Quality Manual (LQM) is to describe the implementation of the Severn Trent Laboratories (STL) Quality System at the STL Knoxville laboratory. The LQM is written within the guidelines of the STL Quality Management Plan (QMP), which applies to all STL laboratories. The organization of this LQM is based on the "EPA Requirements for Quality Management Plans" (EPA QA/R-2, March 2001). This LQM outlines specific policies, organization, responsibilities, and activities required to assure high quality laboratory services. The LQM also fulfills the requirements of our clients, government agencies, and NELAC to document the laboratory Quality System.

This LQM contains references to other essential STL quality documents. The company-wide QMP, STL Knoxville LQM, and referenced policies and SOPs are interrelated. Together they provide an integrated quality foundation that meets the objectives of the STL Quality Assurance Policy, as stated in Section 1.2.

The requirements set forth in this document are applicable to all employees at the STL Knoxville laboratory. The policies and practices described here are presented as minimum guidelines only. Based on good scientific judgment, more rigorous requirements may be applied by laboratory employees. Specific requirements delineated in project plans may supersede general quality requirements described in this manual.

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1.0 Management Commitment and Organization

1.1 STL Mission Statement

Through the innovation and dedication of our people, together with the quality of our systems, we will deliver levels of performance that delight our clients, retain the confidence of our stakeholders and enable the profitable growth of our business.

1.2 STL Quality Assurance Policy

It is STL's policy to:

- Provide high quality, consistent, and objective environmental testing services that meet all federal, state, and municipal regulatory requirements.
- Generate data that are scientifically sound, legally defensible, meet project objectives, and are appropriate for their intended use.
- Provide STL clients with the highest level of professionalism and the best service practices in the industry.
- Build continuous improvement mechanisms into all laboratory, administrative, and managerial activities.
- Maintain a working environment that fosters open communication with both clients and staff and ensures data integrity.

1.3 STL Management Statement of Commitment to Quality Assurance

STL management is committed to providing the highest quality data and the best service in the environmental testing industry. To ensure that the data produced and reported by STL meet the requirements of its clients and comply with the letter and spirit of municipal, state and federal regulations, STL maintains a quality system that is clear, effective, well communicated, and supported at all levels in the company.

1.4 Ethics, Waste, Fraud and Abuse

Establishing and maintaining a high ethical standard is an important element of a quality system. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times, STL has established an Ethics Policy, including an Employee Ethics Statement (see Figure 1.4-1). Ethics is also a major component of the STL QA training program (see Section 4 for more discussion). A central tenant is that management must consistently convey the message to analysts that financial pressures can never be allowed to compromise the quality of work.

See the following documents related to ethics in the laboratory:
P-L-006, Ethics Policy

LQM Section 6 – Computer Hardware and Software
KNOX-QA-0013 – Instrument Records and Logbooks
S-Q-004 – Acceptable Manual Integration Practices
P-T-001 – Selection of Calibration Points

1.5 Organizational Structure and Relationships

STL Knoxville is a local operating unit of Severn Trent Laboratories, Inc., a Delaware Corporation. The date of incorporation was August 27, 1997. Severn Trent Laboratories is wholly owned by Severn Trent (Del.), Inc., a Delaware Corporation.

The organizational structure, responsibilities and authorities of the corporate staff of Severn Trent Laboratories, Inc. are presented in the STL QMP.

STL Knoxville has day-to-day independent operational authority overseen by corporate officers (e.g., President, Chief Operating Officer, Corporate Quality Assurance, etc.). The STL Knoxville laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for STL Knoxville is presented in Figure 1.5-1. A list of key STL Knoxville personnel qualifications is provided in Figure 1.5-2. The lab also maintains job descriptions that contain general job responsibilities for all laboratory employees. The following section outlines responsibilities and authorities for all employees of the STL Knoxville laboratory, as they relate to quality management.

The STL Knoxville QA Manager (QAM) is independent from day-to-day laboratory operations, has no direct analytical testing responsibilities, and is free from financial and other undue pressures which might adversely affect the quality of work. The QAM, a key member of the laboratory's management team, has direct access to the Corporate Quality Assurance Director on all matters involving quality. The QAM is available to any lab employee to resolve quality or ethical issues. The QAM, if required, has the authority to cease operations adversely affecting the validity or integrity of the analytical data.

Figure 1.4-1 STL Employee Ethics Statement

Severn Trent Laboratories, Inc.

EMPLOYEE ETHICS STATEMENT

I understand that STL is committed to ensuring the highest standard of quality and integrity of the data and services provided to our clients. I have read the Ethics Policy of the Company. With regard to the duties I perform and the data I report in connection with my employment at the Company, I agree that:

- I will not intentionally report data values that are not the actual values obtained;
- I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations;
- I will not intentionally misrepresent another individual's work;
- I will not intentionally misrepresent any data where data does not meet Method or QC requirements. If it is to be reported, I will report it with all appropriate notes and/or qualifiers;
- I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner; and I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees;
- If a supervisor or a member of STL management requests me to engage in or perform an activity that I feel is compromising data validity or quality, I will not comply with the request and report this action immediately to a member of senior management, up to and including the President of STL; and
- I will not share the pricing or cost data of Vendors or Suppliers with anyone outside of the Severn Trent family of companies.

As a STL employee, I understand that I have the responsibility to conduct myself with integrity in accordance with the ethical standards described in the Ethics Policy. I will also report any information relating to possible kickbacks or violations of the Procurement Integrity Act, or other questionable conduct in the course of sales or purchasing activities. I will not knowingly participate in any such activity and will report any actual or suspected violation of this policy to management.

The Ethics Policy has been explained to me by my supervisor or at a training session, and I have had the opportunity to ask questions if I did not understand any part of it. I understand that any violation of this policy subjects me to disciplinary action, which can include termination. In addition, I understand that any violation of this policy which relates to work under a government contract or subcontract could also subject me to the potential for prosecution under federal law.

EMPLOYEE SIGNATURE _____ Date _____

Supervisor/Trainer: _____ Date _____

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Figure 1.5-1 STL Knoxville Organizational Structure

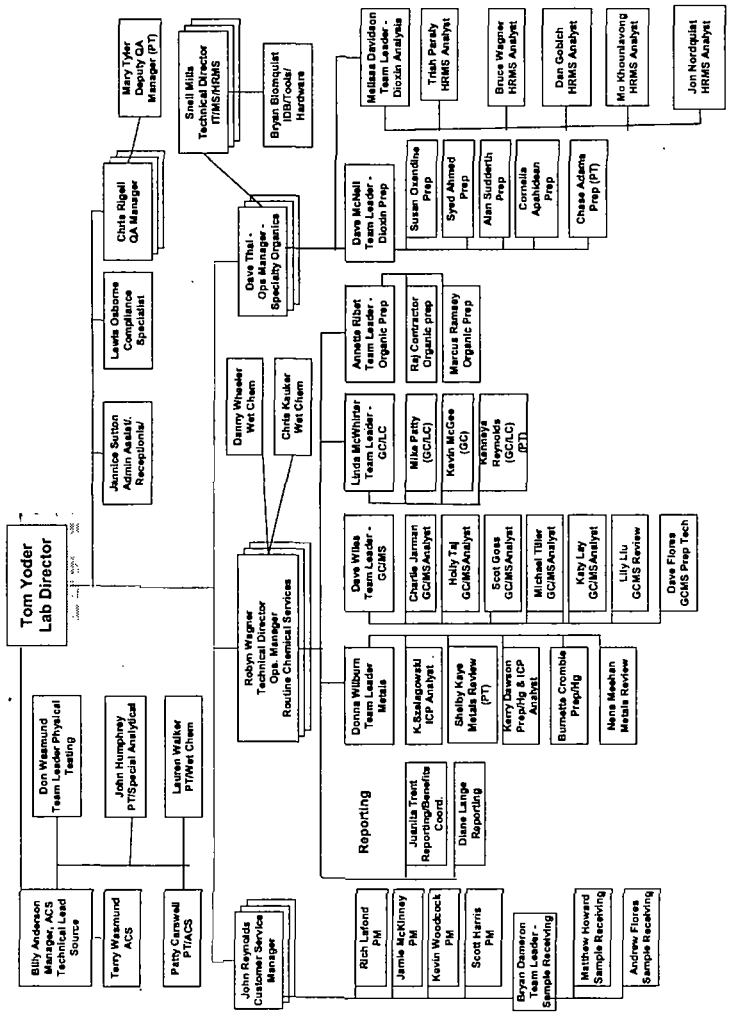


Figure 1.5-2 STL Knoxville Key Personnel

Position	Name	Degree(s), Institution(s), Year	Years Environmental Lab Experience	Years with Company
Laboratory Director	J. Thomas Yoder	B.S., Business Administration, Shippensburg State College, Shippensburg, Pennsylvania; 1982	17	18
Operations Manager, Technical Director	Robyn M. Wagner	B.S., Biology, Rutgers University, New Brunswick, New Jersey; 1981	25	23
Technical Director	Snell A. Mills, III	B.A., Chemistry, Maryville College, Maryville, Tennessee, 1979.	26	25
Compliance Specialist, E H &S Coordinator	B. Lewis Osborne	BS, Industrial Statistics-University of Tennessee, Knoxville, Tennessee, 1987	16	16
Quality Assurance Manager	Christopher W. Rigell	Ph.D., Biochemistry, University of Tennessee, Knoxville, Tennessee; 1986; M.S., Biochemistry, University of Tennessee, Knoxville, Tennessee; 1985, B.A., Chemistry and Mathematics, Maryville College, Maryville, Tennessee; 1979	19	17
Deputy Quality Assurance Manager	Mary E. Tyler	M.S., Environmental Engineering, University of Notre Dame, Notre Dame, Indiana; 1984; B.A., Biology, Indiana University, Bloomington, Indiana; 1980	25	20
Customer Service Manager	John D. Reynolds	B.S., Biology, Troy State University, Troy, Alabama; 1988	15	13
Specialty Organics Operations Manager	David Thal	B.S., Chemistry, University of Tennessee at Chattanooga, 1988; B.S., Psychology, University of Tennessee at Chattanooga, 1976.	16	13
Inorganics Team Leader	Donna Wilburn	Certified Laboratory Technician, Knoxville Area Adult Vocational School; 1972	20	20
GC/HPLC Team Leader	Linda McWhirter	B.S., General Chemistry, University of North Alabama, Florence, Alabama; 1991	13	13

Figure 1.5-2 STL Knoxville Key Personnel, continued

Position	Name	Degree(s), Institution(s), Year	Years Environmental Lab Experience	Years with Company
GCMS Team Leader	David Wiles	Appalachian State University, B.S. in Mathematics, Minor Physics; 1990; Wilkes Community College, Associate in Science, 1987	13	13
Organic Prep Team Leader	Annette Ribet	Associate Degree in Science, Western Piedmont Community College; 1985	15	13
Dioxin Extractions Team Leader	David McNeil	B.S., Natural Science, Bryan College, Dayton, Tennessee, 1985	18	16

1.6 Quality Organization

All personnel are responsible for quality, which includes complying with all QA/QC requirements that pertain to their organizational/technical function. This section outlines the primary QA responsibilities for each position.

1.6.1 Quality Assurance Manager

- Reports directly to the Laboratory Director and, for all QA matters, to the Corporate QA Director to maintain independence of QA oversight
- Responsible for implementing and communicating the QMP
- Maintains, approves, and implements the LQM
- Has joint signature authority, with the Laboratory Director and Technical Director for approval of quality documents
- Directs controlled distribution of laboratory quality documents
- Provides Quality System training to all new personnel
- Reviews and approves documentation of analyst training records
- Serves as a focal point for QA and QC issues, reviews corrective actions and recommends resolution for recurring nonconformances within the laboratory
- Assists in maintaining regulatory analytical compliance, including maintaining certifications
- Monitors data quality measures via statistical methods to verify that the laboratory routinely meets stated quality goals
- Performs systems, data, and surveillance audits
- Hosts external audits conducted by outside agencies
- Responsible for approving quality control reference data changes in the LIMS
- Oversees the selection, review, and approval of analytical subcontractors
- Prepares monthly QA Reports to management describing significant quality events
- Has the final authority to accept or reject data and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data

1.6.2 Laboratory Director

- Reports directly to the Regional General Manager
- Responsible for implementation and adherence by lab staff to the STL QMP, STL Knoxville LQM and all policies and procedures within the laboratory
- Has signature authority for LQM, policies, SOPs, and contracts (as detailed in STL policy)
- Annually assesses the effectiveness of the QMP and LQM within the operation
- Maintains adequate trained staffing documented on organization charts
- Responsible for implementing internal/external audit finding corrective actions

1.6.3 Operations Manager

- Reports directly to the Laboratory Director
- Supervises daily activities of the Operational Groups
- Schedules analytical operations
- Supervises QC activities performed as a part of routine analytical operations
- Implements data review procedures
- Supervises the preparation and maintenance of laboratory records
- Supervises maintenance of instruments and scheduling of repairs
- Supervises the daily activities of the Report Production Group
- Works with the Project Managers and Group/Team Leaders to assure the requirements of projects are met in a timely manner

1.6.4 Laboratory Technical Director

- Reports to Laboratory Director
- Responsible for the technical operation of the laboratory
- Responsible for coordinating the development and implementation of SOPs
- Has joint signature authority for LQM, SOPs, and training records
- Performs technical training in area(s) of expertise
- Interfaces with management on technical needs and solving day-to-day technical issues
- Determines qualifications required for technical positions and evaluates job candidates against those requirements
- Investigates technical issues related to projects as directed by QA
- Evaluates new methods, technical proposals, and statements of work
- Certifies technical laboratory personnel based on education and background to ensure that staff have demonstrated capability in the activities for which they are responsible
- Performs other tasks as required by NELAC

The Technical Director meets the requirements specified in the Section 4.1.1.1 of the NELAC standards.

1.6.5 Customer Service Manager (CSM)

- Reports directly to the Laboratory Director
- Supervises the daily activities of the Project Management and Sample Control groups
- Works with the Operations Manager and/or Group/Team Leaders to ensure the requirements of projects are met in a timely manner
- Has signature authority for laboratory reports
- Defines customer requirements through project definition

- Assesses and assures customer satisfaction
- Provides feedback to management on changing customer needs
- Brings together resources necessary to ensure customer satisfaction

1.6.6 Project Manager

- Reports directly to the Customer Service Manager
- Monitors analytical and QA project requirements for a specified project
- Acts as a liaison between the client and the laboratory staff
- Prepares Quality Assurance Summary (QAS) or equivalent summary form and communicates project-specific requirements to all parties involved
- Assists the laboratory staff with interpretation of work plans, contracts, and QAPP requirements
- Reviews project data packages for completeness and compliance to client needs
- Has signature authority for final reports
- Keeps the laboratory and client informed of project status
- Together with the QA Manager, approves customer requested variances to methods and to standard laboratory protocols
- Monitors, reviews, and evaluates the progress and performance of projects
- Reports client inquiries involving data quality issues or data acceptability to the facility QA Manager and to the operations staff
- Prepares reissue requests for project data

1.6.7 Group (Area) Leader, Team Leader or Supervisor

- Reports directly to the Operations Manager
- Supervises daily activities of analyses within the group
- Supervises QC activities performed as a part of routine analytical operations
- Implements data review procedures
- Supervises the preparation and maintenance of laboratory records
- Evaluates instrument performance and supervises the calibration, preventive maintenance, and scheduling of repairs
- Oversees or performs review and approval of all analytical data
- Reports nonconformances to the appropriate managers
- Responsible for generation of SOPs for their section

1.6.8 Analyst

- Performs analytical methods and data recording in accordance with documented procedures
- Performs and documents calibration and preventive maintenance
- Performs data processing and data review procedures
- Reports nonconformances to the Supervisor/Manager and QA Manager

- Ensures sample and data integrity by adhering to internal chain-of-custody procedures

1.6.9 Sample Custodian

- Ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody
- Reports nonconformances associated with condition-upon-receipt of samples
- Logs samples into the LIMS
- Ensures that all samples are stored in the proper environment
- Assists Environmental Health and Safety staff with sample disposal

1.6.10 Report Production Staff

- Accurately generates and compiles analytical reports and associated deliverables for delivery to the client
- Produces deliverables that meet the NELAC requirements, as required.

2.0 Quality System and Description

2.1 Objectives of the STL Quality System

The Quality System is a set of management principles, objectives, policies, responsibilities, and implementation plans at the organizational and project-specific levels. The goal of the STL Quality System is to ensure that business operations are conducted with the highest level of professionalism in the industry. To achieve this goal, it is necessary to provide STL clients with not only scientifically sound, well documented, and regulatory compliant data, but also to ensure that STL provides the highest quality service available in the industry. A well-structured and well-communicated Quality System is essential in meeting this goal. STL's Quality System is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

2.2 Structure of the STL Quality System

At the highest level, the STL Quality Management Plan (QMP) is the basis for STL's Quality System. The QMP provides the guidance under which all STL facilities conduct their operations. This Laboratory Quality Manual (LQM) describes the implementation of the Quality System at the STL Knoxville laboratory. This LQM and the series of associated quality documents described in Section 2.4 define the organization, project-specific principles, goals, controls, and tools of the Quality System as it is applied at this laboratory. The Quality System as described in this LQM demonstrates the commitment to accepted laboratory practices by STL Knoxville.

2.3 Quality Assurance and Quality Controls

Quality Assurance (QA) is defined as the system of activities which ensures the quality of a process, product, or service. Quality controls (QC) are the tools used to monitor and regulate the desired type and quality of product. The QA activities and QC employed in STL Knoxville are defined in the following quality documents.

2.4 Quality Documents

The STL Quality System is developed from the reference documents shown in Table 2-1. The review and control of the STL Knoxville documents described in the following subsections are described in Section 3 of this LQM. A cross-reference of the LQM to the NELAC requirements for quality manuals is presented in Table 2-2.

2.4.1 STL Quality Management Plan (QMP)

The requirements set forth in the QMP are applicable to all STL facilities. The policies and practices outlined in the QMP are minimum guidelines only.

Requirements that are more rigorous may be applied for specific client or regulatory programs.

2.4.2 STL Company-Wide Policies

Severn Trent Laboratories, Inc. has certain policies that apply company-wide. These policies are consistent with the QMP, and set forth requirements that all STL facilities are to follow.

2.4.3 Laboratory Quality Manual (LQM)

This STL Knoxville LQM along with the associated policies and SOPs, provides the criteria and specifications for the generation of environmental analytical data. The LQM with the SOPs provides QC criteria for standard procedures, facility-specific instrumentation, and reporting.

2.4.4 Laboratory Policies and Standard Operating Procedures

Laboratory policies provide further detail to the requirements of the LQM. Standard Operating Procedures (SOPs) describe step-by-step instructions for performing a method or activity. In addition, there are SOPs that relate to other support services performed in the laboratory. Details of SOP format and document control are described in SOP KNOX-QA-0018. SOPs that are actively used in this laboratory are listed in Table 8-2. SOPs are living documents and may supersede some requirements in this document until the LQM is updated.

2.4.5 Quality Assurance Project or Program Plans (QAPPs)

Regulations and contracts may contain QA requirements that are different from those described in this LQM. To address unique project requirements, Quality Assurance Project Plans (QAPPs) may be prepared and implemented. The requirements documented in a QAPP, as agreed to by STL Knoxville, take precedence over the LQM for that project. Typical specifications contained in a QAPP or similar documentation include:

- New or modified testing methods
- Unique QC logic
- Special requirements for equipment use and maintenance
- Special handling due to safety considerations
- Project-specific detection and reporting limits
- Project-specific accuracy and precision limits or the statistical treatment of data.
- Additional or unique documentation or records management requirements.

2.4.5.1 Quality Assurance Summary

Quality Assurance Summaries (QAS) or the equivalent (e.g., Client Requirement Checklist in LIMS) are used to distill client-specific requirements, typically documented in project QA plans, into a concise format, highlighting the requirements that are different than the laboratory standard practice. The summary describes for each project the required quality control samples, batching schemes, flagging conventions, deliverables, or other special client requests that may differ from routine laboratory operations. The QAS or equivalent is disseminated to laboratory operations by the Project Manager or Quality Assurance Manager to document client or program specific requirements. The QAS may be used alone or in conjunction with the project-specific QA plans.

2.4.6 Other Documents

Other documents that can affect the quality program may include the STL Corporate Safety Manual, memos, guidance documents, work instructions, and periodic management assessment reports. These documents may further define or guide the implementation of quality standards at STL, but shall not conflict with the LQM or diminish the effectiveness of the Quality System.

3.0 Document Control and Records Management

3.1 Objectives for Control of Quality Documents and Vital Records

Quality Documents - The quality documents discussed in Section 2 define the framework of the STL Quality System. Control and security of these documents are necessary to ensure that all staff have access to current policies and procedures at all times, to ensure that all changes to the policies and procedures are properly reviewed, to ensure that the history of use of documents can be reconstructed, and to ensure that confidential information is not improperly distributed. The system described in this section is designed to accomplish these objectives.

Vital Records – Vital records are the documents that provide objective evidence of the performance of a process or observations of an item. Records management ensures that results produced by the laboratory are scientifically and legally defensible, and ensures that project events can be reconstructed. Confidentiality of the records and records retention requirements are discussed in this section.

3.2 Document Control Procedures

Unambiguous identification of a controlled document is maintained by identification of the following items in the document header:

- unique document number/name,
- revision number,
- revision date,
- effective or implementation date (first page only),
- number of pages.

Controlled documents are marked as such, and the QA department keeps records of document distribution. Controlled distribution may be achieved by either electronic or hardcopy means. The effective date is the date when controlled copies are distributed. Controlled documents must be available in the immediate areas where the related work is performed. Details of the numbering system, required format, and restrictions for uncontrolled distribution of documents are in SOP KNOX-QA-0018 and the STL-wide Policy # S-Q-001.

3.3 Document Review, Approval and Revision

Controlled quality documents are authorized by the Laboratory Director, the Technical Director, and the QA Manager. They indicate their authorization by signing the cover page of the document. STL Knoxville quality documents, the individuals responsible for reviewing the documents, and the required frequency of review are listed in Table

2-3 and Table 2-4. In addition to periodic review and revision, quality documents must be revised when a procedure or activity changes in a significant manner.

Amendments to documents must be reviewed and approved by the same parties approving the original document, distributed in a controlled manner, and clearly indicated in the document. Obsolete versions of documents are removed from service when new revisions are issued. The QA Department maintains a record of history of use of all documents based on the effective date. For further details see SOP KNOX-QA-0018, "Preparation and Management of Standard Operating Procedures".

3.4 Records Management

Records may be either hardcopy or electronic copies. It is not required to maintain both if they are properly secured and are complete and true copies. The record keeping system allows for reconstruction of all laboratory activities that produced the analytical results. The history of the sample is readily understood through the documentation. This includes

- chain-of-custody records, including intra-laboratory and inter-laboratory transfers of samples;
- records identifying the personnel involved in sampling, preparation, calibration, and testing;
- observations, calculations, and derived data;
- information relating to laboratory facilities, equipment, analytical test methods, and related laboratory activities (e.g., sample preparation, standards preparation, and data verification);
- original records clearly identifying all subcontracted test data; and
- a copy of the final test report.

Requirements for data recording are described in STL Knoxville SOP KNOX-QA-0013, "Instrument Records and Logbooks". Details concerning control of electronic records are given in Section 6. The types of vital records maintained are listed in Table 3-1.

3.5 Document and Record Storage, Retention and Disposal

It is the policy of STL Knoxville that company records will be available to meet business needs and comply with all applicable legal records retention and disposition requirements. STL Knoxville retains copies of records in a manner that allows prompt retrieval of documents and records for inspection purposes. In accordance with NELAC, all quality documents and records are stored for at least five years. Other types of records have different retention requirements; refer to Table 3-1 for details.

Specific projects and regulatory programs have longer record retention requirements than the standard STL record retention time. Refer to the QMP Table 5 for a listing of examples of special program requirements. If special instructions exist such that client

data cannot be destroyed prior to notification of the client, the project lot folder is marked as to whom to contact for authorization prior to destroying the data.

When records, as contained in files, are transferred to a records storage area or off-site storage area, they shall be placed in suitable containers and include an inventory sheet (hard copy or electronic) prepared by the person submitting the records. The contents of each container shall be compared to the inventory sheet and the container labeled. If there are any discrepancies, the container and inventory sheet shall be reconciled. Archives are indexed such that records are accessible on a project or temporal basis. Archives are protected against fire, theft, loss, deterioration, and vermin. Backup copies of electronic media are stored in archive facilities and are protected against deterioration caused by magnetic fields and/or electronic deterioration. Access to archives is controlled and documented. Further details of the laboratory's document and records archiving process are described in SOP KNOX-AD-0001, current revision.

If the laboratory transfers ownership, vital records will be transferred to the new owner. If the laboratory goes out of business, vital records will be transferred to another operating STL laboratory or to our clients.

3.6 Data Confidentiality

Data and sample materials provided by the client or at the client's request, and the results obtained by STL, shall be held in confidence (unless such information is generally available to the public or is in the public domain or client has failed to pay STL for all services rendered or is otherwise in breach of the terms and conditions set forth in the STL and client contract) subject to any disclosure required by law or legal process. STL's reports, and the data and information provided therein, are for the exclusive use and benefit of client, and are not released to a third party without written consent from the client.

In some cases the client may identify projects requiring confidentiality due to national security. Information concerning these projects will be limited only to those STL Knoxville associates with a need to know.

The audit reports supplied by federal, state, and local regulatory agencies are public information and can be released without written consent of those agencies. However, specific client audits are confidential and must be approved by the client before releasing them to a third party.

Internal evaluation reports shall be maintained as confidential documents and shall not be released for use outside the laboratory. External auditors may view internal audit reports as part of their on-site audit.

4.0 Staff Qualification, Orientation and Training

All activities performed by STL Knoxville shall be accomplished by qualified personnel. Each staff member must have the combination of experience and education needed to demonstrate the required knowledge for his or her position. Each must also have an appropriate general knowledge of laboratory operations, test methods, quality assurance and quality control procedures, and records management. Minimum training requirements are shown in Figure 4-1 at the end of this section. SOP KNOX-QA-0009 describes the details and documentation of the training process. The STL Corporate Safety Manual describes details for health and safety training.

4.1 Qualifications

STL Knoxville maintains job descriptions for all positions. These job descriptions specify the minimum qualifications for education and experience, knowledge and skills, which are necessary to perform at a satisfactory level. Qualifications of professional staff are documented by resumes that include academic credentials, employment history, experience, and professional registrations. A copy of each person's resume is maintained in an electronic file, and is readily available for inspection.

4.2 Orientation and Technical Training

Each new staff member shall receive orientation in quality, health and safety and technical training to the appropriate SOPs. Each new staff member shall be supervised in their assigned duties by their supervisor or a knowledgeable individual designated by the supervisor. The ability and authorization to perform independently shall be documented in the training files, as described below.

4.2.1 Quality Assurance (QA) Orientation

Each new staff member will receive a QA orientation. The QA Manager or designee will conduct this orientation within two weeks of the new employee's first day on the job. The orientation will, at a minimum, include the following topics:

- STL Quality System and hierarchy of quality documents (QMP, LQM, policies, and SOPs);
- key elements of the LQM and the Quality Control Policy (QA-003);
- introduction to the nonconformance memo (NCM) system and corrective action procedures;
- proper data recording practices;
- STL ethics agreement (renewed each year), including the potential consequences of unethical behavior; and

- A confidentiality agreement (renewed each year).

The QA orientation will be documented on a checklist, which is signed by the trainee. The documentation will be placed in the employee's training file.

4.2.2 Quality Training

Continued training in the mission and goals of the QMP and LQM shall be provided at least annually. This may be done in a single session or divided into separate sessions conducted at different times throughout the year. Formal training sessions are conducted and documented by the QA Manager or designee. In addition, each lab staff member shall read and document their awareness of the quality documents related to his or her position.

4.2.3 Ethics and Data Integrity Training

Training on ethics is provided to each new employee within two weeks of hire. Each new employee must sign an Ethics Statement, documenting their commitment to data integrity as part of the employee orientation. Annual ethics training is provided to all employees at STL Knoxville and annual data integrity training is required for all technical employees and project management staff. All employees must sign the Ethics Statement annually. Further details regarding ethics and data integrity training is found in the Ethics Policy, P-L-006, current revision.

4.2.4 Health and Safety, Orientation and Training

Each new employee, contract worker, or working visitor is required to go through health and safety orientation and training as described in the STL Corporate Safety Manual. The Health and Safety Coordinator must conduct the orientation as soon as possible after the individual reports to work and before chemicals are handled. More comprehensive health and safety training, both initial and on-going, must be completed at the frequency given in the STL Corporate Safety Manual. Additional training is required for radiation health and safety, as described in the Radiation Safety documents.

4.3 Training Files

Each active STL Knoxville staff member has an individual training file maintained by the QA Manager or designee. This file can be documented on paper forms or in a database. The following sections shall be included in the training files at a minimum:

- Resume –a hardcopy or an electronic file may be used.
- Quality Assurance - containing documentation of QA/QC orientation and training completed.
- Health and Safety - orientation and training documents.

- Technical Proficiency - initial and on-going demonstrations of proficiency, training courses or workshops on specific equipment or analytical methods are documented in this file. Note that proficiency with technical SOPs is documented on demonstration of capability forms (see next section).

Other types of records to be included in the training file include work place regulatory compliance training and professional development courses. The exact contents will vary depending upon a person's job function and tenure with the company. Details of requirements for training records and the approval process are given in SOP KNOX-QA-0009.

4.4 Technical Proficiency Demonstration

All new personnel are required to demonstrate competency in performing a particular method by successfully completing a Demonstration of Capability (DOC) before conducting analysis independently on client samples. On-going proficiency must be demonstrated annually.

DOCs are most commonly performed by analysis of four replicate QC check samples. Results of successive LCS analyses can be used to fulfill the DOC requirement. As required by the referenced method, the accuracy and precision, measured as average recovery and standard deviation (using n-1 population), of the four replicates are calculated and compared to the method limits or against current laboratory limits if multi-laboratory method acceptance limits are not specified. The DOC Certification documentation must be signed by the Technical Director and the Quality Assurance Manager and filed in the employee's training file (see example in KNOX-QA-0009). The DOC Certification documentation must include a statement that the individual has read, understood, and agreed to perform the most recent version of the test procedure. Use of single-blind proficiency samples and other NELAC acceptable proficiency samples for on-going proficiency are described in SOP KNOX-QA-0009. In procedures such as PM-10, pH, etc., where spiking is not an option and for which quality control samples are not readily available, the proficiency can be demonstrated by analyzing a duplicate sample, with acceptable RPD.

Figure 4-1 Employee Minimum Training Requirements

Required Training	Time Frame*	Employee Type
Environmental Health & Safety	Month 1	All
Ethics	Two Weeks	All
Data Integrity	Two Weeks	Technical and PMs
Ethics Refresher	Annually	All
Quality Assurance	Quarter 1	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

**From date of initial employment unless otherwise indicated.*

5.0 Procurement of Supplies and Services

Controlling the quality of supplies and services is necessary to ensure that STL Knoxville provides high quality analytical services to our clients. The STL procurement program requires:

- assurance that purchased items and services meet requirements set by STL Knoxville and perform as expected;
- definition of the levels of documentation required for applicable technical and administrative procurement functions; and
- maintenance of records of all suppliers from whom we obtain services or supplies required for our analytical testing.

5.1 Selection of Vendors

Materials and supplies are purchased from approved vendors. Prospective vendors are selected based upon criteria appropriate to the materials or supplies provided. STL Corporate Policy PG-001 "Procurement and Contracts" details the process used. For national vendors and contracts, the vendor is selected by the STL Procurement Director through a competitive bidding process, strategic business alliance or negotiated vendor partnership. Potential vendors are required to complete a vendor acceptance application and are evaluated on the following criteria, as appropriate:

- the vendor's history of providing identical or similar products that perform satisfactorily in actual use;
- the vendor's service record and ability to provide a complete product line and commensurate service;
- the vendor's ability to administer inventory at the STL Knoxville facility through an inventory management system that will ensure correct stocking levels as well as shelf-life tracking;
- objective evaluation of the vendor's current quality records, supported by documentation;
- results of audits by STL of the vendor's technical and quality capabilities.

Vendors that provide measuring equipment, solvents, chemical standards, instrument service contracts, or subcontracted laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items.

5.2 Controlling Quality of Purchased Items

The quality of equipment, reagents, solvents, chemical standards, gases, and laboratory containers used in analyses must be of known quality so that their effect upon analytical results can be defined. These quality specifications are derived from analytical method requirements, project-specific requirements, and defined national standards for analytical testing. Quality specifications of materials are described in analytical SOPs. These quality specifications shall be included or referenced in the purchasing documents for the items being purchased. This includes specifications for the purity of standards, reagents,

or chemicals, and technical specifications for accuracy and precision (e.g., Class A volumetric glassware). Reference to a catalogue number, model, lot number, or chemical grade is sufficient.

The Laboratory Director has the responsibility for approving purchase orders. The section supervisors or designees are responsible for ensuring that the requested quality of materials ordered matches those received, for verifying that material storage is properly maintained and for removing materials from use when shelf life has expired.

5.2.1 Evaluation of Off-the-Shelf Items

For items that are used regularly by STL Knoxville where no unique requirements or specifications exist, the items may be purchased off-the-shelf. These items are ordered from the supplier on the basis of specifications set forth in the supplier's published product description. These include items such as glassware, filter paper, pipettes, and chromatography columns. The items are evaluated as a function of the standard analytical process.

5.2.2 Evaluation of Instruments

Evaluation of instruments purchased shall be conducted according to an acceptance testing plan. The acceptance testing plan may be defined by the vendor or the method demonstration requirements specified in the laboratory analytical SOPs. Acceptance criteria may include instrument reliability, sensitivity, stability, selectivity, accuracy, precision, and ability to interface with existing computer systems.

5.2.3 Evaluation of Critical Solvents and Acids

STL Knoxville is part of a group of STL laboratories that conducts additional evaluations for certain solvents and chemical reagents where our criteria for purity are more stringent than the vendor's. These chemicals are listed in Table 5-1. These chemicals are subject to analysis on a lot-by-lot basis before they are put into use. They are tested at one of the STL laboratories, and the chemical test results are evaluated by a designated quality representative. If the solvents or reagents meet the specifications given in SOP S-T-001, an approval memorandum is issued to all participating laboratories. The laboratories use the approved lots for analysis.

5.2.4 Evaluation of Chemical Standards and Reference Materials

Where available, chemical standards will be traceable to the National Institute of Standards Technology (NIST) or an equivalent source. This is largely limited to physical and inorganic chemical standards. If NIST traceability is not commercially available, commercially certified materials shall be used, which are

then tested for accuracy before reporting data. Details of the testing procedures and documentation are described in the laboratory SOPs. Standards must be received with a certification report from the vendor with information such as purity/concentration, traceability, lot number, expiration date, preparation date, unique identification number, formula weight, density, mass and/or volume of standards, and suggested storage requirements. Further details about labeling and handling of standards is described in Section 8 of this LQM.

5.2.5 Corrective Action for Failure to Meet Required Specifications

Corrective actions for failure of an item to meet required specifications are as follows:

- review of current supplies to eliminate the problem item
- notification to the STL Procurement Director to avoid additional problems at other STL labs
- return of the problem item to the vendor
- evaluation of the impact on product or process.

The QA Manager shall be notified of any significant or systematic quality problems. The STL Procurement Director and the STL Quality Assurance Director shall be notified of any quality problems with national vendors.

5.3 Procurement of Subcontract Laboratory Services

Whether external to STL or not, all subcontracting from the STL Knoxville laboratory to another laboratory is arranged with the consent and documented notification of the client, in a timely response that shall not be unreasonably refused. All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Documentation of required certifications from the subcontract facility are maintained in STL project records. Where applicable, specific QC guidelines, QAPPs, and similar project documents are transmitted to the subcontract laboratory. Samples are subcontracted under formal Chain of Custody (COC).

Subcontract laboratories may receive an on-site audit by a representative of STL's QA staff if it is deemed appropriate by the QA Manager. The audit involves an assessment of compliance with the required test method, QC requirements, documentation, as well as any special client requirements.

Project reports received from external laboratories are not altered and are included in original form in the final report provided by STL Knoxville. Intracompany subcontracting may also occur between STL facilities. The originating laboratory is responsible for communicating QA/QC, reporting, and other project requirements.

The final report from STL Knoxville clearly identifies what testing was performed by other laboratories. For projects requiring NELAC approval, the subcontractor must also be NELAC approved.

6.0 Computer Hardware and Software

The primary purpose of quality assurance systems for computer hardware and software is to protect the integrity of computer-resident data. Procedures are in place at STL Knoxville to assure that computer-resident data are accurate, traceable to a known source, protected against loss, and secure.

STL's computer and hardware controls are based on the guidance in EPA's "Good Automated Laboratory Practices" (GALP), August, 1995. This includes both corporate level Information Technology (IT) functions and STL Knoxville IT functions. Some GALP requirements, such as management responsibilities and the training program, are addressed in other sections of the LQM. Some corporate level IT functions, such as the system change management procedures, are described in more detail in corporate IT documents. Table 6-1 provides a cross reference of practices outlined in Section 8 of the GALP manual to corresponding sections of STL's QA and IT documents.

6.1 Computer Hardware

Computer hardware used in the generation, measurement, or assessment of client data shall be of appropriate design and adequate capacity to function according to specifications. Computer equipment must be installed in accordance with the manufacturer's recommendations and must undergo documented acceptance testing.

6.1.1 Wide-Area Systems

STL Knoxville's LIMS (QuantIMS) and the Office Network run on a wide-area network (WAN) serving multiple laboratories. The central node for the WAN is located at the Denver facility with multiple servers and Cisco routers. The central processor for QuantIMS is an IBM AS-400. Records for the system architecture, testing and maintenance, such as Initial Program Loads (IPLs), are documented in the AS-400 System Log, which is also in Denver. Records for installation of the network hardware are maintained by the central System Administrator.

6.1.2 Local Systems

The local systems consist of computer equipment for analytical instruments, data evaluation, and upload to the LIMS. A local-area network (LAN) supports the local office software. Testing, maintenance, and repair of the local computer hardware is the responsibility of the STL Knoxville LAN Analyst. Documentation for the local systems is maintained by the LAN Analyst.

6.2 Facilities and Security

6.2.1 Central Computer Facilities

The environmental conditions of the facility housing the LIMS are controlled to protect against data loss. Access to the central computer facility in Denver is restricted by keypad entry used by IT staff. The central computer room is temperature controlled, and has an Uninterrupted Power Supply (UPS) plus a power generator to ensure that the WAN functions are not disrupted by power failures. Backup media, such as tapes and disks, are maintained daily. In addition, full volume backup copies of the raw data are shipped offsite to a commercial facility specially designed to store electronic data.

6.2.2 Local Computer Facilities

Facilities for housing local computer hardware meet manufacturer's recommendations. Electronic data is protected against environmental hazards such as fire, water damage, and strong electromagnetic fields. Backup copies of data files are made at regular intervals to protect against accidental loss through hardware or software failure.

6.2.3 Controlled Software Access

The integrity of data is also assured by maintaining limited access to administrative functions through a hierarchy of operating system shells controlled by passwords. Access is granted by the LAN analyst depending on a persons experience, training, and assigned duties (see SOP# KNOX-IT-0004 for more details).

Firewalls are in place to protect against unauthorized access from the Internet.

6.2.4 Virus Protection

Commercial virus protection programs are installed on all computers connected to the Internet or email to detect and remove computer viruses. LAN Analysts are notified whenever a virus is detected so that they can isolate any portions of the systems that may be at risk.

6.3 LIMS Raw Data

QuantIMS raw data and instrument raw data from instrument data systems such as Target, TJA, and Chemstation are stored on the laboratory servers (e.g., KNXSVR1). The Systems Administrator and the LAN Analyst are responsible for maintaining the servers.

The individuals responsible for entering and recording raw data must be uniquely identified in the data, together with the date and time the data were entered. The

instrument transmitting raw data must be uniquely identified, together with the date and time of the transmission. Further data recording requirements exist to document manual integrations (see Policy S-Q-004 for details).

Procedures for verifying raw data are discussed in LQM Sections 8.8-8.8.3.

6.4 Software

If computer software is used to acquire, process, or report client data, that software is tested to ensure that it correctly performs its intended function. Software is validated or verified, depending upon its complexity, size, and whether it was purchased or developed by STL. The following definitions are used by STL:

- Validation - the process of establishing documented evidence that provides a high degree of assurance that a specific process will consistently produce a product meeting predetermined specifications and quality attributes. This process demonstrates and documents that the software performs correctly and meets all specified requirements.

- Verification - the process of checking the accuracy of automatically (electronically) calculated information.

6.4.1 Industry Standard Software

Industry standard software programs are defined as those that are purchased and widely used without modification to the program itself. The program is initially verified for use by using tests with known solutions to demonstrate that the program is operational for the desired application.

All purchased software must be used in accordance with the terms of its software license. Any use of software contrary to its license terms is expressly prohibited by STL.

6.4.2 Testing of STL-Developed Software

For programs used to process client data and developed within STL, and externally prepared programs that are modified by STL, validation or verification must be performed. The process used is dependent upon the function of the software as follows:

- Large complex systems consisting of several programs operating in unison to produce an intended result must be validated.

- For smaller software programs which only perform numerical manipulation, sample sets of numbers for which results are known should be processed and the results verified. In this case, known results are usually generated by performing

hand calculations using the same equations and procedures as the software to verify that the software produces identical results.

- Software that performs as part of instrument operation should be verified as previously described and by processing reference materials through the instrument system. Processed instrument response should be evaluated against expected instrument response and performance.

Refer to the IT SOP governing software development and testing, KNOX-IT-0001.

6.4.3 Software Revalidation

Whenever a program is changed, the change is evaluated to determine if it is significant enough to make revalidation necessary. If features have been added, previous test problems are rerun to demonstrate that their function has not been affected. New test problems are processed, as previously discussed, to verify added performance. If a software revision changes the basic operation of the program, complete revalidation of the program may be required.

Spreadsheets and unprotected software used to acquire, process, or report client data must be documented and reverified when changes are made. The test problems used to provide initial verification are reprocessed and the results compared to demonstrate that performance of the software is unchanged.

Laboratory operations are responsible for the generation of the validation and verification documentation for instrument level software. Completed records are kept as QC records. STL Information Technology is responsible for generation and maintenance of documentation relating to verification and validation of the STL QuantIMS system.

6.4.4 Version Control

The laboratory shall maintain copies of outdated versions of software and associated manuals for all software in use at the laboratory for a period of five years from its retirement date. The associated hardware, required to operate the software, must also be retained for the same time period.

6.5 Records Retention

As required by NELAC, electronic raw data and computer documentation are stored for a minimum of five years. See LQM Section 3.0 for further records retention details.

7.0 Contract Review and Project Planning

The generation of environmental analytical data is an intricate process. Success is dependent upon the timely execution of interrelated steps. For many environmental sampling and analysis programs, testing design is site or project specific and is not necessarily the same as the laboratory's standard service. It is STL's intent to provide both standard and customized laboratory services to our clients, provided that any special requirements are documented in writing and that performing the work in this manner does not cause the laboratory to violate relevant regulatory requirements. STL Knoxville has an organizational system in place to ensure that projects are properly planned prior to project initiation. This means that laboratory personnel understand project requirements, that the client clearly understands the lab's capabilities, that the laboratory has the facilities and resources needed to perform the required tests, that samples will be properly handled, that contingency plans are in place, and that analytical data will be reported in accordance with project needs.

7.1 Contract Review

The process of client request for proposal (RFP) and the laboratory's tender of a written response is a process of communication between both parties to understand project requirements and the laboratory's capabilities. All statements of work and contracts for new work entered into by STL Knoxville are reviewed by the Customer Service Manager (CSM) or designee. Agreements for continuing work are the responsibility of laboratory Project Managers (PMs) or the CSM. Depending on the size and scope of the proposed project, the Laboratory Director and other STL management staff can also be involved. Technical staff (Operations Manager, QA Manager, and IT staff) can be called upon to perform a review of the technical and QA/QC requirements. The CSM or PM, with this internal support, will work with clients to align project requirements with laboratory capabilities. Any contract requirement or contract modification communicated to STL verbally is documented and communicated to the client in writing. Any discrepancy between client requirements and STL's capability to meet those requirements is resolved in writing before acceptance of the contract.

All contracts, Quality Assurance Project Plans (QAPP), Sampling and Analysis Plans (SAPs), contract amendments and documented communications become part of the permanent project record as detailed in Section 3.5.

7.2 Certifications and Approvals

A necessary part of the review and work acceptance procedure is the evaluation of project needs for laboratory certification. The persons reviewing the prospective project must determine if project work plans or regulatory permits are tied to specific laboratory certifications or approvals. Where such requirements exist, the laboratory must have the certifications or approvals in place before the work begins. QA personnel coordinate with

the state certification agencies to maintain or add additional parameters. Copies of current laboratory certifications are maintained by the QA office, and are available upon request.

7.3 Data Collection Process

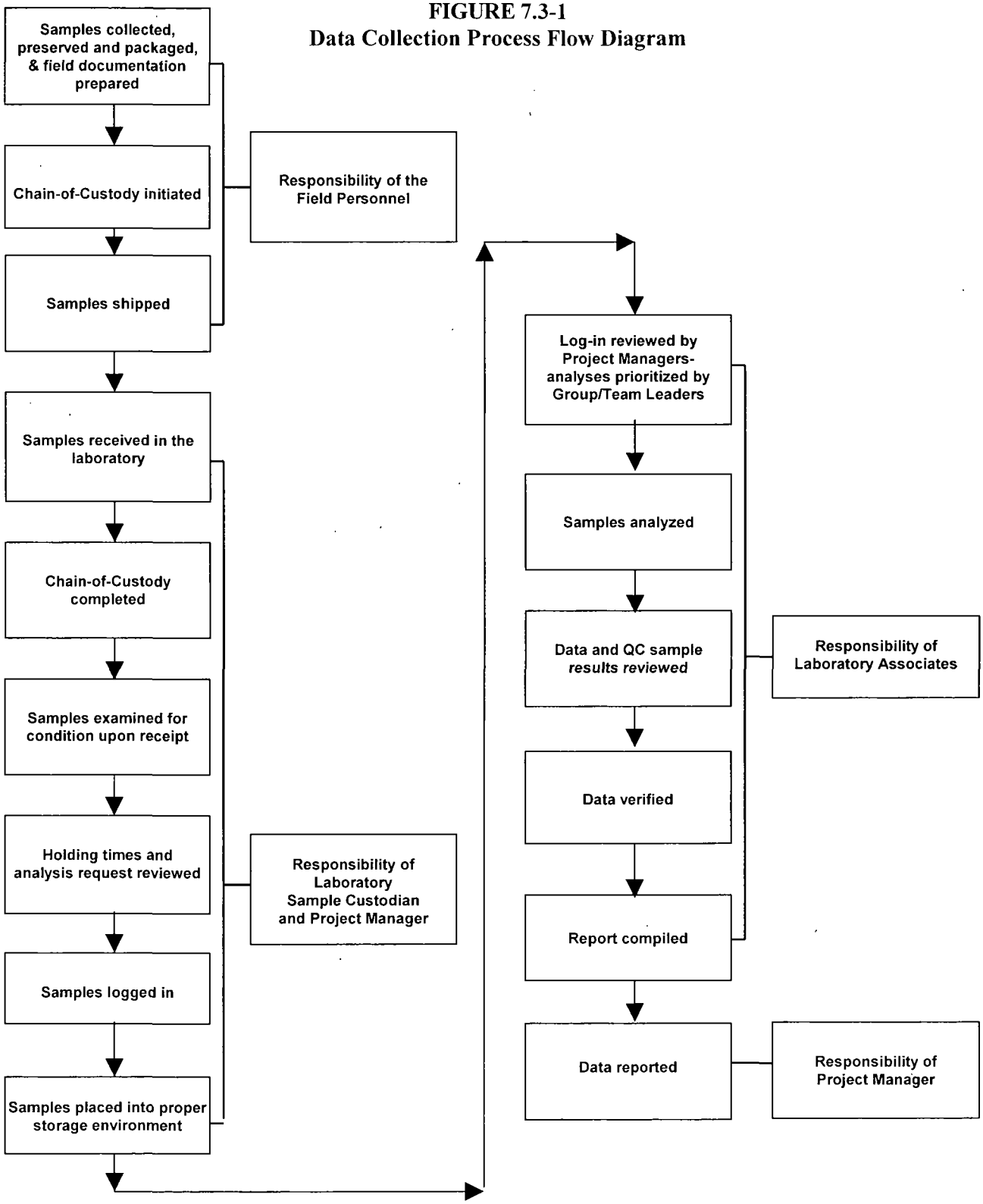
The data collection and data generation processes are shown in Figure 7.3-1. These processes are designed to produce analytical data that accurately reflect the nature of the site or sampling point.

7.4 Project Organizational Responsibilities

Each laboratory client is assigned a single point of contact, usually a PM, to ensure that there is a strong line of communication between the client and STL Knoxville. As a matter of policy, the CSM or designee, PMs, Quality Assurance personnel, the Laboratory Director and the Operations Manager work together to accomplish the following prior to receipt of samples at the laboratory:

- Samples are scheduled for arrival at the laboratory.
- All unique project requirements are identified and communicated to all appropriate personnel.
- Standardized client, state, federal, or STL programs are appropriately selected.
- Fully qualified subcontract laboratories are selected, if needed.
- A review is performed on all pre-project documents such as proposals, contracts, and/or QAPPs to identify the type of tests required and to ensure project requirements are within the scope of the laboratory being used.
- All appropriate and required preparations are made at the laboratory to accommodate or meet project requirements as described in proposals, contracts, and/or QAPPs.
- Determine that the laboratory has the capability and the capacity to analyze the samples including equipment, staff, space and workload.
- Determine that the laboratory is capable of meeting the required sample holding times and is able to report the resulting data within the time line specified by the client.
- All known safety hazards associated with the samples are communicated to all appropriate personnel.

FIGURE 7.3-1
Data Collection Process Flow Diagram



Approval and issuance of a quote, bid or contract document is documentation that this process has occurred. For particularly large or involved projects, STL Knoxville encourages our clients to visit the laboratory and/or participate in kickoff meetings with the laboratory staff. STL has found it very effective to invite the client into the laboratory's project preparations.

7.5 Communicating Project Requirements Internally

STL Knoxville PMs shall document all project-specific requirements prior to receipt of samples. The LIMS system requires the PM to enter a "quote" before any samples can be logged in. In addition to price information, the "quote" is a detailed technical specification of the work to be performed. The quote includes identification of project personnel, numbers and types of samples, tests to be performed, reporting limits, QC to be performed, control limits, data qualifier flags to be used, significant figures to be used, and the types of deliverables required. This is the primary means of communicating routine project requirements to laboratory personnel.

Brief non-routine project requirements are entered into the comments section of the Client Requirements Checklist portion of the quote. The Checklist is reviewed by analysts as analyses are being scheduled and before testing has started. If the special requirements are too lengthy for the Client Requirements Checklist, the PM must prepare a Quality Assurance Summary (QAS) or equivalent, which is a written document describing all requirements that are different than routine work. The QAS is referenced in the LIMS (e.g., the Client Requirements Checklist), and is distributed by the PM to each of the operational groups involved. For complex projects, project kickoff meetings are conducted by the PM with each of the operational groups involved.

7.6 Contingency Planning

An effective QA program must emphasize contingency planning, i.e, actions to prevent problems from recurring, and to ensure timely and effective completion of a measurement effort. The following are considered relative to contingency planning.

7.6.1 Staffing

A primary objective is to ensure that qualified staff are available to perform the necessary analytical work, regardless of employee turnover, vacation, illness, or other absences. STL Knoxville is a relatively large laboratory with multiple staff capabilities for the majority of tests performed. However, other sources of trained personnel are potentially available to assist in the event of unforeseen absences. Given sufficient time for necessary orientation, temporary agency staff can be used. More significantly, STL is a large laboratory network and a large pool of qualified staff can be made available from other STL laboratories.

7.6.2 Backup Instrumentation

Within STL Knoxville, duplicate instrumentation is available for most methods to allow uninterrupted work flow if one piece of equipment fails. The laboratory may also choose to lease equipment. However, in circumstances where a catastrophic instrument failure occurs, alternative, but equivalent, methods may be recommended to the client for approval.

7.6.3 Other Contingency Plan Elements

- Preventive Maintenance - STL's preventive maintenance program is designed to minimize analytical instrument malfunctions, permit simple adjustments, and to ensure fewer and shorter breakdowns of critical analytical equipment. (See Section 8.11, "Preventive Maintenance and Service".)

- STL Laboratories & Subcontractor Laboratories - To support the laboratory during peak periods or in the event of a critical instrument malfunction, STL has the capability to arrange for the use of other STL laboratories or other qualified analytical laboratories as subcontractors for short-term backup analytical support. However, use of a subcontractor laboratory must be approved by the client in writing. For projects requiring NELAC approval, the subcontractor must also be NELAC approved. See Section 5.3 for other procedures related to the control of subcontract laboratory services.

- Uninterruptible Power Supply - An Uninterruptible Power Supply (UPS) system provides line conditioning and backup power to the LIMS computer system/server and critical analytical instruments. This contingency allows sufficient time for the main computer system and instruments to be shut down and for data archival. All electronically generated data that are stored on the main computer systems are backed up at regular intervals.

8.0 Work Processes and Operations

Many activities related to environmental project activities are planned and designed externally to the laboratory or field operation, and are presented to the laboratory in the form of a contract, work plan, sampling and analysis plan (SAP) or QA Project Plan (QAPP). Laboratory and field activities are in turn planned, implemented, and assessed by STL to meet client requirements according to approved procedures and methodologies. The LQM provides the systems to document and implement these activities. The execution and assessment of the implemented operational systems are detailed in STL SOPs. The entire process is assessed on a regular basis for conformance to prescribed requirements.

Standard practices for STL Knoxville operations are detailed in this section. Specific project or program requirements may differ from those described here, but they must be explicitly stated in approved contracts, work plans, QAPPs or other project documents. Special project requirements can generally be accommodated provided that they are properly documented, communicated, and they do not cause the laboratory to violate relevant regulatory requirements.

Table 8-1 lists the test methods performed by STL Knoxville. Table 8-2 lists the SOPs associated with those methods. Table 8-3 provides a list of the major equipment in place at the laboratory, and Figure 8.11-1 (at the end of this section) shows the laboratory floor plan.

8.1 Traceability of Measurements

STL documents all laboratory activities in sufficient detail to allow their reconstruction. To this end, documentation is generated to trace a sample from its point of origin, through receipt in the laboratory, analysis, reporting and disposal.

The required documentation includes, but is not limited, to:

- Chain of custody documenting movement and possession of samples
- Sample preparation
- Sample analysis
- Calibration and QC data associated with the samples
- Instrument maintenance
- Control of ancillary equipment and materials (e.g., deionized water and glassware)
- Sample disposal
- Final reports

These topics are described in this section. Traceability of chemical standards is also discussed in Section 5.2.4.

8.2 Analytical Methods

Whenever possible, STL operations use industry- and regulatory agency-recognized analytical methods from source documents published by agencies such as the Environmental Protection Agency (EPA), Department of Energy (DOE), and the American Society for Testing and

Materials (ASTM) as described in STL's SOPs. Analytical methods performed by STL Knoxville are given in Table 8-1. The methods approved by a NELAC Accrediting Authority are indicated in the table.

Method performance data, as described in Section 8.2.2 below, are developed by the laboratory operations staff to demonstrate method proficiency. The operations staff and the QA staff evaluate and approve the performance data before a methodology is performed routinely. The method must also be described and documented in an SOP.

8.2.1 Standard Operating Procedures

SOPs are required for all repetitive analytical and administrative activities ranging from the receipt of samples in the laboratory through their analysis, reporting, and subsequent disposal. Training, health and safety procedures, QC, method procedures, and instrument and equipment calibrations are included in SOPs. SOP requirements are discussed in the SOP KNOX-QA-0018, "Preparation and Management of SOPs". The specifications in the SOP meet NELAC requirements. Table 8-2 lists laboratory standard operating procedures.

New SOPs and proposed SOP revisions are reviewed by technically qualified lab personnel. SOPs are controlled documents and are distributed and maintained as described in SOP KNOX-QA-0018. Requirements for SOP approval and frequency of review are listed in Tables 2-3 and 2-4. All significant modifications to the published method are described in a section of the SOP. All operations must be performed as described in these SOPs.

Planned changes in procedure, which may occur due to expected sample matrix effects or project requirements, are documented in the project files. These planned changes may be documented using nonconformance memos, NCMs (see discussion of NCMs in section 9.1), project-specific case narratives, or as modifications or additions to associated QAPPs.

Unplanned deviations in the SOPs, which may occur due to sample matrix or other events, are documented in NCMs and in the project-specific case narratives.

8.2.2 Method Validation and Verification

Before analyzing samples by a new method or method modification, the method must be verified or validated and analyst capability must be demonstrated (see Section 4.4).

8.2.2.1 Method Verification

Method verification is required for methods developed by authoritative agencies, such as EPA or ASTM. The level of verification can vary

depending on the type of method or level of modification, but generally should include:

- Determination of method sensitivity,
- determination of working range,
- an initial demonstration of capability (as specified by NELAC), and
- a written SOP or project-specific written protocol.

Each of these is described in the next section.

8.2.2.2 Method Validation

A complete validation is required for methods developed by STL Knoxville. While method validation can take a variety of courses, the following are the key concerns:

Determination of Method Selectivity
Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices. In some cases, to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

Determination of Method Sensitivity
Method sensitivity is normally demonstrated using the 40 CFR Part 136 Appendix B method detection limit protocol (see MDLs, section 8.2.3, below), but can also be based on variance of blank results and signal-to-noise ratios.

Determination of Interferences
This is demonstrated by analyzing samples of the matrix of interest that are known to be free of the analyte(s) of interest.

Determination of Range
In most cases, analytical range is determined and demonstrated by comparison of the response of an analyte at different concentrations to targeted criteria. The curve is used to establish the range of quantitation, with the lower and upper values representing the upper and lower quantitation limits.

Determination of Accuracy and Precision
Accuracy and precision studies are generally performed using replicate analyses of samples of known concentration. The resulting percent recovery and relative standard deviation, or other precision measure are calculated and compared to a set of target criteria.

Documentation of Method
The method is formally documented in an SOP (see SOP KNOX-QA-0018 for details).

Continued Demonstration of Method Performance
Continued ability of the lab to perform the method is addressed in the SOP. Generally this is accomplished with the specified calibration and batch QC requirements.

8.2.3 Method Detection Limits

It is STL Knoxville's policy to follow the specifications in the U.S. EPA 40 CFR Part 136 Appendix B in determining MDLs for chemical tests. The STL requirement for this procedure is detailed in the SOP S-Q-003 "Method Detection Limit Studies," and further defined in the STL Knoxville attachment to the SOP. This procedure requires that the MDLs be determined for each analyte of interest representing the aqueous and solid matrices within the capability of the primary analytical methods. The laboratory's MDLs are subject to update. Current MDLs are available from the laboratory upon request.

8.2.4 Instrument Detection Limits

Instrument Detection Limits (IDLs) are required to be performed quarterly for metals constituents and cyanide when analyses are performed in support of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) activities or when the USEPA CLP SOW protocol is required. IDLs will also be performed annually for the SW-846 methods. When required, IDLs will be performed as described in the associated laboratory SOPs.

Prior to acceptance and use for reporting purposes, all data from detection limit studies and reporting limits must undergo technical review and approval by the laboratory management and QA staff.

8.2.5 Reporting Limits

Reporting limits are established and modified within STL according to the SOP S-T-002, "Reporting Limits for Laboratories Using QuantIMS." Two reporting limit conventions are discussed in the policy: the standard Reporting Limit (RL) and the Project-Specific Reporting Limit (PSRL). The standard STL RL is the lowest level at which measurements become quantitatively meaningful. The RL is always greater than the statistically determined MDL. PSRLs are used when project data quality objectives (DQO) require a reporting limit other than the standard RL. PSRLs tailor STL's product to meet customer requirements. Higher PSRLs may be established based on maximum contaminant levels (MCLs), applicable or relevant and appropriate requirements (ARARs), or project-specific DQOs. PSRLs below the lab's standard RL may be used, but they must be supported by the MDL and the instrument calibration.

A standard at the PSRL taken throughout the entire preparation and extraction procedure may be used to support a PSRL with QA approval. The STL RLs and PSRLs are maintained in the LIMS. STL Knoxville RLs are provided in Tables 8-4-1 through 8-4-26.

8.3 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements used to ensure the generation of the type, quantity, and quality of environmental data that will be appropriate for the intended application (EPA 1994)[1]. Typically, DQOs are identified during project scope and the development of sampling and analysis plans. In this LQM, however, we refer to only the analytical DQOs because laboratories generally do not have any authority over sample collection, shipment, or other field-related activities that may affect the data quality of the environmental sample before the sample is received in the laboratory. The EPA has established six primary analytical DQOs for environmental studies. These DQOs are precision, accuracy, representativeness, completeness, comparability, and detectability.

The components of analytical variability (uncertainty) can be estimated when QC samples of the right types and quantities are incorporated into measurement procedures at the analytical laboratory. STL incorporates numerous QC samples to obtain data for comparison with the analytical DQOs and to ensure that the measurement system is functioning properly. The QC samples and their applications, described in Section 8.4, are selected on the basis of method or client-specific requirements. Field blanks, field duplicates, and performance evaluation (PE) samples are received from the client as unknown samples. Analytical laboratory QC samples for inorganic and organic analyses may include calibration or instrument blanks, method blanks, duplicates, replicates, laboratory control samples (LCSs), calibration standards, matrix spikes (MSs), matrix spike duplicates (MSDs), post-digestion spikes (PDSs) and surrogate spikes.

8.3.1 Precision and Accuracy

Precision is an estimate of variability, that is, it is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed, similar conditions. The precision of a measurement system is affected by random errors. Precision is expressed either as relative standard deviation (RSD) for replicate measurements greater than two or as relative percent difference (RPD) for duplicate measurements. Table 8-5 illustrates the formula used to calculate units of precision (i.e., RSD and RPD).

Accuracy is the degree of agreement between a measurement and the true or expected value, or between the average of a number of measurements and the true or expected value. Systematic errors affect accuracy. For chemical properties, accuracy is expressed either as a percent recovery (R) or as a percent bias (R - 100).

[1] "Guidance for the Data Quality Objectives Process", EPA 600/R-96/005, September 1994.

The precision and accuracy measures that are to be used in evaluating inorganic and organic constituents at STL are provided in Tables 8-6 through 8-8, in method-specific SOPs, and in the documentation for the analytical method of interest.

Precision and accuracy are determined, in part, by analyzing data from matrix spike and matrix spike duplicates, unspiked duplicates, LCSs, PDSs and single blind audit samples. A description of these QC samples is provided in Section 8.4.

8.3.2 Completeness

Completeness is a measure of the percentage of measurements that are judged to be valid measurements. Typically, a data quality objective of at least 90% completeness is specified in quality assurance project plans.

8.3.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy, therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result (concentration) is representative of the constituent concentration in the sample matrix. At STL, efforts must be made to analyze an aliquot that is representative of the original sample, and to reasonably homogenize the sample before subsampling.

8.3.4 Comparability

Comparability is a measure of the confidence with which one data set can be compared to another. To ensure comparability, all laboratory analysts are required to use uniform procedures (i.e., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

8.4 Quality Control Samples

Two types of Quality Control (QC) samples are field QC samples and laboratory QC samples. Field QC samples are collected during the sampling event and are useful in determining sampling precision and accuracy and monitoring for contamination that may occur during collection, transport or storage of environmental samples. Laboratory QC samples are routinely added at the laboratory to the normal sample stream. Successful analysis of these samples demonstrates that the laboratory is operating within prescribed requirements for accuracy and precision. In addition, by utilizing matrix-specific laboratory QC samples, information regarding the effect of the matrix or field conditions on the analytical results can be obtained. The following sections describe common field and laboratory QC samples.

8.4.1 Field QC Samples

When field QC sample collection and analysis are required for a project, it is the responsibility of the client to ensure that this sampling is performed correctly and at the project-required frequencies. Field QC samples may or may not be identified as such to the laboratory and are considered by the laboratory as field samples for the purpose of QC batching, sample preparation and analysis. Field QC sample results are reported in the same manner as actual field samples, unless a specific deliverable is requested by the client. No correction of the analytical data is done in the laboratory based on the analysis of field QC samples.

Field QC sample types, applicability to organic and inorganic analyses, precision and accuracy applications and by whom they are introduced are summarized in Table 8-9.

8.4.2 Laboratory QC Samples

Laboratory performance QC is required to ensure the laboratory systems (instrumentation, sample preparation, analysis, data reduction, etc.) are operating within acceptable QC guidelines during data generation as required to meet the client's objectives. Laboratory QC samples consist of method blanks (MB), instrument blanks, laboratory control samples (LCS) and calibration verification samples. In addition to laboratory performance QC, matrix-specific QC is utilized to determine the effect of the sample matrix on the data being generated. Typically, this includes matrix spikes (MS), matrix spike duplicates (MSD), sample duplicates, PDS/PDSD and the use of surrogate compounds.

Laboratory and matrix-spike QC sample types are summarized in Tables 8-10 through 8-12. In addition, Tables 8-6 through 8-8 list laboratory QC samples, acceptance criteria and corrective actions by reference method for inorganic methods, organic methods, and the USEPA CLP Statements of Work, respectively. The following sections provide descriptions of laboratory QC samples and their frequency of use. Policy QA-003, "Quality Control Program", describes in detail the QC data evaluation process.

8.4.2.1 Quality Control (QC) Batch

The QC batch consists of a set of up to 20 field samples that behave similarly (i.e., same matrix) and are processed using the same procedures, reagents, and standards within the same time period. This definition of a QC batch is utilized by STL unless there is clear regulatory guidance, contract specifications, or differing client requirements that are explicitly documented. Further details and requirements for the application of the definition of QC batch are described in Policy QA-003.

8.4.2.2 Method Blank

The method blank (MB) is a QC sample that consists of all reagents specific to the method and is carried through every aspect of the procedure, including preparation, cleanup, and analysis. The method blank is used to identify any interferences or contamination of the analytical system that may lead to the reporting of elevated analyte concentrations or false positive data. Potential sources of contamination include solvents, reagents, glassware, other sample processing hardware, or the laboratory environment. In general, the method blank is a volume of deionized laboratory water for water samples, or a purified solid matrix for soil/sediment samples, that is processed as a sample. In the event that no appropriate solid matrix exists, deionized water may be used. The volume or weight of the method blank must be approximately equal to the sample volume or sample weight processed. A method blank shall be prepared with each group of samples processed.

8.4.2.3 Instrument/ Calibration Blank

The instrument blank is an unprocessed aliquot of reagent used to monitor the contamination of the analytical system at the instrument. System contamination may lead to the reporting of elevated analyte concentrations or false positive data. The instrument blank does not undergo the entire analytical process and generally consists of an aliquot of the same reagent(s) used for a sample dilution. Instrument blanks are also referred to as initial calibration blanks (ICBs) and continuing calibration blanks (CCBs).

8.4.2.4 Laboratory Control Sample

A laboratory control sample (LCS) is a laboratory-prepared, suitable clean matrix sample that is fortified with target analytes or a solid reference material purchased from an approved vendor. The LCS contains selected target analytes specified in the method, and must contain the same analytes as the matrix spike and matrix spike duplicate. For certain regulatory or client programs, an LCS may contain a full list of analytes. However, in these cases, a subset of analytes, as defined by the program, may be used to determine the acceptability of a batch of sample data. The LCS recovery data are used to monitor the analytical method performance in terms of analytical accuracy. On-going evaluation of the LCS recoveries demonstrates that the laboratory is performing the method within statistical control (i.e., accuracy and precision) in the absence of matrix interference. The LCS results, coupled with MS data, help determine whether the laboratory performed the method correctly and if the sample matrix affected the analytical results. When a laboratory control sample duplicate (LCSD) is required, a percent recovery for each target analyte is calculated, as well as a relative percent difference (RPD) between the LCS and the LCSD.

8.4.2.5 Matrix Spike

A matrix spike (MS) is an environmental sample to which known concentrations of selected target analytes have been added. MS samples are analyzed to evaluate the effect of the sample matrix on the analytical methodology. MS samples are generated by taking a separate aliquot of an actual field sample and spiking it with the selected target analyte(s) prior to sample extraction. The MS sample then undergoes the same extraction and analytical procedures as the unfortified client sample. Due to the potential variability of the matrix of each sample, these results may have immediate bearing only on the specific sample spiked and not on samples collected at other locations that are included in the QC batch.

8.4.2.6 Matrix Spike Duplicate

A matrix spike duplicate (MSD) is a second aliquot of a sample that is spiked with the selected target analyte(s) and analyzed with the associated sample and MS sample. The results of the MS and MSD are used together to determine the effect of a matrix on the accuracy and precision of the analytical process. Due to the potential variability of the matrix of each sample, the MS/MSD results may have immediate bearing only on the specific sample spiked and not all samples in the QC batch.

8.4.2.7 Sample Duplicate

A sample duplicate is a second aliquot of an environmental sample taken from the same sample container that is processed identically with the first aliquot of that sample. That is, sample duplicates are processed as independent samples within the same QC batch. The results are compared to determine the sample homogeneity and the precision of the analytical process.

8.4.2.8 Surrogates

Surrogates are organic compounds that are similar in chemical composition and behavior to the target analytes but that are not normally found in environmental samples. Surrogates are added to all appropriate samples and QC samples being tested for organic analytes to monitor the effect of the sample matrix and the procedure on the accuracy of the process.

8.4.2.9 Post-digestion Spike

A post-digestion spike is created by spiking target analytes into a prepared portion of a sample just prior to analysis. It provides information on matrix effects encountered during analysis such as suppression or enhancement of instrument signal levels. It is most often used in elemental analysis involving various forms of atomic emission or atomic absorption spectroscopy. A

single analytical spike serves as a single point application of the "method of standard additions" or MSA.

8.4.2.10 Interference Check Sample

An interference check sample (ICS) is a solution containing known concentrations of both interfering and analyte elements. Analysis of this sample by ICP can be used to verify background and interelement correction factors.

8.4.2.11 Internal Standards

An internal standard (IS) is a compound or element with similar chemical characteristics and behavior in the analysis process to the target analytes, but is not normally found in environmental samples. The internal standard is usually added after sample preparation. The primary function of the internal standard is quantitation; however, it also provides a short-term indication of instrument performance. For isotope dilution methods, internal standards are added during sample preparation and are used for quantitation.

8.5 Data Collection Operations

Laboratory analyses are designed to produce data that are representative of existing conditions present at the time the sample was obtained. The data collection design includes field sampling events, sample handling and custody, analytical operations, data recording procedures, data assessments, data verification, and data reporting requirements and techniques to assess limitations of data use. These operations are discussed in this section through section 8.10.

8.5.1 Field Collection and Shipment

In order to provide a sample that most accurately represents the test matrix, field sample collection personnel must abide by the sample collection guidelines and procedures established by involved regulatory agencies. A significant part of the efforts of regulatory agencies include the use of appropriate sample containers, chemical and physical preservation techniques, and observance of specified holding times. It is imperative that all samples be collected and preserved according to the appropriate analytical method specified in the QAPP (if one exists). Although the sampling may be performed by non-STL personnel, the importance of sampling and transportation of the sample to the laboratory is understood and must be considered during data validation.

The sample acceptance policy must be made available to sample collection personnel (refer to section 8.5.3.2).

Field personnel are responsible for labeling each individual sample collected with the following information:

- Project name
- Unique client sample number
- Sample location (including as appropriate: borehole and depth or grid coordinates)
- Sampling date and time
- Sample preservation
- Analysis required.

An overriding consideration for the resulting analytical data is the ability to demonstrate that the samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, laboratory custody, and disposal must be documented to accomplish this. Figure 8.5-1 shows an example Chain-of-Custody (COC) form that is used by the STL laboratory to document this evidence. Field personnel are responsible for initiating the COC form.

The prompt shipment of samples to the laboratory is necessary to ensure that required holding times are met. Samples should be shipped by an overnight carrier, be hand-delivered, or transported in a manner that assures prompt delivery to the laboratory. Some sites require an extensive radioactive screening process before a sample may be shipped. In these cases, it is imperative for the Project Manager to maintain good communication with the client to assure proper staffing of the laboratory in response to a decreased holding time.

Radioactive samples that are shipped to STL Knoxville must be screened prior to delivery to the laboratory and found not to contain radioactivity that exceeds the level stated in the laboratory's radiological license. Samples received by STL Knoxville containing radioactivity exceeding the license limit will immediately be returned to the project site.

FIGURE 8.5-1
Example STL Chain-of-Custody Form

Reference Document No. _____
Page 1 of _____

Project Name/No.: _____
Sample Team Members: _____
Profit Center No.: _____
Project Manager: _____
Purchase Order No.: _____
Required Report Date: _____

Sample Shipment Date: _____
Lab Destination: _____
Lab Contact: _____
Project Contact/Phone: _____
Carrier/Waybill No.: _____

Bill To: _____

Report To: _____

ONE CONTAINER PER LINE

Sample Number	Sample Description/Type	Date/Time Collected	Container Type	Sample Volume	Preservative	Requested Testing Program	Condition on Receipt	Disposal Record No.

Special Instructions:

Possible Hazard Identification:
Non-hazard ❑ Flammable ❑ Skin Irritant ❑ Poison B ❑ Unknown ❑

Sample Disposal:
Return to Client ❑ Disposal by Lab ❑ Archive _____ (mos.)

Turnaround Time Required:
Normal ❑ Rush ❑

QC Level:

1. Relinquished by: *(Signature/Affiliation)*	Date: _____ Time:	1. Received by: *(Signature/Affiliation)*	Date: _____ Time:
2. Relinquished by: *(Signature/Affiliation)*	Date: _____ Time:	2. Received by: *(Signature/Affiliation)*	Date: _____ Time:
3. Relinquished by: *(Signature/Affiliation)*	Date: _____ Time:	3. Received by: *(Signature/Affiliation)*	Date: _____ Time:

Comments:

8.5.2 Sample Containers, Shipping Containers, Preservatives, and Holding Times

8.5.2.1 Sample Containers

A sample container is defined as the sealed enclosure, usually made of plastic or borosilicate glass, that the sample is collected in and stored in until analysis. All sample containers provided by STL operations for environmental sampling are new, with the exception of some air sampling canisters, which must be recertified before reuse, and demonstrated to be clean for their appropriate use. All documentation certifying sample container cleanliness must be maintained by the laboratory or the vendor and can be provided to the client upon request. The sample containers to be supplied are listed in Tables 8-13 through 8-16. Container volumes listed in these tables may be decreased with the approval of the laboratory QA Manager or Technical Director to accommodate reduced sample volumes required by the facility SOP.

8.5.2.2 Shipping Containers

Shipping containers are defined as the sealed enclosure in which the sample containers are stored during shipment from the sample collection site to the analytical laboratory. Shipping containers must be of sufficient number and size to accommodate the samples in an upright condition. Shipping containers must also meet all requirements for the shipment of environmental and/or radioactive samples.

Packaged samples must be shipped to the analytical laboratory in a safe manner that preserves the integrity of the samples. The most common method of sample shipment employs coolers or ice chests that are sealed with custody tape and shipping tape. These coolers must be durable and resistant to crushing during shipment. All coolers must be well maintained and cleaned to prevent cross-contamination of the samples. It is the ultimate responsibility of the person collecting and packaging the sample for shipment to ensure that the shipping containers are clean and functional.

To help prevent sample breakage during shipment, additional consideration must be given to providing shock absorbency to all samples packaged inside the shipping container. Use of bubble-wrap around each sample container is the best way to provide this protection. Foam packing materials and vermiculite are also successfully used.

8.5.2.3 Sample Preservatives

Most analytes have a finite holding time in a given sample matrix. Sample

preservation is the chemical or physical means by which samples are treated during and/or following sample collection to aid in the stability of the analytes of interest in that matrix. Sample holding times are adversely affected when samples are improperly preserved or shipped unpreserved. The preservation of samples at the time of sample collection follows the requirements of the analytical methods used. This preservation includes the addition of reagents to deter chemical and biochemical degradation and the maintenance of refrigeration during transit and ultimate storage in the laboratory. The required preservatives for the analyses to be performed on each matrix are included in Tables 8-13 through 8-16.

8.5.2.4 Sample Holding Times

Holding time is defined as the maximum allowable time a sample can be stored after sample collection and preservation (or laboratory receipt for CLP) until appropriate processing occurs (preparation or analysis). The holding time may vary according to method or client requirements. Tests designated with holding times as "analyze immediately or ASAP" are considered parameters that should be tested by field personnel or on-site. A system is in place to ensure that holding times are monitored by each group within the operating unit. It is the responsibility of each STL associate processing the sample to assure that holding times are met. STL is responsible for meeting all holding times for properly preserved samples received within 48 hours of collection or if less than half the holding time has passed. If these conditions are not met, STL will attempt to expedite sample analysis as soon as possible. Sample holding times are listed in Tables 8-13 through 8-16.

8.5.3 Sample Handling

STL Knoxville's SOP KNOX-SC-0003 describes the sample receipt and log-in process in detail. The following sections describe the general policies followed by STL.

8.5.3.1 Sample Receipt

Samples shall be received and logged in at STL by a designated sample custodian or other properly trained associate. Upon sample receipt, the sample custodian shall, as appropriate:

- Wear appropriate personal protective equipment. At a minimum, this consists of gloves, a lab coat and safety glasses.
- Examine the shipping containers to verify that the custody tape is intact.
- Examine all sample containers for damage.
- Open shipping containers in adequately ventilated areas to assure worker

safety.

- Determine if the temperature required by the requested testing program has been maintained during shipment. Document the shipping container temperature on the COC.
- Compare samples received against those listed on the COC.
- Verify that sample holding times have not been exceeded.
- Examine all shipping records for accuracy and completeness.
- Verify sample pH if it is required preservation for the scheduled analysis (except VOA samples) and record on the COC. Also check for residual chlorine (if required) and note on the COC.
- Sign and date the COC immediately (only after shipment is accepted) and retain the waybill and/or the waybill number.
- Note any problems associated with the coolers and samples on the COC, immediately initiate a Condition Upon Receipt Report (CUR) or equivalent form, and notify the PM who, in turn, notifies the client.
- Attach durable (water-resistant) laboratory sample container labels with unique laboratory identification number and test.
- Place the samples in proper laboratory storage.

A CUR or an equivalent form/system is generated by sample control during the sample log-in process and is used to document anomalies identified upon the receipt of samples in the laboratory. These anomalies are outside of laboratory control and may not require corrective actions to be taken within the laboratory. The affected client shall be notified by the PM or designee of all CUR anomalies for their samples. The PM is responsible for resolving with the client how to proceed with the samples and documenting the decision to proceed with the analysis of compromised samples. The completed CUR form shall be stored in the project file. An example CUR is shown in Figure 8.5-2. The report narrative will include an explanation of sample receiving related anomalies. Further details are given in SOP KNOX-AD-0004.

8.5.3.2 Exceptions or Discrepancies

STL reserves the right to reject samples, as required by NELAC, for any of the following reasons:

- No custody seals as required by project.
- No chain of custody documentation provided.
- Preservation inappropriate for analysis requested.
- Sample container inappropriate for analysis requested.
- Sample received out of holding time for analysis requested.
- Incomplete sample information provided.
- Discrepancies between COC and sample labels.
- Samples have high levels of polychlorinated dibenzo-p-dioxins/ dibenzo furans (PCDD/PCDFs.)

- Samples have a high level gross alpha or beta radiation.
- Samples are from a site known to contain chemical warfare agents (CWAs) and the samples have not been screened for them.

These or any other project exceptions or discrepancies are discussed with the client and agreed upon actions are taken.

8.5.3.3 Sample Log-in

Sample log-in activities at STL are fully documented in SOP KNOX-SC-0003. The following is a general description of the log-in process:

- Enter the samples in the LIMS which contains the following information at a minimum:
  - Project name or identification number
  - Unique sample numbers (both client and internal laboratory)
  - Type of samples
  - Required tests
  - Date and time of laboratory receipt of samples
  - Field ID supplied by field personnel
- Notify the PM and appropriate Group/Team Leader(s) of sample arrival
- Place the completed COCs, waybills, and any additional documentation in the project file.

8.5.3.4 Sample Storage

The primary considerations for sample storage are:

- Maintenance at the method prescribed temperature, if required.
- Maintenance of sample integrity through adequate protection from contamination from outside sources or from cross-contamination of samples. Low-level and high-level samples, when known, should be stored separately. Samples and standards must be stored in separate refrigerators or freezers. Storage areas for volatile organic test requests should be monitored twice per month by the analysis of a holding (refrigerator) blank (an aliquot of contaminant-free water stored in a VOA vial).
- Security of samples within the laboratory.

The requirements listed in Tables 8-13 through 8-16 for temperatures and holding times shall be used. Placing of samples in the proper storage environment is the responsibility of sample control personnel. The PM or designee shall have the responsibility of notifying the Group/Team Leaders or their designees if there are any samples that must be analyzed immediately because of holding time requirements.

STL KNOXVILLE SAMPLE RECEIPT/CONDITION UPON RECEIPT ANOMALY CHECKLIST

Client: _____ **Project:** _____ **Lot Number:** _____

Review Items	Yes	No	NA	If No, what was the problem?	Comments/Actions Taken
1. Do sample container labels match COC? (IDs, Dates, Times)				☐ **1a** Do not match COC ☐ **1b** Incomplete information ☐ **1c** Marking smeared ☐ **1d** Label torn ☐ **1e** No label ☐ **1f** COC not received ☐ **1g** Other:	
2. Is the cooler temperature within limits? (North Carolina, 1668, 1613B: 0-4°C; VOST: 10°C) (Cooler temp should be used only if no temp blank.)				☐ **2a** Temp Blank = _____ ☐ **2b** Cooler Temp = _____	
3. Were samples received with correct chemical preservative (excluding Encore)?				☐ **3a** Sample preservative =	
4. Were custody seals present/intact on cooler and/or containers?				☐ **4a** Not present ☐ **4b** Not intact ☐ **4c** Other:	
5. Were all of the samples listed on the COC received?				☐ **5a** Samples received-not on COC ☐ **5b** Samples not received-on COC	
6. Were all of the sample containers received intact?				☐ **6a** Leaking ☐ **6b** Broken	
7. Were VOA samples received without headspace?				☐ **7a** Headspace (VOA only)	
8. Were samples received in appropriate containers?				☐ **8a** Improper container	
9. Did you check for residual chlorine, if necessary?					
10. Were samples received with ≥½ HT remaining?				☐ **10a** Holding time expired ☐ **10b** <½ HT left	
11. For rad samples, was sample activity info. provided?				☐ Incomplete information	
12. For SOG water samples (1613B, 1668A, 8290, LR PAHs), do samples have visible solids present?				If yes, was SOG notified? _____	
13. Are the coolers intact?				☐ **13a** Leaking ☐ **13b** Other:	
14. Was COC relinquished? (Signed/Dated/Timed)				☐ **14a** Not relinquished by client	
15. Are tests/parameters listed for each sample?				☐ **15a** Incomplete information	
16. Is the matrix of the samples noted?				☐ **15a** Incomplete information	
17. Is the date/time of sample collection noted?				☐ **15a** Incomplete information	
18. Is the client and project name/# identified?				☐ **15a** Incomplete information	
19. Was the sampler identified on the COC?				☐ **15a** Incomplete information	

Quote #: _____ PM Instructions: _____

Sample Receiving Associate: _____ Date: _____ QA026R14.doc, 7/12/04

FIGURE 8.5-2
Example STL Knoxville Condition Upon Receipt Anomaly Report (CUR)

8.5.3.5 Internal Sample Chain-of-Custody and Interlaboratory Transfers

Sample custody within STL Knoxville is described in SOP KNOX-SC-0004. Internal COC may be required for programs defined by state or federal agency. The sample custody documentation shall include the following minimum requirements:

- Name of associate taking custody of the sample from the sample storage area for preparation or analysis.
- Dates sample removed from and returned to the sample storage area.
- Identification of tests to be performed on the sample aliquot(s) selected by the associate.
- Sample matrix.
- Laboratory sample numbers.
- Sample storage location.

Access at STL Knoxville is restricted to prevent any unauthorized contact with samples, extracts, or documentation.

Samples transferred to a different laboratory than the original receiving facility are transferred under chain-of-custody (COC). The COC is maintained whether the laboratory is another STL facility or a subcontracted laboratory. If all sample containers are transmitted, the original copy of the client's COC form will be used to document the relinquishing of the samples and will accompany the samples to the destination. A copy of the completed COC form shall be retained in the laboratory project file. In the case where an aliquot of a sample is shipped from the laboratory, a new COC will be generated by the laboratory and shipped with the sample aliquot. The original COC will be retained in the project file at the site holding the original sample container until the sample results are reported.

Samples are not transferred to other STL facilities or to subcontractor laboratories without prior approval of the client.

8.5.3.6 Subsampling

Sample preparation procedures are referenced in the method SOPs. SOP KNOX-QA-0006 describes processes for obtaining representative subsamples.

8.5.3.7 Sample Disposal and Return Chain-of-Custody

After the requested analyses on the samples have been completed, any remaining portions of the samples will be maintained by the sample custodian until the

samples are disposed of or returned to the client. Sample disposal procedures and documentation are described in SOP KNOX-SC-0005. STL's routine sample retention period is at least thirty days after the analytical report is issued to the client, unless otherwise specified by the client.

For Nuclear Regulatory Commission (NRC) or state licensed laboratories, a real-time inventory of all radioactive isotopes contained in the laboratory (including radioactive samples), as required by the NRC or state, is maintained by the Radiation Safety Officer (RSO). If the quantities of radioactive materials in-house approach the limits stipulated by the laboratory NRC or state license, appropriate action must be taken to ensure the licensed level is not exceeded. This may involve returning samples to clients immediately.

If samples are returned to the client rather than disposed of by the laboratory, the original COC or a new COC is used to document custody transfer back to the client from the laboratory. A copy of the completed COC is retained in the laboratory project records.

8.5.4 Calibration Procedures and Criteria

All equipment and instruments used at STL operations for quantitative measurements are controlled by a formal calibration program. Table 8-3 lists the lab's major analytical instrumentation, and Tables 8-17 through 8-20 outline calibration requirements. Calibrations may be periodic or operational. These are described in the lab's method SOPs. The Policy P-T-001, "Selection of Calibration Points", is applicable when the number of data points is not described in the method. At a minimum, these calibration procedures shall include:

- Instrument to be calibrated.
- Reference standards used for calibration.
- Calibration technique (e.g., linear, quadratic).
- Acceptable performance tolerances and corrective actions required if specifications are not met.
- Frequency of calibration.
- Calibration documentation requirements.

Whenever possible, recognized procedures such as those published by ASTM or the USEPA or procedures provided by manufacturers shall be adopted. If established procedures are not available, a procedure shall be developed, considering the type of equipment, stability characteristics of the equipment, required accuracy, and the effect of operation error on the quantities measured.

8.5.4.1 Physical Reference Standards

Physical reference standards associated with periodic calibrations include weights for calibrating balances and certified thermometers for calibrating working thermometers. Whenever possible, physical reference standards shall be

calibrated by a body that can provide traceability to nationally or internationally recognized standards. If these standards are not available, the basis for the reference standard shall be documented.

Physical reference standards shall be used only for calibration procedures and shall be stored separately from equipment used for analysis.

8.5.4.2 Chemical Reference Standards and Reagents

Chemical reference standards are generally associated with operational calibration. These standards include reference materials traceable to recognized standards suppliers. This may include vendor-certified materials traceable to national or international standard reference materials (e.g., NIST). This topic is also discussed in the Section on "Procurement of Supplies and Services" (see 5.2.4).

All chemical reference standards maintained in the laboratory for use in calibrations (or as QC spiking solutions) and reagents prepared in the laboratory shall be labeled or referenced to appropriate documentation (hard copy or electronic) with the following information at a minimum:

- A unique identification including concentration (solutions containing several analytes can be identified such that the solution constituents and concentrations can be referenced to a logbook).
- Medium prepared in (if non-aqueous).
- Preparation date.
- Expiration date.
- Initials of preparer.

Vials containing standard solutions that are not large enough to accommodate labels listing the above information may be referenced to a laboratory logbook/notebook entry or standards software. The expiration date of the working standard and reagent must not exceed the expiration date of the original material. These records should provide sufficient detail to allow one to reproduce the standard or reagent.

Records for all purchased standards and reagents shall include the date of receipt, the date opened, and, where applicable, the expiration date.

8.5.4.3 Standard Verification

When possible, reference standards are purchased from a STL preapproved vendor. Standards are verified by quantitation against a second known standard before reporting data. The standard for verification must meet the laboratory's criteria for the independent/second source initial calibration verification (ICV). Therefore, the verification of a new initial calibration standard with a second source ICV meets this verification requirement. Realizing that some "bad acting"

analytes may not meet these criteria, alternative criteria must be approved by the QAM before use. Standard spiking solutions and surrogates shall be verified by analyzing an LCS with the new standards and verifying against historical control limits. Special standards that are obtained from another source must also be independently verified at the lab. Verification by the laboratory of a reference standard from neat materials is also necessary.

An independent or second source standard is used to verify initial calibrations. An independent/second source standard is defined as a standard composed of the same target constituents as, but from a different source than, those used in the standards for the initial calibration. An independent standard may be a laboratory-prepared or a certified independent standard solution. Independence of reference material can be achieved by: (1) purchasing reference materials from two separate vendors, (2) using a different lot from the same vendor that is certified by the vendor as an independent standard or (3) having two separate individuals prepare the calibration and verification standard solutions if independent sources are not available.

To extend the use of an expired standard, reverification is necessary, provided that the new analysis produces acceptable data. Note that not all programs may allow this. The reverification of an expired standard is performed against a current, independent standard reference material by analyzing within a valid calibration. The analysis of the expired standard must meet the QC criteria.

Stock and working standards and reagents are checked regularly for signs of deterioration, such as discoloration, formation of precipitates, or change in concentration. Care is exercised in the proper storage and handling of standard and reagent solutions. Standards and reagents are always stored separately from samples.

8.5.4.4 Periodic Calibration

Periodic calibration is performed at prescribed intervals. In general, equipment that can be calibrated periodically are distinct, singular purpose units and are relatively stable in performance. These include balances, micropipettors, counters, thermometers, refrigerators, freezers, and ovens. Equipment employed at STL requiring periodic calibration are listed along with their respective calibration requirements in Tables 8-17. NELAC requires mechanical volumetric dispensing devices (except Class A glassware) to be checked for accuracy on at least a quarterly basis if in use. Refer to SOP KNOX-QA-0012 for the calibration of mechanical volumetric dispensing devices.

8.5.4.5 Operational and Continuing Calibration

Operational calibration is routinely performed as part of instrument usage, such as the development of a standard calibration curve (see Tables 8-18 to 8-

20). The accuracy of initial calibrations is verified prior to sample analysis through the use of an independent standard.

Detailed requirements for operational and continuing calibration are contained in method-specific SOPs.

When an initial calibration is not performed on the day of analysis, the initial calibration must be verified prior to sample analyses by a continuing instrument calibration verification with each analytical batch.

- A continuing instrument calibration verification must be analyzed at the beginning and end of each analytical batch, as defined by the laboratory SOPs. The concentrations of the calibration verification shall be varied within the established calibration range on an annual basis for each NELAC accredited analytical method. If an internal standard is used for organic analyses, only one continuing instrument calibration verification must be analyzed per analytical batch, unless otherwise specified by the method.

- Sufficient raw data records must be retained to permit reconstruction of the continuing instrument calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, and calibration curve or response factor.

- If the continuing instrument calibration verification results obtained are outside the established acceptance criteria, corrective actions must be performed. If routine corrective action procedures fail to produce a second consecutive (immediate) calibration verification within acceptance criteria, then either the laboratory has to demonstrate performance after corrective action with two consecutive successful calibration verifications or a new initial instrument calibration must be performed. If the laboratory has not demonstrated acceptable performance, sample analyses must not occur until a new initial calibration curve is established and verified. However, sample data associated with an unacceptable calibration verification may be reported as qualified data under the following special conditions:

    - When the acceptance criteria for the continuing calibration verification is exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

    - When the acceptance criteria for the continuing calibration verification is exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit. Otherwise the samples affected by

the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

8.5.4.6 Calibration Failure

Equipment or instruments that fail calibration or become inoperable during use shall be tagged as necessary to prevent inadvertent use. Such instruments or equipment shall be repaired and successfully recalibrated before reuse. Following recalibration or verification, back to control will be documented in the injection/run log and/or maintenance logbook through the routine identification of the required calibration runs specified by the standard operating procedure.

8.5.4.7 Calibration Records

Calibration shall be documented for each piece of equipment subject to calibration. All calibration records (periodic and operational) directly affect data and may not be limited to one project. These records shall be stored in either the quality records or the associated project files. Project files that include sample data shall either include the calibration records or include reference to them.

8.6 Quality Assessment

The effectiveness of the QA practices is measured by the quality of data generated by the laboratory. Procedures are in place to detect, prevent, and correct quality problems and to ensure quality improvement. Items and processes that do not meet established requirements must be investigated to determine their cause. Improvements must be implemented in the operations that will prevent a recurrence of these quality problems and provide overall quality performance. All phases of laboratory work should be designed with the objective of preventing problems and improving quality on a continuous basis.

8.6.1 Data Quality Assessment

Data quality is judged in terms of precision, accuracy, representativeness, completeness and comparability. The areas of representativeness, comparability, and completeness for an overall project, inclusive of sampling issues, may be beyond the control of the laboratory. The elements over which the laboratory has direct control are precision, accuracy, and completeness relative to analytical testing results.

Precision and accuracy assessments are made as part of the evaluation of laboratory QC data generated during sample preparation and analysis. The QC samples employed at STL Knoxville as part of routine sample analysis are summarized in Section 8.4 of this document. Table 8-5 shows the precision and accuracy measurements employed. Analytical method SOPs and Policy QA-003 include information on requirements for the type of QC samples, frequencies, and acceptance criteria. Additionally, the SOPs and

policy describe the appropriate actions to be taken when a QC sample result does not meet acceptance criteria.

8.6.2 Statistical Evaluation of Data

In-house limits for QC data must be evaluated at least annually and compared to the appropriate limits published in the methods for applicable matrices. Method limits may be employed until sufficient QC data are acquired. A minimum of 20 to 30 data points is recommended to establish the in-house QC limits. Calculated results of the QC (e.g. LCS) samples are evaluated by comparing against control limits (3-sigma).

Control charts are used to develop control limits, trouble-shoot analytical problems, and, in conjunction with the nonconformance system, to review trends.

Precision and accuracy measurements employed by STL Knoxville are shown in Table 8-5 through 8-8.

8.7 Data Recording Procedures

To ensure data integrity, all documentation of data, and records generated or used during the process of data generation, must be performed in compliance with SOP KNOX-QA-0013, "Instrument Records and Logbooks".

8.8 Data Reduction and Verification Procedures

Data review procedures comprise a set of computerized and manual checks applied at appropriate levels of the measurement process. Data review begins with the reduction or processing of data and continues through verification of the data and the reporting of analytical results. Calculations are checked from the raw data to the final value prior to reporting results for each group of samples. Data reduction can be performed by the analyst who obtained the data or by another analyst. Data verification starts with the analyst who performs a 100 percent review of the data to ensure the work was done correctly the first time. Data verification continues with review by a second reviewer who verifies that data reduction has been correctly performed and that the analytical results correspond to the data acquired and processed. This procedure is outlined in Figure 8.8-1.

8.8.1 Data Reduction and Initial Verification

Data reduction and initial verification may be performed by more than one analyst depending upon the analytical method employed. The preparation and analytical data may be reviewed independently by different analysts. In these instances, each item may not be applicable to the subset of the data verified or an item may be applicable in both instances. It is the responsibility of the analyst to ensure that the verification of data in his or her area is complete. The data reduction and initial verification process must ensure that:

- Sample preparation information is correct and complete including documentation of standard identification, sample amounts, etc.

- Analysis information is correct and complete including proper identification of analysis output (charts, chromatograms, mass spectra, etc.).
- Analytical results are correct and complete including calculation or verification of instrument calibration, QC results, and qualitative and quantitative sample results with appropriate qualifiers.
- The appropriate SOPs have been followed and are identified in the project records.
- Proper documentation procedures have been followed.
- All nonconformances have been documented.
- Special sample preparation and analytical requirements have been met.
- The data generated have been reported with the appropriate number of significant figures as defined by the analytical method in the LIMS or otherwise specified by the client.

In general, data will be processed by an analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets.
- Input of raw data for computer processing.
- Direct acquisition and processing of raw data by a computer.

If data are manually processed by an analyst, all steps in the computation shall be provided including equations used and the source of input parameters such as response factors (RFs), dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, they may be attached to the data sheets.

Manual integrations are sometimes necessary to produce good chromatography, but must only be performed when necessary. Further discussion of manual integrations and the required documentation is given in Policy S-Q-004, "Acceptable Manual Integration Practices".

For data that are input by an analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the project number and other information as needed. The samples analyzed must be clearly identified.

If data are directly acquired from instrumentation and processed, the analyst must verify that the following are correct:

- Project and sample numbers
- Calibration constants/RFs
- Units
- Numerical values used for reporting limits.

Analysis-specific calculations for methods are provided in SOPs. In cases where computers perform the calculations, software must be validated or verified, as described in Section 6.0 of this document, before it is used to process data.

The initial verification of the data reduction (level 1 review) by the analyst is documented on a data review checklist, which is signed and dated by the analyst. Data review requirements are described in Section 5.3.6 of the QMP.

8.8.2 Data Verification

Following the completion of the initial verification by the analyst performing the data reduction, a systematic check of the data that has been fully reduced and checked through level 1 review is performed by an experienced peer, supervisor, or designee. This check (level 2 review) is performed to ensure that level 1 review has been completed correctly and thoroughly. The second level reviewer examines the data signed by the analyst. This review includes an evaluation of all items required in the raw data package. Any exceptions noted by the analyst must be reviewed. Included in this review is an assessment of the acceptability of the data with respect to:

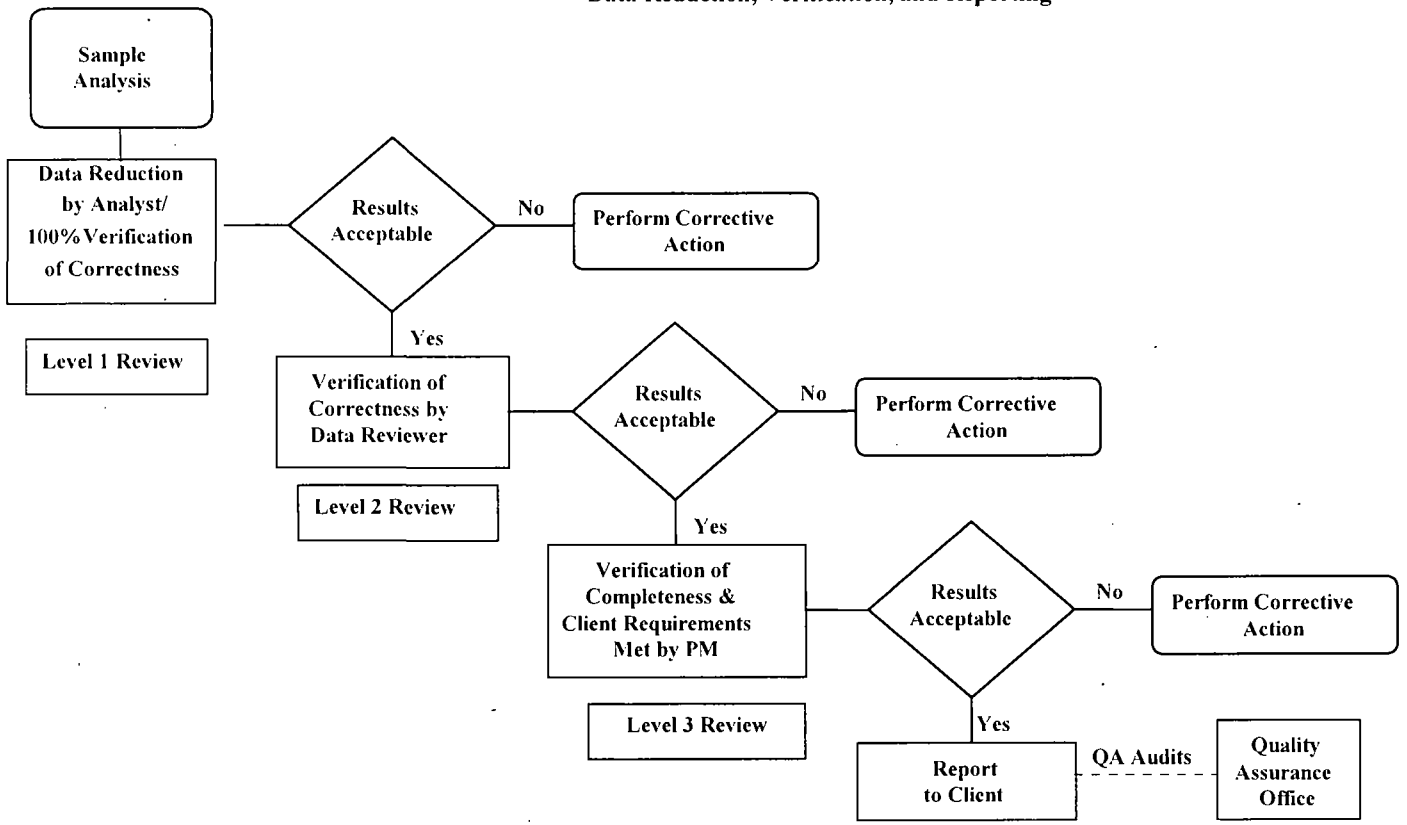
- Adherence of the procedure used to the requested analytical method SOP.
- Correct interpretation of chromatograms, mass spectra, etc.
- Correctness of numerical input when computer programs are used (checked randomly).
- Correct identification and quantitation of constituents with appropriate qualifiers.
- Numerical correctness of calculations and formulas (checked randomly).
- Acceptability of QC data.
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.).
- Documentation of dilution factors, standard concentrations, etc.
- Sample holding time assessment.

The level 2 review also serves as verification that the process the analyst has followed is correct in regard to the following:

- The analytical procedure follows the methods and specific instructions given on the project QAS or equivalent summary form.
- Nonconforming events have been addressed by corrective action as defined on a nonconformance memo.
- Valid interpretations have been made during the examination of the data and the review comments of the initial reviewer are correct.
- The package contains all of the necessary documentation for data review and report production and results are reported in a manner consistent with the method used for preparation of data reports.

The specific items covered in the level 2 review may vary according to the analytical method, but this review of the data must be documented by signing the data review checklist. Data review requirements are described in Section 5.3.6 of the QMP.

FIGURE 8.8-1
Data Reduction, Verification, and Reporting



8.8.3 Completeness Verification

A third-level review is performed by the PM. This review is required before results are submitted to clients. This review serves to verify the completeness of the data report and to ensure that project requirements are met for the analyses performed. The items to be reviewed are:

- Analysis results are present for every sample in the analytical batch, reporting group, or sample delivery group (SDG).
- Every parameter or target compound requested is reported with either a value or reporting limit.
- The correct units and correct number of significant figures are utilized .
- All nonconformances and receipt variances with the resolution, including holding time violations and data evaluation statements that impact the data quality, are accompanied by clearly expressed comments from the laboratory.
- The final report is legible, contains all the supporting documentation required by the project, and is in either the standard STL format or in the client-required format.
- Implement checks to monitor the quality of laboratory results using correlation of results for different parameters of a sample (for example, does the TOC results justify the concentration of organic compounds found by GC/MS.)
- A narrative to accompany the final report will be finalized by the PM. This narrative will include relevant comments collected during the earlier reviews.

8.9 Data Reporting

8.9.1 Data Reports

STL Knoxville is capable of developing a variety of data deliverable reports. Standard reports will contain:

- Cover Letter/Narrative - Information on sample types, tests performed, any problems encountered, and general comments are provided.
- Analytical Data - Results are reported by sample or by test with the appropriate significant figures and reporting limits, and with the proper adjustment for dilution, if appropriate. Pertinent information including dates sampled, received, prepared, extracted, and analyzed are provided.
- Laboratory Performance QC Information - The results of LCSs and method blanks analyzed with the project are listed. Any data or QC anomalies are discussed in the narrative.
- Matrix-Specific QC Information - Results of any client sample duplicates and MS/MSDs analyzed with the samples as batch QC are reported, as requested by the client. Other project-specific QC requested by the client

are also reported. The results include supporting information such as amount spiked, percent recovery, or percent difference/RPD.

- Methodology - Reference for analytical methodology used is cited.
- Other Deliverables - Other deliverables available include disk deliverables, electronic data transfer, sample raw data packages, complete deliverable packages, and custom report formats.

8.9.2 Final Report Details

STL Knoxville will provide paginated reports or a uniquely defined, identifiable certificate/report (i.e., electronic file, CD). The report will include:

a) Report title, name, address and phone number of the laboratory.
b) Name and address of client/project name/client identification number.
c) Description (lab ID of sample).
d) Dates and time of sample collections (if known) and receipt, and date of preparation and analysis. If the required holding time is 48 hours or less, time of sample preparation and analysis.
e) Method identifiers traceable to all procedures used.
f) Reporting limit.
g) Test result with appropriate units and how reported (wet weight/dry weight). Any results outside of quantitation limits will be identified. When required, a statement of the estimated uncertainty of the test result should be added.
h) If appropriate, description of any QC failures or deviations from SOPs.
i) Signature and title of the individual responsible for the report. Electronic signature is acceptable.
j) Date of issue.
k) All subcontract work is clearly identified, and name and address of subcontractor laboratory noted.
l) Where relevant, a statement to the effect that the results relate only to the items tested or to the sample as received by the laboratory.
m) Where relevant, a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory.
n) NELAC statement, as described in SOP KNOX-AD-0004, current revision.

After the final report, any correction, addition, or deletion must clearly identify its purpose and meet the above reporting requirements as appropriate.

8.9.3 Verbal Results

STL Knoxville, as a policy, discourages the release of data verbally or without

full data review. If however, the client requests analytical results to be communicated verbally or by facsimile prior to final review, they must be clearly identified as "Preliminary" results. The client must understand that the data have not undergone the required levels of review and may potentially change.

8.9.4 Reporting Analytical Results

Sample results are reported according to analytical method SOPs or client specifications. Normally, the laboratory uses the STL Knoxville Reporting Limit (RL) at which any analyte of interest detected at or above that level is reported as a positive value and any analyte of interest not detectable or detected below that level is reported as "not detected" at the RL. The laboratory will report results from within the calibration range; however, any reported results outside of the calibration range will be flagged in the final report.

If a QC measurement is out of control and the data is to be reported, data qualifiers are reported with samples associated with failed QC measurements.

The laboratory must certify that the test results meet all NELAC requirements or provide reasons and/or justification if they do not.

In some cases a contract, QAPP, or documented client request may require the laboratory to report sample results in a specified manner. Some examples are given below:

- The laboratory may be requested to report all analytes of interest that are less than the laboratory's RL but are greater than the MDL. This data will be flagged with an appropriate qualifier or noted in the report case narrative. (See precautions in "Reporting Limits for STL Laboratories Using QuantIMS", Policy Number S-T-002).
- The laboratory may be requested to report any tentatively identified compounds (TICs). These data will be flagged with an appropriate qualifier.
- The laboratory may be requested to report sample results using an RL that is higher than the standard STL Knoxville RL. In this case, only the analytes of interest found at or above the higher RL would be reported as positive values. In this case, the laboratory will report to the project-specific RL (PSRL) rather than the standard RL. All analytes of interest not detected or detectable below that level would be reported as "not detected" at the PSRL.

  In any of these situations, the laboratory must include documentation in the project file that supports the reporting procedure employed. It is the responsibility of the laboratory to provide a reporting system that assures that any problems associated with an analysis are properly documented on a

nonconformance memo, communicated to the appropriate STL Knoxville staff, and addressed appropriately in the data report.

8.9.5 Reissued Deliverables

If, after issuance of a report, STL Knoxville observes any mistake that affects the results reported or the QC interpretation of those results, the client will be notified. After issuance of the report, the original laboratory report remains unchanged. Any material amendments to a report after issue must be in the form of a further document or further data transfer and must be identified as a revised or supplemental report. For further discussion, see SOP KNOX-AD-0004, "Data Reporting".

8.9.6 Client Confidentiality

Data and sample materials provided by the client or at the client's request, and the results obtained by STL, shall be held in confidence, unless such information is generally available to the public or is in the public domain. STL's reports, and the data and information provided therein, are for the exclusive use and benefit of our clients, and are not released to a third party without written consent from the client. Data confidentiality is also discussed Section 3.6.

8.10 Data Validation

Data validation for STL refers to data reviews conducted in accordance with the USEPA CLP "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses" and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses", or modifications thereof, for non-CLP type analyses.

This form of data validation provides an impartial evaluation of the laboratory's results. Data validation may be requested by the client for a percentage of data and is performed by a third party, one that was not involved with the sample analysis. Qualifiers are assigned to data, when required during data validation, according to the requirements of the data validation protocol being used.

8.11 Preventive Maintenance and Service

Facilities, instruments, equipment, and parts are subject to wear, deterioration, or change in operational characteristics. Within STL, preventive maintenance, coupled with vendor service agreements, is an organized program of actions taken to maintain facilities and equipment in control.

8.11.1 Analytical Instrumentation and Equipment

The primary purpose of the maintenance program is to prevent instrument and equipment failure and to minimize down time. A properly implemented maintenance program increases the reliability of a measurement system.

Each instrument or piece of equipment shall be uniquely identified. The laboratory maintains the following:

- Instrument/equipment inventory list with serial number of the item or equipment
- Instrument/equipment major spare parts inventory
- External service agreement documents (if applicable)
- Instrument-specific preventive maintenance logbook or file for each functional unit.

The records of routine maintenance and non-routine maintenance shall include at a minimum:

- Name of the item or equipment
- Details of maintenance performed
- Dates and results of recalibrations/reverifications indicating return to control (this may be done in the analytical run log)
- Analyst initials and the date maintenance was performed whether by the analyst or a contracted service representative.

Any item or equipment that does not perform to specifications or is found to be defective shall be taken out of service (and tagged as necessary to prevent inadvertent use) until it has been repaired and shown by calibration/verification to perform satisfactorily.

8.11.2 Frequency of Equipment Maintenance

The frequency of maintenance must consider manufacturer's recommendations and previous experience. Frequency of preventive maintenance along with the recommended preventive maintenance schedules are given in STL Knoxville SOP KNOX-QA-0003, "Preventive Maintenance" for analytical instrumentation and equipment. Frequency of maintenance for the facility systems is documented in the STL Corporate Safety Manual.

8.11.3 Facilities

Another important aspect of the laboratory operation is the existence and maintenance of adequate, safe, and clean facilities including appropriate engineering controls such as proper ventilation, lighting, dust control, hoods, air flow, protection from extreme temperatures, waste disposal, and a source of

stable power. The facility floor plan is provided in Figure 8.11-1.

The maintenance and use of these facilities and proper operations are described in the STL Corporate Safety Manual. The Laboratory Director has responsibility for ensuring a properly maintained facility. The Laboratory Director also has the responsibility for ensuring that facilities are available to store samples properly without contamination, work areas are equipped with adequate bench, hood and operational space, and that procedures are in place to ensure the areas are free from chemical and radiological contamination that may affect analytical results.

8.11.4 Facility Security

The laboratory building is a limited access, secure facility. To ensure that only authorized personnel are able to enter the building from an entrance that is not monitored, entry into each building is limited in one or more of the following ways at a minimum:

- The use of key pads or electronic locks activated by swipe or magnetic cards which are issued only to authorized personnel
- Locking doors and issuing keys only to authorized personnel
- Alarm systems to detect unauthorized entrance

During business hours, entry is possible only through the main entrance. This entrance is monitored at all times, usually by a receptionist. All guests are required to sign in by using a visitor logbook.

8.12 Requirements for Ancillary Equipment and Materials

8.12.1 Water

High purity water (e.g., ASTM reagent grade or equivalent water) will be used in all metals, wet chemistry, and organic analyses. Demonstration of contaminant-free water is shown through the routine analysis for the analyte of interest of method blanks consisting of the reagent water used. This water is obtained by the use of either a commercial ion-exchange deionizing, distillation, or reverse osmosis unit plus an appropriate polishing unit. The resulting water has a maximum conductivity of 1.0 umho-cm at 25°C or a minimum resistivity of 1.0 Mohm at 25°C. Conductivity or resistivity will be monitored and documented daily or on each day that water is dispensed for analytical use.

For volatile analyses, the water may be further purified by purging with an inert gas before use to remove potential traces of organic solvents.

8.12.2 Compressed Air and Gases

Ultra high-purity compressed gases from pre-approved vendors or in-house gas generators will be used when required for instrumentation. These air and gases must meet the requirements and specifications of the analytical methods performed. In-line filters will be used when appropriate to minimize contamination and moisture from the gases.

8.12.3 Glassware Preparation

Glassware preparation procedures implemented at operating units are designed to ensure that contaminants are not introduced during sample analysis. Procedures describing glassware preparation are detailed in SOP KNOX-QA-0002.

8.12.4 Chemical Storage

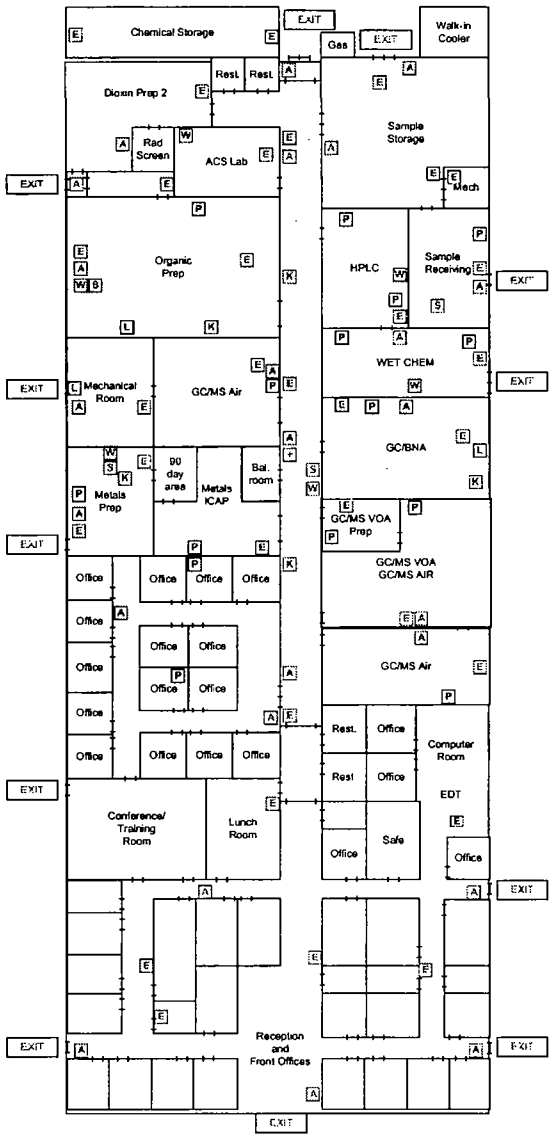
Storage of chemicals shall be conducted in a manner to minimize the potential for fire or release of hazardous material resulting from an unplanned chemical reaction. Flammable solvents shall be stored in appropriate cabinets meeting all necessary codes. All chemicals are stored according to chemical compatibility. Further details regarding chemical storage are provided in the STL Corporate Safety Manual.

8.12.5 Waste Management

The goal of STL's policy for waste management is to ensure that laboratory wastes are disposed of safely and in a manner consistent with applicable federal, state and local regulations. The waste disposal program is designed to assure that minimal harm to people and the environment shall result from the disposal of laboratory chemicals. This goal is accomplished by requiring that the laboratory comply with the procedures presented in the STL Corporate Safety Manual.

Figure 8.11 -1 Floor Plan

STL Knoxville Laboratory
Main Building



Safety Equipment Location

- E Fire Extinguisher
- A Fire Alarm or Siren
- + First Aid Kit
- S Safety Shower
- W Eye Wash Station
- K Emergency Spill Kit
- L Emergency Lighting - Wired
- P Emergency Lighting - Portable

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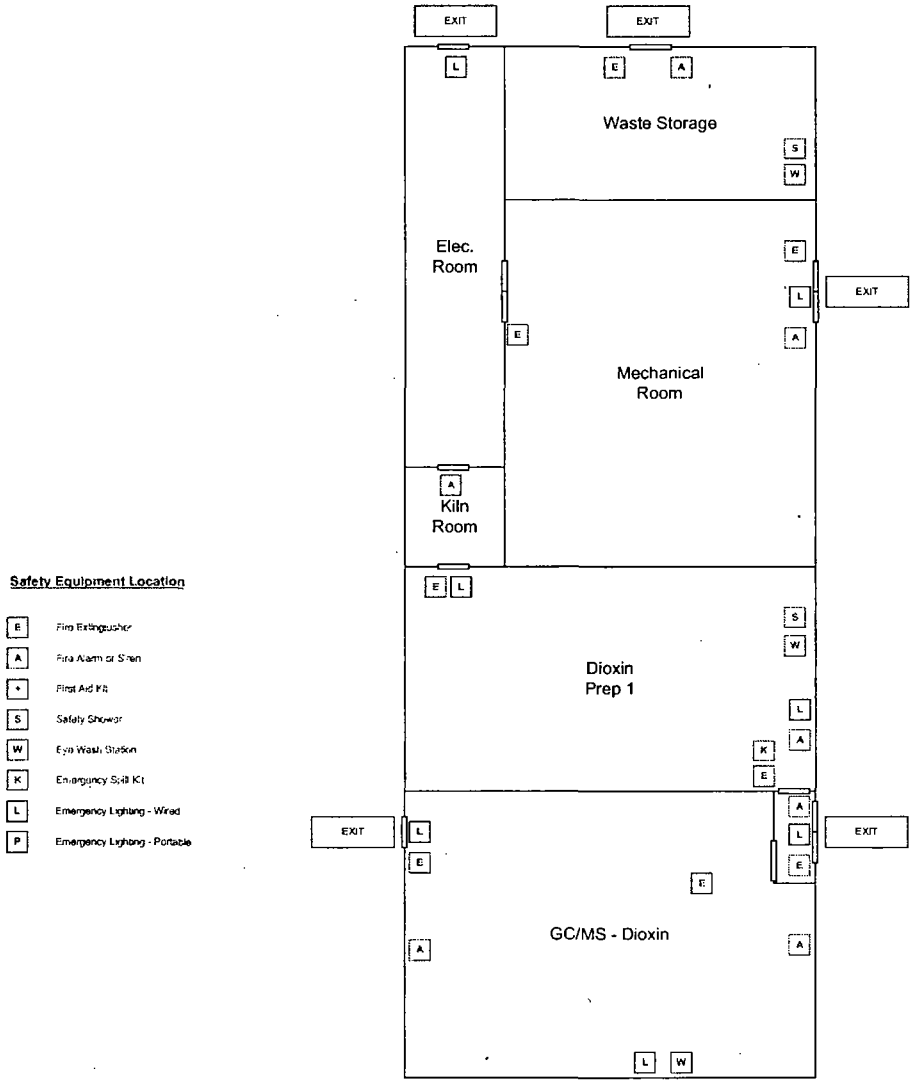
Figure 8.11 -1 Floor Plan, continued

STL Knoxville Laboratory
Building 2 - Specialty Organics Group Lab



9.0 Quality Assessment and Response

9.1 Nonconformances

A nonconformance is an unplanned deviation from an established protocol or plan and in some cases may be exceptionally permitted departures from the documented policies and procedures or from standard specifications. The deviation may be the result of STL's actions as a systematic error, then termed a deficiency. A single isolated event or event beyond the control of STL is termed an anomaly.

Nonconformances can be identified on the basis of internal or external systems or performance audits, sample processing, routine calibration and monitoring of analytical and support equipment, or QC sample analyses. The Technical Director, Operations Manager, Project Manager, QA Manager, Team Leader, and Analyst may be involved in identifying the most appropriate corrective action. If previously reported data are affected, the issue is immediately brought to the attention of QA.

9.1.1 Nonconformance Memo (NCM)

Nonconformances, deficiencies and anomalies, are documented via an electronic process or on a paper form that meets NCM requirements as approved by QA. An allowed exception is log-in conformance problems, which are documented on a Condition Upon Receipt Form (see Section 8.5). A detailed description of the procedure and responsibilities associated with nonconformance documentation, communication, and resolution is described in SOP KNOX-QA-0008.

The Clouseau NCM program, available on the local-area network throughout the laboratory, is the main vehicle for documenting and communicating NCMs. The program allows anyone in the laboratory to document a nonconformance, explain the cause of the problem, and link to the LIMS system to identify the samples and clients involved. The program uses the local e-mail to automatically notify the person's supervisor, the Project Managers associated with the samples, and the QA department. The program is used to document approval and completion of the immediate corrective actions for the samples involved, and can be used to document long-term corrective actions. It provides a place to document resolution of problems with the clients, and it provides routines to query the associated database to examine trends and prepare management reports. An electronic record of the nonconformance shall be kept in the Clouseau Program database. Nonconformances affecting client sample results are addressed in the project narrative.

9.2 Client Complaints

Client inquiries and complaints are generally received through the PM or Customer Services Manager. Typically, the PM or CSM communicates with the client to determine the details of the inquiries, including technical data problems, deliverable issues, turn-around-time problems, etc. Technical and deliverable issues are coordinated by the PM and usually involve input from operations, QA, and management staff. A formal written response to the client is coordinated by the PM, but may on occasion be delivered by the CSM or the Account Manager. Details of the types and levels of complaints and required documentation are provided in Section 4.8 of the QMP. Client complaints are recorded as a type of NCM in the Clouseau database, which are summarized in the monthly QA Reports to Management (see Section 9.6 for more about the monthly QA reports).

9.3 Corrective Actions

Corrective actions are measures taken to rectify conditions adverse to quality and, where possible, to prevent their recurrence. Investigations of potential problems and corrective actions should be timely, determine the root cause, and evaluate any propagation of the error or problem. Whenever a systematic error is discovered that affects the accuracy or defensibility of results reported to STL's clients, Corporate QA notification and written client notification will be part of the corrective action.

Corrective actions should be implemented with an understanding of the technology and work activities associated with the quality element, and may include appropriate training of STL associates, and should be monitored for progress and success. The occurrence of the problem, the corrective action employed, and results of the corrective action must be documented properly. On-the-spot actions are used to correct minor problems, such as recalibration, retuning or a minor repair (e.g., replacement of a minor part) of a malfunctioning instrument or the correction of poor analytical technique being used by an analyst. These occurrences are documented in the appropriate injection, run, or analysis logbooks. Similarly, routine instrument maintenance, malfunctions, and power failures are also documented in the appropriate instrument maintenance logbooks. These events do not require a formal NCM process, provided reported analytical results are not affected. Corrective actions specific to quality controls for analytical methods are discussed in the operational-specific SOPs.

9.3.1 Monitoring Corrective Actions

All formal corrective action documentation is maintained by the QA department, either in the Clouseau database or in paper files. The QA department reviews all corrective actions and may implement a spot assessment audit. The purpose of spot assessments is not only to monitor the implementation of the corrective action, but also to assess laboratory adherence to procedures, policies, etc.

9.4 Preventive Action

Preventive action is defined as noting and correcting a problem before it happens, because of a weakness in a system, method or procedure. When potential problems are identified, preventive action is initiated to effectively address the problem to eliminate or reduce the risk identified. STL Knoxville implements preventive action as a part of its quality system. For example, preventive action is inherent in the Preventive Maintenance SOP (KNOX-QA-0003) which helps ensure that instruments remain operational and in the Project Set-up SOP (KNOX-AD-0005) which helps ensure that laboratory capabilities meet client data quality objectives. Section 7, Contract Review and Project Planning, and specifically Section 7.6, Contingency Planning, are also part of the preventive action process. Documentation of preventive action may also be documented as part of the corrective action process.

9.5 Internal Audits

Internal audits are performed to assess the degree of adherence to established policies, procedures and standards. These assessments are conducted by STL personnel who are independent of the area being evaluated. Audits can identify areas for improvement with regard to compliance with policies, procedures and standards. Audits also provide a means for correction prior to system failure.

Audits and assessments are generally conducted through the use of checklists and relevant reference documents. The findings of all audits and assessments are documented as is the laboratory response and any corrective actions. Follow-up checks are performed and the status of implementation of corrective actions is documented for all categories of audits and assessments. This cycle continues until all findings are closed.

9.5.1 Audit Types and Frequency

The following types of audits are performed at STL Knoxville:

Figure 9.5-1 Audit Types and Frequency

Audit Type	Performed by	Frequency
Systems	QA Department or Designee	Annual
Data	QA Department or designee	**Data Report Review:** As necessary to ensure an effective secondary review process
		Analyst Data Audits: 100% of all analysts annually
		Electronic Data Audits: 100% of all organic instruments
Special	QA Department or Designee	As Needed

Note that some programs, e.g., AFCEE, require project data audits conducted by QA at a defined frequency.

9.5.2 Systems Audits

Facility systems audits are comprehensive technical and systems evaluations covering each operational and support area at least once per year. The audit report is issued by the auditor within 30 calendar days of the audit. The audit report is addressed to the Laboratory Director and copied to the STL Corporate Director of Quality Assurance, the Regional Manager and Laboratory QA Manager. A written audit response is required within 30 calendar days of the date of the audit report. The audit response from the lab must follow the format of the original audit report. The audit response is directed to all individuals copied on the audit report. When a corrective action is not completed by the time of the audit response, the target date for the corrective action is stated. Evidence of corrective action is submitted to the QA department either at the time of the audit response or in the agreed upon time frame. Refer to SOP S-Q-002 for details regarding internal systems audits.

9.5.3 Data Audits

Data audits assess the level of customer service, SOP compliance, regulatory compliance, accuracy and completeness of test results and reports, documentation, and adherence to established QC criteria, laboratory SOPs, technical policy, and project specific QC criteria. Data Audits may be accomplished through electronic instrument data audits, analyst data authenticity audits or through final project report reviews.

Records of the data audits shall be kept, and the frequency of data audits shall be included in the monthly QA report. In performing data audits, it is essential that data be assessed in terms of differentiating between systematic and isolated errors. Upon noting anomalous data or occurrences in the data audits, the QA Department is responsible for seeking clarification from the appropriate personnel, ascertaining whether the error is systematic or an isolated error, and overseeing correction and/or revision of the project report if necessary. Errors found in client project reports are revised and the revision sent to the client. The QA Department is also responsible for assisting in the corrective action process where a data audit leads to identification of the need for process evaluation and change.

Where specific clients and regulatory programs require more frequent data auditing, the individual facility must meet the data auditing frequency for that program.

9.5.3.1 Data Authenticity Audits

Data authenticity audits shall be performed on 100% of all analysts by the QA department or a designee independent from the operations. Performing data authenticity checks will typically include verifying raw data, evaluating calculation tools and independently reproducing the final results and comparing it to the hardcopy on randomly selected batches of data. The laboratory will report the percentage of analysts reviewed (for the year) in their monthly QA report and should average about 8% per month.

9.5.3.2 Electronic Data Audits

Electronic data audits shall be performed on 100% of all organic instruments by the QA department or a designate independent from the operations. This may include Mint Miner® scanning of randomly selected batches of electronic data followed by a chromatography system review. The laboratory will report the percentage of instruments reviewed (for the year) in their monthly QA report and should average about 8% of instruments per month. Electronic data audits must include spot-checking of manual integrations by QA personnel in order to determine that the manual integration is appropriate and documented according to Section 5.3.6).

9.5.4 Spot Assessments

Spot assessments, equivalent to special audits as described in the STL QMP, are conducted on as needed basis, and may be conducted as a follow up to specific issues such as client complaints, validator concerns, corrective actions, control chart or NCM trends, proficiency testing results, data audits, or external audit issues. Spot assessments are focused on a specific issue. The frequency, report format, distribution, and timeframes are tailored to address the nature of the issue.

9.5.5 Proficiency Testing

Proficiency testing samples (PTs) are analyzed to verify the ability of the laboratory to correctly identify and quantitate compounds in PT samples. PT samples may be supplied internally or externally as single-blind or double-blind samples. They can be used to assess if a deficiency has been corrected, to document the proficiency of the analyst to perform the analysis, or to assess the overall performance of an analytical method.

PT samples are handled and tested in the same manner as environmental samples. It is not acceptable to run multiple replicates that would not otherwise be performed; it is not acceptable to average multiple results; and PT results cannot

be shared among labs in advance of the close of the study. PT test sample data is archived using the same requirements as for project and raw data record retention.

STL Knoxville participates in a number of PT studies, as shown in Table 9-1. The NELAC PT program involves a minimum of two PT rounds each year for each NELAC field of testing for which the lab is maintaining certification.

STL Knoxville also participates in a double-blind performance evaluation annually. An external vendor is contracted to submit double-blind samples to the lab. Both the level of customer service and the accuracy of the test results are assessed objectively by the external contractor. The PT contractor provides a detailed report to the Corporate Director of QA and to STL Knoxville.

9.6 External Audits

STL Knoxville is regularly audited by clients and external regulatory authorities. STL Knoxville is available for these audits, and makes every effort to provide the auditors with the personnel, documentation and assistance they require. STL Knoxville recommends that all audits be scheduled with the QA department so that all necessary personnel are available on the day of the audit. As required, deficiencies reported to the laboratory must be responded to within the time frame specified in the audit report. It is the responsibility of the QA Manager to coordinate the response to the audit report. The development and implementation of the corrective actions is the responsibility of the operations management of the affected areas. All responses must be approved by the Laboratory Director or Operations Manager prior to submitting the final response. It is the responsibility of the QA Manager to verify implementation of the corrective actions and inform the responsible manager of the closure of all deficiencies from the audit.

9.7 Management Reviews

9.7.1 Quality Reports to Management

A monthly QA report is prepared by the QA Manager and forwarded to the Laboratory Director, the Regional General Manager, and the Corporate QA Manager. The reports include metrics (i.e., frequency and number of revised reports, frequency and number of client complaints) to assess the effectiveness of the Quality System. The contents of the monthly report include:

- Audits
  Internal System Audits
  External System Audits
  Analyst & Instrument Data Authenticity Audits
- Revised Reports / Client Complaints
  Frequency of revised reports
  Total number of client complaints, reason, and resolution

Client Compliments
- Certification/Parameter Changes
- Proficiency Testing
  Score for each PT as a percentage of maximum score
  Note repeat failures and/or significant problems
- SOP Status
  # of active SOPs, # needing to be written and # reviewed/revised in the past 24 months
- Miscellaneous QA and Operational Issues
  Narrative outlining improvements, regulatory compliance issues, general concerns
- Metrics Spreadsheet
  Summarize metrics in the template provided by the Corporate Quality Director.

This information is compiled by the Corporate QA Manager together with similar information from and about other STL laboratories, which is then presented in a report to the STL Chief Operating Officer.

9.7.2 Management Review of QA Systems

The Laboratory Director will conduct an annual management quality system review to assess the adequacy of the quality systems in the laboratory and plan any changes in laboratory organization, policies, practices, certifications, accreditations in order to achieve operational efficiencies, meet regulatory requirements and client expectations. The evaluation shall consider:
- The suitability of policies and procedures
- Reports from managerial and supervisory personnel
- The outcome of recent internal audits
- Corrective and preventative actions
- Assessments by external bodies
- The results of interlaboratory comparisons and proficiency tests
- Status of QA documents
- Changes in the volume and type of work and the effects on QA systems
- Client feedback
- Complaints
- Quality control activities
- Resources and staff training

Acronyms and Initialisms

A2LA	American Association for Laboratory Accreditation
AA	Atomic Absorption
ANSI	American National Standards Institute
AR/COC	Analysis Request/Chain-of-Custody
ASQC	American Society for Quality Control
ASTM	American Society for Testing and Materials
BFB	Bromofluorobenzene
BLK	Blank
BOD	Biochemical Oxygen Demand
CCC	Calibration Check Compound
CEO	Chief Executive Officer
CF	Calibration Factor
CFR	Code of Federal Regulations
CHP	Chemical Hygiene Plan
CLP	Contract Laboratory Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act (Superfund)
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
CSM	Customer Service Manager
CSRM	Certified Standard Reference Material
CUR	Condition Upon Receipt
CV	Coefficient of Variation
CVAA	Cold Vapor Atomic Absorption (Spectroscopy)
DFTPP	Decafluorotriphenylphosphine
DOC	Dissolved Organic Carbon
DOE	Department of Energy
DOT	Department of Transportation
DQO	Data Quality Objective

Acronyms and Initialisms (continued)

EH&S	Environmental Health and Safety
EPA	(U. S.) Environmental Protection Agency
FLAA	Flame Atomic Absorption (Spectroscopy)
FTIR	Fourier Transform Infrared (Spectrometry)
GC	Gas Chromatograph(y)
GC/MS	Gas Chromatography/Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption (Spectroscopy)
HDPE	High Density Polyethylene
HPLC	High Performance Liquid Chromatography
HRGC	High Resolution Gas Chromatography
HRMS	High Resolution Mass Spectrometry
ICAP	Inductively Coupled Argon Plasma (Spectroscopy)
ICAP/MS	Inductively Coupled Argon Plasma/Mass Spectrometry
ICS	Interference Check Sample
IDL	Instrument Detection Limit
IR	Infrared (Spectroscopy)
IS	Information Systems
IS	Internal Standard
ISO	International Organization for Standardization
IT	Information Technology
KRI	Key Result Indicator
LAN	Local Area Network
LCL	Lower Control Limit
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
LQM	Laboratory Quality Manual
LRGC	Low Resolution Gas Chromatography
LRMS	Low Resolution Mass Spectrometry
LWL	Lower Warning Limit
MBAS	Methylene Blue Active Substance

Acronyms and Initialisms (continued)

MDC	Minimum Detectable Concentration
MDL	Method Detection Limit
MS	Matrix Spike
MSA	Method of Standard Additions
MSD	Matrix Spike Duplicate
MSDS	Material Safety Data Sheet
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NCM	Nonconformance Memo
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards Technology
NMOC	Non-Methane Organic Compounds
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRM	National Reference Material
PAH	Polynuclear Aromatic Hydrocarbons (or PNA)
PC	Personal Computer
PCB	Polychlorinated Biphenyls
PDS	Post Digestion Spike
PEM	Performance Evaluation Mixture
PM	Project Manager
PQL	Practical Quantitation Limit
PSRL	Project-Specific Reporting Limit
PT	Proficiency Testing
PUF	Polyurethane Foam
QA	Quality Assurance
QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan or Quality Assurance Program Plan
QAS	Quality Assurance Summary
QC	Quality Control
QS	Quality System

Acronyms and Initialisms (continued)

QuantIMS	STL Knoxville Laboratory Information Management System
QRI	Quality-Related Item
RCRA	Resource Conservation and Recovery Act
RF	Response Factor
RFP	Request for Proposal
RFQ	Request for Quote
RL	Reporting Limit
RPD	Relative Percent Difference
RRF	Relative Response Factor
RSD	Relative Standard Deviation
RSO	Radiation Safety Officer
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
SOW	Statement of Work
SPCC	System Performance Check Compounds
SPLP	Synthetic Precipitation Leaching Procedure
SRL	Standard Reporting Limit
SRM	Standard Reference Material
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TOX	Total Organic Halides
UCL	Upper Control Limit
UPS	Uninterruptable Power Supply
USEPA	United States Environmental Protection Agency
UWL	Upper Warning Limit
VOA	Volatile Organic Analysis
VOST	Volatile Organic Sampling Train
WAN	Wide Area Network
WS	Water Supply
WP	Water Pollution

Glossary

acceptance limits

Data quality limits specified for analytical method performance.

accuracy

Accuracy is the degree of agreement between a measurement and the true or expected value, or between the average of a number of measurements and the true or expected value. Systematic errors affect accuracy. For chemical properties, accuracy is expressed either as a percent recovery (R) or as a percent bias (R - 100).

aliquot, aliquant

A measured portion of a sample taken for analysis.

analytical spike

A sample created by spiking target analytes into a prepared portion of a sample just prior to analysis. (Also see matrix spike.)

anomaly

See nonconformance.

areas needing improvement

Represent isolated instances of noncompliance or issues that are judged to have a less immediate impact on data quality. Laboratory management must correct the situation or otherwise ensure that the condition does not recur. This term replaces the previous term used "Observations."

arithmetic mean

The arithmetic mean ($\bar{x}$) is the average of a set of values. It is equal to the sum of the observed values divided by the number of observations. Also called "average".

where: $\bar{x}$ = the mean

x_i = the ith data value

n = number of data values

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Glossary (continued)

assessment
The evaluation process used to measure the performance or effectiveness of a system and its elements. Assessment is used as an all-inclusive term to denote any of the following: performance, systems, data and compliance audits, management systems reviews, peer reviews, inspections, or spot assessments.

associate
Employee.

audit
A planned and documented investigative evaluation of an item or process to determine its adequacy and effectiveness as well as compliance with established procedures, instructions, drawings, quality management plans, and other applicable documents.

benchmarking
A step-by-step method of improving performance by identifying and studying best practices and comparing them to industry practices.

bias
A systematic (consistent) error in test results. Bias is expressed as the difference between the population mean and the true or reference value, or as estimated from sample statistics, the difference between the sample average and the reference value.

blind performance evaluation sample
A sample either submitted to the laboratory or prepared in the laboratory whereby the concentrations of parameters of concern are known by the preparer and not by the laboratory.

calibration
Establishment of a relationship between various calibration standards and the measurements of them obtained by a measurement system, or portions thereof. The levels of the calibration standard should bracket the range of levels at which actual measurements are to be made. Calibration is also the act of making a scheduled comparison of instrument performance against national standards for instruments which measure physical parameters such as mass, time, and temperature. This type of calibration is independent of use in specific analyses and projects.

calibration curve

Glossary (continued)

The graphical relationship between the known values for a series of calibration standards and instrument responses.

calibration factor (CF)
The ratio of the instrument response of an analyte to the amount injected. CFs are used in external standard calibrations.

$$CF = \frac{Total\ Area\ of\ Peak}{Mass\ Injected}$$

calibration standard
A standard used to quantitate the relationship between the output of a sensor and a property to be measured. Calibration standards should be traceable to standard reference materials (provided by NIST, or other recognized standards agencies) or a primary standard.

certified reference material
A reference material accompanied by a certificate issued by an organization certifying the contents and concentration(s) of the material. (See also standard reference material.)

chain-of-custody (COC)
A system of documentation demonstrating the physical custody and traceability of samples.

check standard analyses
A standard (often a midpoint standard) analyzed at a frequency specified in the method or in a SOP to verify the continuing calibration of the standard curve.

client
Any individual or organization for whom items or services are furnished or work is performed in response to defined requirements and expectations.

Glossary (continued)

client sample
The material or collection media submitted to the laboratory for analysis. Field QC samples are considered client samples but laboratory QC samples are not counted as client samples when counting samples for QC batches.

coefficient of variation (relative standard deviation)
A measure of precision (relative dispersion). It is equal to the standard deviation (s) divided by the mean ($\bar{x}$) and multiplied by 100 to give a percentage value.

$$CV\ (RSD) = \left(\frac{s}{\bar{x}}\right) x\ 100$$

collocated samples
Independent samples collected in such a manner that they are equally representative of the variable(s) of interest at a given point in space and time. The results will indicate sampling as well as analytical variability.

comparability
Comparability is a measure of the confidence with which one data set can be compared to another. To ensure comparability, all laboratory analysts are required to use uniform procedures (i.e., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

completeness
Completeness is a measure of the percentage of measurements that are judged to be valid measurements. At a minimum, the objective for completeness of data is 90% for each constituent analyzed. It is usually expressed as a percentage:

$$\%\ Completeness = \frac{V}{n} x\ 100$$

where: V = number of measurements judged valid
n = total number of measurements

composite
A sample composed of two or more increments.

control chart

Glossary (continued)

A graphical representation of analytical accuracy. Displays the arithmetic mean of a data set, the upper and lower warning limits and the upper and lower control limits.

controlled document
A document for which the distribution is known. Updates of the document are sent to the original recipients, unless the copy distributed is an uncontrolled copy.

corrective action
A measure taken to rectify conditions adverse to quality and, where necessary, to preclude their recurrence.

correlation coefficient
The correlation coefficient (r) is a determination of how closely data "fits" a straight line. It is a number between -1 and 1 that indicates the degree of linear relationship between two sets of numbers. A correlation coefficient of +1 (usually calculated to three decimal places or 1.000) means the data falls exactly on a straight line with positive slope. A correlation coefficient of -1 (or -1.000) means the data falls exactly on a straight line with negative slope.

customer
See client.

data quality objectives (DQO)
Data quality objectives (DQOs) are quantitative and qualitative measures of principal quality attributes, including precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS). Typically, DQOs are identified during project scope and development of sampling and analysis plans. In this QA manual, however, we refer to only the analytical DQIs because laboratories generally do not have any authority over sample collection, shipment, or other field-related activities that may affect the data quality of the environmental sample before the sample is received in the laboratory.

The components of analytical variability (uncertainty) can be estimated when QA and QC samples of the right types and quantities are incorporated into measurement procedures at the analytical laboratory. STL Knoxville incorporates numerous QA and QC samples to obtain data for comparison with the analytical DQOs and to ensure that the measurement system is functioning properly. The QA and QC samples and their applications, described in Section 8.4 and are selected on the basis of method- or client-specific requirements. Field blanks, field duplicates, and

Glossary (continued)

performance evaluation (PE) samples are received from the client as unknown samples. Analytical laboratory QC samples for inorganic, organic, and radionuclide analyses may include calibration or instrument blanks, method blanks, background, duplicates, replicates, laboratory control samples (LCSs), calibration standards, matrix spikes (MSs), matrix spike duplicates (MSDs) and surrogate spikes.

data validation
See validation - data.

data verification
See verification - data.

deficiency
A practice that is not compliant with procedure or policy. See nonconformance or finding.

degrees of freedom
The number of independent deviations used in calculating an estimate of the standard deviation.

double blind performance evaluation sample
A sample that contains select parameters at defined levels. The levels are unknown to the laboratory. The laboratory is also unaware that the sample is a performance evaluation sample.

duplicate sample analyses
Different aliquots of the same sample are analyzed to evaluate the precision of an analysis.

error
The difference between an observed or measured value and its true value.

field blank
A blank that is prepared and handled in the field and analyzed in the same manner as its corresponding client samples.

field matrix spike
A sample created by spiking target analytes into a sample in the field at the point of sample acquisition.

Glossary (continued)

finding
Noncompliant practices or policies which have significant adverse impact on data quality, technical defensibility, or regulatory acceptance of data. Findings require immediate attention by the laboratory management and must be resolved to comply with STL Knoxville's quality documents and laboratory-established procedures.

geometric mean
The nth root of the product of all values in a set of n values or the antilogarithm of the arithmetic mean of the logarithms of all the values of a set of n values. The geometric mean is generally used when the logarithms of a set of values are nearly normally (Gaussian) distributed, such as is the case of much population data.

initial calibration
Analysis of a series of analytical standards at different specified concentrations; used to define the linearity and dynamic range of the response of an instrument to the target compounds prior to the analysis of samples.

inspection
Examination or measurement of an item or activity to verify conformance to specific requirements.

instrument detection limit (IDL)
IDL is a calculated estimate of instrument detectability defined by the USEPA Contract Laboratory Program (CLP).

Glossary (continued)

internal standard (IS)
A compound added to every standard, QC sample, client sample, or sample extract at a known concentration prior to analysis for the purpose of quantitation. For example, internal standards are used as the basis for quantitation of the target compounds by GC/MS.

Laboratory Quality Manual (LQM)
A document stating the quality policy, quality system and quality practices of the laboratory. The LQM may include by reference other documentation relating to the laboratory's quality system.

linear regression
A statistical method for finding a straight line that best fits a set of two or more data points, thus providing a relationship between two or more variables.

matrix
The component or substrate which contains the analyte(s) of interest. Examples of matrices are water, soil or sediment, and air. Matrix is not synonymous with phase (liquid or solid).

matrix effect
An interference in the measurement of analyte(s) in a sample that is caused by materials in the sample. Matrix effects may cause elevated reporting limits or may prevent the acquisition of acceptable results.

matrix spike (MS)
An aliquot of a matrix fortified (spiked) with known quantities of specific compounds and subjected to an entire analytical procedure in order to indicate the appropriateness of the method for a particular matrix. The percent recovery for the respective compound(s) is then calculated.

matrix spike duplicate (MSD)
A second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

may
Denotes permission but not a requirement.

mean

Glossary (continued)

See arithmetic mean.

measurement
The process or operation of ascertaining the extent, degree, quantity, dimensions, or capability with respect to a standard.

median
The middle value of a set of data when the data set is ranked in increasing or decreasing order.

method
An assemblage of techniques.

method blank (MB)
An analytical control consisting of all reagents, which may include internal standards and surrogate standards, that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background contamination. Examples of method blanks are a volume of deionized or distilled laboratory water for water samples, a purified solid matrix for soil/sediment samples, or a generated zero air.

method detection limit (MDL)
The minimum concentration of an analyte that, in a given matrix and with a specific method, can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is operationally defined as:

$$MDL = st_{(n-1,\ \alpha=0.99)}$$

where:

s = the standard deviation of a number of measurements of a blind or sample matrix containing the analyte at a concentration near the lowest standard recommended in the method and

$t_{(n-1,\ \alpha=0.99)}$ = the student's value for a one-sided t-statistic appropriate for the number of samples used to determine (s), at the 99% confidence level and n-1 degrees of freedom.

modified method
A standard or reference method which has been changed to meet project or matrix requirements.

Glossary (continued)

must
Denotes a requirement is mandatory and has to be met.

notable practices
Laboratory practices that increase effectiveness and quality and represent improvements with respect to conventional laboratory operations.

nonconformance
An unplanned deviation from an established protocol or plan. The deviation may be the result of STL Knoxville's actions, then termed a deficiency. If the deviation is the result of events beyond the control of STL Knoxville, it is termed an anomaly.

operational calibration
Routinely performed as part of instrument usage, such as the development of a standard calibration curve. Operational calibration is generally performed for instrument systems.

outlier
A result excluded from the statistical calculations due to being deemed "suspicious" when applying the "Grubbs Test" (or equivalent).

parameter
A constant or coefficient that describes some characteristic of a population (e.g., standard deviation, mean, regression coefficients). Also, a chemical being measured, i.e., an analyte.

percent difference
When two independent measurements of the same characteristics are available, it is possible to use the percent difference instead of the coefficient of variation to measure precision.

$$\%D = \left| \frac{X_1 - X_2}{X_1} \right| x\ 100\%$$

where: $\%D$ = percent difference
X_1 = first value
X_2 = second value

Glossary (continued)

percent recovery
A measure of accuracy determined from the comparison of a reported spike value to its true spike concentration.

$$\%R = \frac{observed\ conc.\ -\ sample\ conc.}{true\ spike\ conc.} \times 100\%$$

performance audit
See performance evaluation.

performance testing (PT)
A type of audit in which a known or characterized value is compared to the result obtained through the routine analysis of the sample in the laboratory to evaluate the proficiency of an analyst or laboratory. This was formerly referred to as a PE.

periodic calibration
A calibration that is performed at prescribed intervals for equipment such as balances, thermometers, and balance weights. In general, they are performed on equipment that are distinct, singular purpose units, and are relatively stable in performance.

population
A generic term denoting any finite or infinite collection of individual things, objects, or events.

practical quantitation limit (PQL)
The lowest concentration a method can reliably achieve within limits of precision and accuracy and is derived from empirical, matrix-free method performance studies.

precision
Precision is an estimate of variability, that is, it is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. The precision of a measurement system is affected by random errors. Precision is expressed either as relative standard deviation (RSD) for replicate measurements greater than two or as relative percent difference (RPD) for duplicate measurements.

preventive maintenance

Glossary (continued)

An organized program within STL Knoxville of actions (such as equipment cleaning, lubricating, reconditioning, adjustment and/or testing) taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use.

primary standard
A material having a known, stable property that can be accurately measured or derived from established physical or chemical constants. It is readily reproducible and can be accepted (within stated limits) and used to establish the same value of another substance or item.

procedure
Detailed instructions to permit replication of a method. (See standard operating procedure.)

proficiency testing
A series of planned tests which will determine the ability of field technicians or laboratory analysts to perform routine analyses. The results from this testing may be used for comparison against established criteria or for relative comparisons among the data from a group of technicians or analysts.

project-specific reporting limit (PSRL)
See reporting limit.

protocol
Methodology specified in regulatory, authoritative, or contractual situations.

QC batch
The QC batch consists of a set of up to 20 field samples that behave similarly (i.e., same matrix) and are processed using the same procedures, reagents, and standards within the same time period.

Glossary (continued)

QC check sample
A reference matrix containing known concentrations of parameters of interest. If prepared in the laboratory, it is made using stock standard solutions independent of those used for calibration. If the results of these parameters do not meet acceptance criteria, corrective actions are taken.

qualification (personnel)
The characteristics of abilities gained through education, training, or experience, as measured against established requirements, such as standards or tests, that qualify an individual to perform a required function.

quality
The sum of features and properties/characteristics of a process, item, or service that bears on its ability to meet the stated needs of the user.

quality assurance (QA)
An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Management Plan (QMP)
A formal document describing the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an agency, organization or laboratory to ensure the quality of its product and the utility of the product to its users.

Quality Assurance Project or Program Plan (QAPP)
A formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure the results of the work performed will satisfy the stated performance criteria.

quality control (QC)
The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that it meets the stated requirements established by the client or by STL.

quality improvement

Glossary (continued)

The process of improving the quality of operations. This process encourages worker recommendations for improvement of work processes and requires timely management evaluation and feedback or implementation.

quality management
That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality management system.

quality management system (QMS)
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

random error
Variations of repeated measurements that are random in nature and individually not predictable.

range
The difference between the largest and smallest numbers in a set of numbers.

raw data
All documentation associated with the original recording of analytical results pertinent to a specific sample or set of samples. This may include laboratory worksheets, calculation forms, instrument-generated output, analyst notes, etc., from sample receipt through final reporting.

reagent water
Water in which an interferant is not observed at or above the minimum quantitation limit of the parameters of interest. The reagent water's purity and acceptability is verified by analysis with each set of samples.

recovery
See percent recovery.

Glossary (continued)

reference method
A method of known and demonstrated accuracy.

regression coefficients
The quantities describing the slope and intercept of a regression line.

relative error
An error expressed as a percentage of the true value or accepted reference value.

relative percent different (RPD)
Statistic for evaluating the precision of a replicate set. For replicate results:

$$RPD = \left[\frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2} \right)} \right] x\ 100$$

where: X_1 = first observed concentration or recovery
X_2 = second observed concentration or recovery

Glossary (continued)

relative response factor (RRF)
A measure of the relative mass spectral response of a compound compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples. Because a RRF is the comparison of two responses, it is a unitless number. RRFs are determined by the following equation:

$$RRF = \frac{A_x}{A_{IS}} x \frac{C_{IS}}{C_x}$$

where: A = area of the characteristic ion measured
C = concentration
IS = internal standard
x = analyte of interest

relative standard deviation (RSD)
See coefficient of variation.

reporting limit (RL)
One of two types of reporting limit conventions within STL. The Reporting Limit (RL) is a uniform reporting limit based on an evaluation of the PQLs at STL Knoxville and the expected method performance in routine water and soil matrices. Project Specific Reporting Limits (PSRLs) are reporting limits that are defined by project requirements.

representative sample
A sample taken to represent a lot or population as accurately and precisely as possible.

representativeness
Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result (concentration) is representative of the constituent concentration in the sample matrix. At STL Knoxville, every effort must be made to analyze an aliquot that is representative of the original sample, and to ensure the homogeneity of the sample before subsampling.

Glossary (continued)

reproducibility
The precision, usually expressed as a standard deviation, measuring the variability among results of measurements of the same sample at different laboratories.

response factor (RF)
A factor derived from the calibration of a compound that is used in the quantitation calculation of sample analytes. A response factor may be derived from an external standard calibration (then called a Calibration Factor) or from an internal standard calibration (then called a Relative Response Factor).

secondary standard
A material having a property that is calibrated against a primary standard.

self assessment
Assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing or performing the work.

shall
Denotes a requirement that is mandatory and has to be met.

should
Denotes a guideline or recommendation.

standard addition
The procedure of adding known increments of the analyte of interest to a sample to cause increases in detection response to subsequently establish, by extrapolation of the plotted responses, the level of the analyte of interest present in the original sample.

standard deviation
A measure of the dispersion about the mean of the elements in a population. The square root of the variance of a set of values:

Glossary (continued)

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

where: s = standard deviation
Σ = sum of
X = observed values
n = number of observations

standardization
The establishment of the value of a potential standard with respect to an established or known standard.

standard method
A method of known and demonstrated precision issued by an organization generally recognized as competent to do so.

standard operating procedure (SOP)
A written document that details an operation, analysis, or action, with prescribed techniques and steps, that is officially approved as the method for performing certain routine or repetitive tasks.

standard reference material (SRM)
A material produced in quantity, of which certain properties have been certified by the National Institute of Standards and Technology (NIST), formerly NBS, or other agencies to the extent possible to satisfy its intended use.

standard verification
Standard is checked by STL or the vendor versus a known specification.

statistic
A constant or coefficient that describes some characteristic of a sample. Statistics are used to estimate parameters of populations.

stock solution

Glossary (continued)

A concentrated solution of analyte(s) or reagent(s) prepared and verified by prescribed procedure(s), and used for preparing working standards or standard solutions.

subsample
A portion taken from a sample. A laboratory sample may be a subsample of a gross sample; similarly, a test portion may be a subsample of a laboratory sample.

supplier
See vendor.

surrogate (surrogate standard)
Compounds, when required by a method, that are used added to every blank, sample, LCS, matrix spike, matrix spike duplicate, and standard. They are used to evaluate analytical efficiency by measuring recovery. Surrogates include brominated, fluorinated, or isotopically-labeled compounds that are not expected to be detected in environmental media.

systematic error
The condition of a consistent deviation of the results of a measurement process from the reference or known level.

systems audit or evaluation
A systematic on-site qualitative review of facilities, procedures, equipment, training, record keeping, data verification, and reporting aspects of a quality assurance system to arrive at a measure of the capability of the system. Within STL, system audits or evaluations are performed on a periodic basis.

technique
Physical or chemical principle for characterizing materials of chemical systems.

traceability of data
The entire documented chain of acquired data from the original acquisition effort through to the final tabulation, synthesis, reduction, and storage activities. The documentation will allow complete reconstruction of the data.

traceability of samples

Glossary (continued)

During all environmental monitoring field efforts, acquired samples will be assigned specific and unique identification numbers. These sample numbers shall be accompanied by documentation (chain-of-custody form) which clearly identifies all parameters associated with sample acquisition. All additional sample numbering systems applied to the sample must be clearly cross-referenced to the field sample number to provide for traceability of samples from acquisition to reporting of sample results.

traceability of standards
The ability of an analytical standard material used for calibration purposes to be traced to its source. The standards used by STL must be traceable via written documentation to sources which produce or sell verified or certified standards.

validation - computer software
The process of establishing documented evidence which provides a high degree of assurance that a specific process will consistently produce a product meeting predetermined specifications and quality attributes. This process demonstrates and documents that the software performs correctly and meets all specified requirements.

validation - data
The process of a second party performing a systematic review of the raw and final data produced by a laboratory using predetermined criteria to ascertain the validity of the data with respect to the criteria.

vendor
Any individual or organization furnishing items or services or performing work according to a procurement document. This is an all-inclusive term used in place of any of the following: supplier, seller, contractor, subcontractor, or consultant.

verification - computer software
The process of checking the accuracy of manually entered or automatically (electronically) calculated information.

Glossary (continued)

verification - data

The process of reviewing data to ensure that data reduction has been correctly performed and that analytical results to be reported correspond to the data acquired and processed.

Table Section

TABLE 2-1
LQM Source Documents Requirements Matrix

STL LQM	EPA QA/R-2[1]	ANSI/ASQC E4-1994[2]	NQA-1[3], [7]	414.1A[4]	ANSI N 13.30[5]	ANSI/ASQC Q2-1991[6], [8]
1.0 Management Commitment and Organization	3.2 Management and Organization	2.1 Management and Organization	1 Organization	4 b 1)(a) Program	1.1 Introduction 1.2 Purpose 1.3 Scope	5.0 Management Responsibility
2.0 Quality System and Description	3.3 Quality System and Description	2.2 Quality System and Description	2 Quality Assurance Program	4 b 1)(a) Program	2.1 Special Word Usage 2.2 Specific Terms 5.1 Quality Assurance 5.2 Quality Control	5.2 Quality System
3.0 Document Control and Records Management	3.6 Documentation and Records	2.5 Documents and Records	6 Document Control 17 Quality Assurance Records	4 b 1)(d) Documents and Records	3.6 Direct Bioassay-Record Retention 4.5 Indirect Bioassay Record Retention	8.4 Quality Documentation and Records
4.0 Staff Qualification, Orientation and Training	3.4 Personnel Qualification and Training	2.3 Personnel Training and Qualification		4 b 1)(b)Personnel Training and Qualification	3.2 Personnel Preparation	14.0 Personnel
5.0 Procurement of Supplies and Services	3.5 Procurement of Items and Services	2.4 Procurement of Items and Services	4 Procurement Document Control 7 Control of Purchased Items and Services	4 b 2)(c) Procurement	N/A	7.0 Quality in Procurement 13.0 Subcontracting
6.0 Computer Hardware and Software	3.7 Computer Hardware and Software	2.6 Computer Hardware and Software	3 Design Control 11 Test Control	N/A	N/A	ISO 9000-3[9]

TABLE 2-1
LQM Source Documents Requirements Matrix (continued)

STL LQM	EPA QA/R-2[1]	ANSI/ASQC E4-1994[2]	NQA-1[3], [7]	414.1A[4]	ANSI N 13.30[5]	ANSI/ASQC Q2-1991[6], [8]
7.0 Contract Review and Project Planning	3.8 Planning	2.7 Planning 3.1 Planning and Scoping 3.3 Implementation of Planned Operations	2 Quality Assurance Program 3 Design Control 5 Instructions, Procedures, and Drawings 8 Identification and Control of Items 9 Control of Processes 11 Test Control 13 Handling, Storage, and Shipping	4 b 1) (a) Program 4 b 2 (b) Design	3.1 Facility Criteria 3.4 Direct Bioassay-Performance Criteria for Service Laboratories 3 5 Direct Bioassay-Reporting Results 4.1 Indirect Bioassay-Responsibilities of the Service Laboratory Customer 4.2 Indirect Bioassay-Analytical Methodology 4.3 Indirect Bioassay-Performance Criteria for Service Laboratories 5.2 Quality Control	6.3.3 Quality Plans
8.0 Work Processes and Operations	3.9 Implementation of Work Processes	2 8 Implementation of Work Processes	1 Organization 5 Instructions, Procedures, and Drawings	4 b 2 (a) Work Processes 4 b 2 (b). Design	3.1 Facility Criteria	8.0 Laboratory Operations Quality Assurance 9.0 Control of Measuring and Test Equipment 10.0 Data Validation 15.0 Use of Statistical Methods

TABLE 2-1
LQM Source Documents Requirements Matrix (continued)

STL LQM	EPA QA/R-2[1]	ANSI/ASQC E4-1994[2]	NQA-1[3], [7]	414.1A[4]	ANSI N 13.30[5]	ANSI/ASQC Q2-1991[6], [8]
	3.9 Implementation of Work Processes (Continued)	3.2 Design of Data Collection Operations	10 Inspection 12 Control of Measuring and Test Equipment 14 Inspection, Test, and Operating Status	4 b 2 (d) Inspection and Acceptance Testing		
9.0 Quality Assessment and Response	3.10 Assessment and Response 3.11 Quality Improvement	2.9 Assessment and Response 3.4 Assessment and Response 3.5 Assessment and Verification of Data Usability 2.10 Quality Improvement	2 Quality Assurance Program 13 Handling, Storage, and Shipping 15 Control of Non-conforming Items 16 Corrective Action 18 Audits	4 b 3 (a) Management Assessment 4 b 3 (b) Independent Assessment 4 b 1 c) Quality Improvement	3 3 Direct Bioassay-Interpretation of Measurements 3.5 Direct Bioassay-Reporting Results 4.4 Indirect Bioassay-Reporting Results 6.1 Direct Bioassay Measurements 6.2 Indirect Bioassay Measurements	16 0 Nonconformity 17.0 Corrective Action 18.0 Auditing the Quality System

Footnotes

[1] EPA Requirements for Quality Management Plans, U.S. Environmental Protection Agency, EPA QA/R-2, March 2001
[2] Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, American Society for Quality Control, Energy and Environmental Quality Division, Environmental Issues Group, ANSI/ASQC E4-1994 (Formerly EQA-1), January 1994
[3] Quality Assurance Program Requirements for Nuclear Facilities, The American Society of Mechanical Engineers, ASME NQA-1-1989 edition
[4] Quality Assurance, Office of Nuclear Energy & Office of Environment, Safety, and Health, United States Department of Energy, DOE ORDER 414.1A, September 1999
[5] Performance Criteria for Radiobioassay, ANSI N 13.30, September 1989
[6] Quality Management and Quality System Elements for Laboratories - Guidelines, American National Standard, American Society for Quality Control, ANSI/ASQC Q2-1991
[7] Section II, "Basic Requirements."
[8] Technically equivalent to ISO 9001.
[9] Quality Management and Quality Assurance Standards, ISO 9000, Part 3, "Guidelines for the Application of ISO 9001 to the Development, Supply and Maintenance of Software."

TABLE 2-2
Cross-Reference of LQM to NELAC Requirements for Quality Manuals

NELAC QUALITY MANUAL: REQUIRED ELEMENTS*	LQM, QA POLICY, AND/OR QA SOP REFERENCE
a) A quality policy statement, including objectives and commitments, by top management	LQM Chapter 1
b) The organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts	LQM Chapter 1
c) The relationship between management, technical operations, support services and the quality system	LQM Chapter 1 LQM Chapter 7
d) Procedures to ensure that all records required under this chapter are retained as well as procedures for control and maintenance of documentation through a document control system which ensures that all standard operating procedures, manuals, or documents clearly indicate the time period during which the procedure or document was in force	LQM Chapter 2 LQM Chapter 3
e) Job descriptions of key staff and reference to the job descriptions of other staff	LQM Chapter 1 and Chapter 4 Separate document (hardcopy and/or electronic) provides job descriptions
f) Identification of the laboratory's approved signatories; at a minimum, the title page of the Quality Manual must have the signed concurrence, (with appropriate titles) of all responsible parties including the QA officer, technical director, and the agent who is in charge of all laboratory activities such as the laboratory director or laboratory manager	LQM Title/Approval Page
g) The laboratory's procedures for achieving traceability of measurements	LQM Chapter 8

*National Environmental Laboratory Accreditation Conference Standard, Quality Systems, Approved July 12, 2002

TABLE 2-2
Cross-Reference of LQM to NELAC Requirements for Quality Manuals (continued)

NELAC QUALITY MANUAL: REQUIRED ELEMENTS*	LQM, QA POLICY, AND/OR QA SOP REFERENCE
h) A list of all test methods under which the laboratory performs its accredited testing	LQM Table 8-1
i) Mechanisms for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work	LQM Chapter 7
j) Reference to the calibration and/or verification test procedures used	LQM Chapter 8 Tables 8-17 through 8-20
k) Procedures for handling submitted samples	LQM Sections 8.5.2 and 8.5.3
l) Reference to the major equipment and reference measurement standards used as well as the facilities and services used by the laboratory in conducting tests	Equipment list is Table 8-3 LQM Sections 5.2.4, 8.1, 8.5.4, 8.11 to 8.12
m) Reference to procedures for calibration, verification and maintenance of equipment	Calibrations in Tables 8-17 through 8-20 LQM Sections 8.5.4, 8.11 to 8.12
n) Reference to verification practices including interlaboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes	LQM Section 9.4.5
o) Procedures to be followed for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur	LQM Chapter 9 SOP KNOX-QA-0008, "Nonconformance and Corrective Action"

*National Environmental Laboratory Accreditation Conference Standard, Quality Systems.

TABLE 2-2
Cross-Reference of LQM to NELAC Requirements for Quality Manuals (continued)

NELAC QUALITY MANUAL: REQUIRED ELEMENTS*	LQM, QA POLICY, AND/OR QA SOP REFERENCE
p) The laboratory management arrangements for exceptionally permitting departures from documented policies and procedures or from standard specifications	LQM Section 7.4 and 9.1
q) Procedures for dealing with complaints	LQM Section 9.2
r) Procedures for protecting confidentiality and proprietary rights (including national security concerns)	LQM Section 8.9.6
s) Procedures for audits and data reviews	LQM Section 5.3.6, 8.8 and 9.4
t) Processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and/or receive any needed training	LQM Chapter 4 SOP KNOX-QA-0009, "Employee Orientation and Training"
u) Ethics policy statement developed by the laboratory and process/procedures for educating and training personnel in their ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions	LQM Section 1.4 SOP S-Q-004 – Acceptable Manual Integration Practices P-T-001 – Selection of Data Points Required for Initial Calib.
v) Reference to procedures for reporting analytical results	LQM Section 8.9 SOP S-T-004 "Reporting Limits"

TABLE 2-2
Cross-Reference of LQM to NELAC Requirements for Quality Manuals (cont.)

NELAC QUALITY MANUAL: REQUIRED ELEMENTS*	LQM, QA POLICY, AND/OR QA SOP REFERENCE
w) A table of contents and applicable list of references, glossaries, and appendices	LQM Table of Contents Table 8-2 Table 2-1
x) Data integrity procedures defined in detail including • Data integrity training • Signed data integrity documentation for all laboratory employees • In depth, periodic monitoring of data integrity • Data integrity procedure documentation (see NELAC 5.4.2.6)	LQM Section 4 Ethics Policy, P-L-006 LQM, Section 9

*National Environmental Laboratory Accreditation Conference Standard, Quality Systems, Approved May 25, 2001

TABLE 2-3
STL Knoxville Quality Documents and Required Approval

Quality Document	Required Approvals
Laboratory Quality Manual (LQM)	• Laboratory Director • Technical Directors • Quality Assurance Manager
STL Knoxville Policies	• Laboratory Director • Technical Director • Quality Assurance Manager
STL Knoxville Standard Operating Procedures (SOPs)	• Laboratory Director • Technical Specialist • Laboratory Health and Safety Coordinator[1] • Quality Assurance Manager

[1] Required only if procedure encompasses more than standard office safety requirements.

TABLE 2-4
STL Quality Document Review Frequency

Document Type	Frequency of Review	Responsible Party
Laboratory Quality Manual (LQM)	Every Year	Quality Assurance Manager
Standard Operating Procedures (SOP) and Policies	Every Two Years [1]	Quality Assurance Manager & Operations Manager, along with Group (Area) Leaders

[1] SOPs for analytical methods performed in support of DOD (i.e., NFESC and USACE) must be reviewed annually.

TABLE 3-1

STL Knoxville Records & Retention Schedule

Type of Record	Retention [2]	Disposition [1, 2]
General Laboratory Documents		
Instrument output	5 yrs from report completion	Shred or burn
Quality control data	5 yrs from report completion	Shred or burn
Field sample data	5 yrs from report completion	Shred or burn
Final analytical reports	5 yrs from report completion	Shred or burn
Instrument logbooks	5 yrs from last entry	Shred or burn
Equipment monitoring & maintenance records	5 yrs from last entry	Shred or burn
Instrument calibration records	5 yrs from last entry	Shred or burn
Standard preparation logs	5 yrs from last entry	Shred or burn
Standards certificates	5 yrs from last entry	Shred or burn
Measurement & test equipment logs (e.g., refrig., balances, etc.)	5 yrs from last entry	Shred or burn
Method & instrument validation records	5 yrs from last entry	Shred or burn
Instrument manuals	Retain until superseded	Trash
Project management files	5 yrs from project completion	Shred or burn
Quotes & proposals	2 yrs from date of expiration	Shred or burn
LQM, policies, & SOPs	5 yrs from date superceded	Shred or burn
Analyst demonstrations of proficiency	5 yrs from last date of employment	Shred or burn
Quality assurance audits	5 yrs from last entry	Shred or burn
Certifications & approvals	5 yrs from last entry	Shred or burn
Employee signature list	5 yrs from date of completion	Shred or burn
MDL Studies	5 yrs from last entry	Shred or burn
Performance testing studies	5 yrs from last entry	Shred or burn
QA reports to management	5 yrs from last entry	Shred or burn
Quality control charts	5 yrs from last entry	Shred or burn

TABLE 3-1

STL Knoxville Records & Retention Schedule

Type of Record	Retention [2]	Disposition [1, 2]
Environment, Health and Safety Records		
Medical records	Retain while active & 30 yrs from last entry	Shred or burn
Employee exposure & monitoring records	Retain while active & 30 yrs from last entry	Shred or burn
Workers compensation files & first report of injury	Retain while active & 30 yrs from last entry	Shred or burn
Accident logs (OSHA Form 200)	5 yrs from last entry	Shred or burn
Accident reports	5 yrs from last entry	Shred or burn
Environmental permits	5 yrs from last entry	Shred or burn
Environmental management, e.g., discharge reports	5 yrs from last entry	Shred or burn
Health & safety audits	5 yrs from last entry	Shred or burn
STL Corporate Safety Manual	5 yrs from archival	
Safety Inspections	5 yrs from last entry	Shred or burn
Radioactive materials records	5 yrs from last entry	Shred or burn
NRC or state radioactive materials handling inspections	5 yrs from last entry	Shred or burn
TLD exposure records	5 yrs from last entry	Shred or burn
EH&S training	5 yrs from last entry	Shred or burn
Accounting	See Accounting and Controls Procedures Manual	
Administrative		
Personnel records (not including medical or disability records)	7 years from last entry	Shred or burn

[1] Approved paper recycling services may be used if paper is shredded as part of the recycling process.
[2] Ten year record retention is required for some programs. See KNOX-AD-0001 for details.

TABLE 5-1
List of STL Knoxville Quality-Related Items that Require Evaluation Prior to Use

Quality-Related Item
Acetone
Dichloromethane
Hexane
Hydrochloric acid
Methanol
Nitric acid
Hydrogen Peroxide
Sulfuric acid
Toluene

TABLE 6-1
GALP Cross Reference To LQM

GALP Section	GALP Guidance	STL Document
8.1 Laboratory Management	8.1.1 ensure that personnel clearly understand the functions they are to perform	LQM 1.6.2, 1.6.4, and 4.0
	8.1.2 ensure that QAU monitors computer activities	LQM 9.4.2
	8.1.3 ensure that personnel, resources, and facilities are adequate and available as scheduled	LQM 1.6.1-1.6.4
	8.1.4 receive reports of QAU inspection and audit reports, and ensure corrective actions are promptly taken in response to any deficiency	LQM 9.4.2
	8.1.5 approve SOPs related to the computer activities, and ensure that devations to the SOPs are documented	LQM 3.3 and 9.1.1
	8.1.6 assure that GALP provisions are followed	LQM 6.0, KNOX-IT-0001
8.2 Personnel	8.2.1 must have adequate education, training, and experience to perform assigned IT functions	LQM 4.0, KNOX-QA-0009
	8.2.2 a summary of training, experience, and job description must be maintained	LQM 4.1
	8.2.3 personnel must be of sufficient number for timely and proper operation of the computer systems	LQM 1.6.1 – 1.6.4
8.3 Quality Assurance Personnel	8.3.1 shall be separate and independent of IT personnel, and shall report directly to laboratory management	LQM 1.6.1
	8.3.2 shall have immediate access to the computer data, SOPs, and other records	LQM 1.61 and 9.4
	8.3.3 inspect the LIMS at intervals to ensure the integrity of LIMS raw data, and shall present inspection reports to management	LQM 9.4
	8.3.4 determine that no deviations from approved SOPs were made without proper authorization and documentation	LQM 9.1.1
	8.3.5 periodically audit raw data to ensure their integrity	LQM 9.4.3
	8.3.6 maintain adequate records of the QAU operations	LQM 9.4.2
8.4 LIMS Raw Data	8.4.1 LIMS raw data and the storage media on which they reside must be identified and documented. The documentation shall be included in the lab's SOPs.	KNOX-IT-0001
	8.4.2 the individual(s) responsible for entering and recording LIMS raw data must be uniquely identified, together with the date and time the data were entered	KNOX-QA-0013

TABLE 6-1
GALP Cross Reference To LQM (cont.)

GALP Section	GALP Guidance	STL Document
8.4 LIMS Raw Data, continued	8.4.3 the instrument transmitting raw data must be uniquely identified in the record, together with the date and time of transmission	KNOX-QA-0013
	8.4.4 procedures and practices used to verify LIMS raw data must be documented in controlled SOPs	KNOX-IT-0001; LQM 8.8-8.8.3
	8.4.5 procedures and practices for making changes to LIMS raw data are documented and provide evidence of change, preserve the original recorded documentation are dated, indicate the reason for the change, identify the person who made the change and, if different, the person who authorized the change. These procedures shall be included in the laboratory's SOPs.	KNOX-IT-0001, LQM 6.4.3
8.5 Software	8.5.1 SOPs shall be established for: a. software development b. software testing c. change control d. version control e. maintaining historical file	KNOX-IT-0001
	8.5.2 documentation shall be maintained for: a. software description & functional requirements b. algorithms and formulas c. testing and quality assurance	KNOX-IT-0001
	8.5.3 all documentation is readily available in the facility where the software is used and SOPs are readily available where procedures are performed	KNOX-IT-0001
	8.5.4 a historical file of software and documentation shall be retained	KNOX-IT-0001
8.6 Security	Laboratory management shall ensure that security practices are adequate to assure the integrity of data	LQM 6.2; KNOX-IT-0004
8.7 Hardware	8.7.1 must be of adequate design and capacity, and a documented description maintained	LQM 6.1; KNOX-IT-0001
	8.7.2 must be installed in accordance with manufacturer's recommendations, and undergo documented acceptance testing as described in a laboratory SOP	KNOX-IT-0001; LQM 6.1
	8.7.3 testing, maintenance, and repair must be described in a laboratory SOP	KNOX-IT-0001
8.8 Comprehensive Testing	Management shall ensure that comprehensive testing shall be documented at least every 24 months or more frequently as a result of software changes.	KNOX-IT-0001

TABLE 6-1
GALP Cross Reference To LQM (continued)

GALP Section	GALP Guidance	STL Document
8.9 Records Retention	Procedures must be in place for the retention of LIMS raw data and documentation and records pertaining to LIMS	QMP; LQM 3.4-3.5
8.10 Facilities	8.10.1 the environmental conditions of the facility housing the LIMS must be controlled to protect against data loss	LQM 6.2
	8.10.2 environmental conditions for storing LIMS raw data and records must be adequate	LQM 6.2
8.11 SOPs	8.11.1 SOPs, as described above, must be maintained and readily available where the procedure is performed	LQM 3.1-3.2; SOP Index
	8.11.2 SOPs must be reviewed periodically to ensure that they are accurate	LQM 3.3
	8.11.3 SOPs must be authorized and controlled, with all changes subject to the same approvals and control	LQM 3.3
	8.11.4 an historical file of SOPs must be maintained	LQM 3.5

TABLE 8-1
Analytical Methods and Matrices

Analytical Parameters	Fields of Testing[1]				
	Drinking Water (SDWA)	**Non-Potable Water (CWA/RCRA)**	**Solid and Chemical Materials (RCRA-SW846)**	**Air and Emissions (CAA)**	**Biological Tissue**
Anions (Br^-, Cl^-, F^-, NO_2, NO_3, o-PO_4, SO_4	**EPA 300.0**	**EPA 300.0** **EPA 9056**	**EPA 9056**	Mod Method 26A/0050 (9057 Mod)	---
Ash	---	---	ASTM D482	---	---
Cyanide (Amenable)	---	**EPA 9012A** EPA 335.1	**EPA 9012A**	---	---
Cyanide (Total)	---	**EPA 9012A** EPA 335.4	**EPA 9012A**	---	---
Density	---	---	ASTM D1963, D854	---	---
Halogens	---	---	ASTM E442, EPA 5050	---	---
Heat of Combustion (Btu)	---	---	ASTM D5865, D240	---	---
Hexavalent Chromium	---	---	---	Method 0061/7199	---
Perchlorate	**EPA 314.0**	EPA 314.0		---	---
pH	**EPA 150.1**	**EPA 9040B** **EPA 150.1**	**EPA 9040B** **EPA 9045C**	---	---
Hardness	SM 2340B	**SM 2340B**	---	---	---
Particulates	---	---	---	PM-10, 40CFR, Part 50, App. J & App. B Method 0050/5 40CFR Part 60 App. A	---
Mercury	**EPA 245.1**	**EPA 245.1** **EPA 7470A**	**EPA 7470A** **EPA 7471A**	**EPA 0060/7470A** ASTM D6784-02 EPA IO-3.1/7470A **EPA Method 29/7470A**	EPA 7471A
Metals	**EPA 200.7**	**EPA 200.7** **EPA 6010B**	EPA 6010B	**EPA 0060/6010B** EPA IO-3.1/6010B **EPA Method 29/6010B**	EPA 6010B
Toxicity Characteristic Leaching Procedure (TCLP) & Synthetic Precipitation Leaching (SPLP)	---	---	**EPA 1311** **EPA 1312**	---	---
Viscosity	---	---	ASTM D445	---	---

TABLE 8-1 (continued)
Analytical Methods and Matrices

Analytical Parameters	Fields of Testing[1]				
	Drinking Water (SDWA)	**Non-Potable Water (CWA/RCRA)**	**Solid and Chemical Materials (RCRA-SW846)**	**Air and Emissions (CAA)**	**Biological Tissue**
Volatiles by GC/MS	---	**EPA 8260B**	**EPA 8260B**	**TO-14A, TO-15 EPA 0031/5041A (VOST)**	---
Volatiles by GC	---	---	---	EPA 0040 Condensates ASTM D1946-90	---
Semivolatiles by GC/MS	---	**EPA 8270C**	**EPA 8270C**	**TO-13A EPA 3542/8270C**	---
Semivolatiles by GC	---	**Pesticides EPA 8081A, PCBs EPA 8082, Congeners EPA 8082**	**Pesticides EPA 8081A, PCBs EPA 8082, Congeners EPA 8082**	**TO-4A,** TCO/Grav	**Congeners EPA 8082**
Explosives by HPLC	---	**EPA 8330 EPA 8332**	**EPA 8330 EPA 8332**	---	---
Dioxins/Furans by HRGC/HRMS	**EPA 1613B**	**EPA 1613B EPA 8290**	**EPA 8290**	**TO-9A, Method 23/8290 EPA 0023A/8290**	**EPA 8290**
PCBs by HRGC/HRMS	---	**EPA 1668A**	**EPA 1668A**	---	**EPA 1668A**
Polycyclic Aromatic Hydrocarbons (PAH)	---	---	---	KNOX-ID-0016 (CARB 429 Mod, HRGC/LRMS)	---

Footnotes

(1) **NELAC accredited methods are highlighted in bold font.**

Table 8-2 Standard Operating Procedures

SOP No.	Rev. No.	Rev. Date	Title
Administrative			
KNOX-AD-0001	5	4/27/04	Document Storage
KNOX-AD-0002	7	5/12/03	Project Records
KNOX-AD-0003	2	1/28/03	Documenting Project Requirements
KNOX-AD-0004	5	9/24/04	Data Reporting
KNOX-AD-0005	1	1/12/04	Project Quote and Setup
KNOX-AD-0006	0	4/28/03	QDS Report Form Generation
GC Laboratory			
KNOX-GC-0003	2	11/6/01	Permanent Gas Analysis by GC/TCD
KNOX-GC-0010	2	8/26/03	Analysis of Extractable Semivolatile and Nonvolatile Total Organics by Gas Chromatography and Gravimetric Analysis
KNOX-GC-0011	4	11/29/04	Analysis of Polychlorinated Biphenyl Congeners Based on SW-846 Method 8082
KNOX-GC-0014	4	12/10/04	Analysis of Organochlorine Pesticides Based on Method 8081A
KNOX-GC-0015	5	3/26/04	Analysis of PCBs Based on Method 8082 and TO-4A
KNOX-GC-0016	1	4/8/04	Analysis of Method 0040 Condensates by Gas Chromatography for Total Unspeciated Mass in the Volatile Range
KNOX-GC-0017	1	1/3/05	Analysis of Tedlar Bag Samples Collected by SW-Method 0040 by Gas Chromatography for Total Unspeciated Mass in the Volatile Range
Health & Safety			
KNOX-HS-0001	6	8/4/04	Radiological Sample Screening and Classification
KNOX-HS-0002	3	2/20/02	Waste Characterization and Categorization
KNOX-HS-0003	3	8/20/02	Waste Shipping and Manifesting
KNOX-HS-0004	4	8/16/04	Waste Packaging and Storage
KNOX-HS-0005	4	3/5/04	Waste Minimization Program
KNOX-HS-0006	3	8/11/04	Safety Precautions for Samples Containing Chemical Warfare Materials
KNOX-HS-0007	3	6/3/03	Facility Engineering Control Maintenance Program
KNOX-HS-0008	3	8/20/02	Safety Inspections and Audits
KNOX-HS-0009	2	8/20/02	TSCA Waste Accumulation, Storage and Disposal
KNOX-HS-0010	5	1/16/04	Radiation Protection Program
KNOX-HS-0012	2	8/20/02	Radiation Safety Training
KNOX-HS-0013	4	11/13/02	Handling and Storage of Potentially Radioactive-Contaminated Waste and Disposal of Radioactive Waste
KNOX-HS-0014	1	6/11/01	Background and Source Check and Use of Portable Survey Instruments
KNOX-HS-0015	2	10/1/02	Operation of Low Background Alpha Beta Counting Instruments
KNOX-HS-0016	2	1/14/02	Facility Radiological Surveys and Monitoring
KNOX-HS-0017	3	8/16/01	Waste Accumulation and Collection
KNOX-HS-0018	2	10/7/03	Inventory and Leak Testing of Sealed Sources
KNOX-HS-0019	1	6/11/01	Radioactive Sample Inventory
KNOX-HS-0020	2	1/5/05	Hazardous Waste Management Plan

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SOP No.	Rev. No.	Rev. Date	Title
KNOX-HS-0021	0	8/21/01	Respiratory Protection Program
Specialty Organics Laboratory			
KNOX-ID-0004	5	6/18/04	Analysis of Polychlorinated Dioxins/Furans by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) Based on Methods 8290, 1613B, 23, 0023A and TO-9A
KNOX-ID-0007	0	3/5/03	Concentration Verification of Standard Solutions
KNOX-ID-0012	1	11/5/02	Method 0023A and Method 0010 Sampling Train Pre-Test Preparation
KNOX-ID-0013	2	2/6/02	Analysis of Polychlorinated Biphenyl (PCB) Isomers by Isotope Dilution HRGC/HRMS
KNOX-ID-0016	3	6/2/04	Extraction and Isotope Dilution Analysis of Polynuclear Aromatic Hydrocarbons and Selected Semivolatile Organic Compounds by High Resolution Gas Chromatography-Low Resolution Selected Ion Monitoring Mass Spectrometry (HRGC/LRMS-SIM)
KNOX-ID-0017	1	11/25/02	High Volume Water Sampling Media Preparation and Extraction; Glass Fiber Filters and XAD-2 Resin
Information Technology			
KNOX-IT-0001	1	11/10/04	Good Automated Laboratory Practices
KNOX-IT-0002	3	9/9/04	Electronic Data and Software Backup
KNOX-IT-0003	1	3/24/03	Electronic Data Deliverable
KNOX-IT-0004	0	9/11/02	LIMS User Profile Setup and Maintenance
KNOX-IT-0005	0	11/12/04	Laptop Computer Security
HPLC Laboratory			
KNOX-LC-0001	11	4/22/04	Analysis of Nitroaromatic and Nitramine Explosives by HPLC
KNOX-LC-0005	1	11/11/04	Analysis of Nitroglycerin by HPLC
GCMS Laboratory			
KNOX-MS-0001	6	12/2/03	VOA Canister Analysis
KNOX-MS-0010	2	1/15/03	Volatile Analyte Screening by Purge and Trap
KNOX-MS-0011	4	7/30/03	VOST Analysis
KNOX-MS-0012	1	5/19/03	Unspeciated Mass Procedure
KNOX-MS-0014	2	1/21/04	Tentatively Identified Compounds (TICs)
KNOX-MS-0015	5	6/16/04	Determination of Volatile Organics by GCMS Based on Method 8260B
KNOX-MS-0016	3	3/24/04	GCMS Analysis Based on Methods 8270C and 625
KNOX-MS-0017	1	11/29/04	GCMS Analysis of Polyaromatic Hydrocarbons in Ambient Air Based on EPA Method TO13A
KNOX-MS-0018	0	7/21/03	Methanol Extraction of VOST Tubes

Table 8-2 Standard Operating Procedures

SOP No.	Rev. No.	Rev. Date	Title
Metals Laboratory			
KNOX-IP-0002	1	9/13/01	Metals Sample Preparation based on Method 3030C
KNOX-IP-0003	2	3/18/03	Digestion of Total Metals in Filters
KNOX-IP-0004	2	4/5/04	Acid Digestion of Soils, SW846 Method 3050B
KNOX-IP-0005	3	4/22/04	Acid Digestion of Aqueous Samples by SW846 and EPA Method 200.7
KNOX-IP-0006	1	4/21/03	Ontario Hydro Mercury Sampling Train Preparation
KNOX-MT-0004	2	6/10/03	Microwave-Assisted Acid Digestion of Sediments , Soils and Oils by Method 3051 and 3052
KNOX-MT-0005	2	4/9/03	Hardness by Calculation
KNOX-MT-0006	6	1/28/04	Multi-Metals (MMT) Sampling Train Preparation
KNOX-MT-0007	1	1/30/03	Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method For Trace Element Analyses, SW-846 Method 6010B and EPA Method 200.7
KNOX-MT-0007	2	5/13/04	FOR US ARMY CORPS SAMPLES ONLY Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method For Trace Element Analyses, SW-846 Method 6010B and EPA Method 200.7
KNOX-MT-0008	2	6/3/04	Sequential Extraction Procedure for Arsenic
KNOX-MT-0009	3	4/19/04	Preparation and Analysis of Mercury in Aqueous Samples by Cold Vapor Atomic Absorption, SW-846 7470A and MCAWW 245.1
KNOX-MT-0010	3	4/20/04	Preparation and Analysis of Mercury in Solid Samples by Cold Vapor Atomic Absorption, SW-846 7471A and MCAWW 245.5
KNOX-MT-0013	1	11/8/04	Sequential Extraction Procedure for TAL Metals for EA Engineering, Science and Technology
KNOX-MT-0014	0	11/8/04	Metals Laboratory Data Review and Reporting
Organic Prep Laboratory			
KNOX-OP-0002	5	1/4/05	Extraction of PUF/XAD-2 or PUF Air Sampling Cartridges for TO-13A and TO-4 Analyses
KNOX-OP-0009	2	2/28/03	Method 0010 Sample Train (Modified Method 5) Component Extraction
KNOX-OP-0011	4	3/8/04	Extraction and Cleanup of Organic Compounds From Waters and Soils, Based on SW-846 3500 Series, 3600 Series, 8151A and 600 Series Methods
KNOX-OP-0012	2	6/3/03	Toxicity Characterisitic Leaching Procedure and Synthetic Precipitation Leaching Procedure
KNOX-OP-0014	2	3/19/04	Extraction and Cleanup of PCB Congeners from Waters, Wastes and Soils
Quality Assurance			
KNOX-QA-0001	4	3/12/03	Standard/Reagent Labeling and Documentation
KNOX-QA-0002	5	5/5/04	Glassware Cleaning
KNOX-QA-0003	4	5/11/04	Preventive Maintenance

Table 8-2 Standard Operating Procedures

SOP No.	Rev. No.	Rev. Date	Title
KNOX-QA-0004	3	10/24/03	Control Limits and Control Charting
KNOX-QA-0005	3	10/20/03	Balance Calibration and Weight Verification
KNOX-QA-0006	1	2/9/04	Subsampling
KNOX-QA-0007	3	6/2/03	Quality Assurance Records
KNOX-QA-0008	2	9/22/04	Nonconformance and Corrective Action System
KNOX-QA-0009	1	12/19/02	Personnel Orientation and Training
KNOX-QA-0010	3	6/203	Temperature Monitoring and Thermometer Calibration
KNOX-QA-0011	3	5/27/03	Document Control and Distribution
KNOX-QA-0012	3	10/24/03	Pipetter Calibration
KNOX-QA-0013	3	10/20/03	Instrument Records and Logbooks
KNOX-QA-0014	0	3/3/03	Air Sampling Media Tracking and Quality Control
KNOX-QA-0015	2	5/23/01	Facility Security
KNOX-QA-0016	2	5/23/01	Routine Monitoring of Deionized Water
KNOX-QA-0017	5	5/12/04	Audits
KNOX-QA-0018	2	12/29/04	Preparation and Management of Standard Operating Procedures
KNOX-QA-0020	0	1/16/02	Selection and Evaluation of Subcontract Laboratories
S-Q-002	3	11/30/04	System Audits
S-Q-003	1	4/18/02	Method Detection Limits Studies
S-Q-004	2	9/17/04	Acceptable Manual Integration Practices
S-Q-005	1	7/8/04	Data Recall Process
S-T-001	2	7/26/01	Testing of Solvents and Acids
S-T-002	1	11/12/01	Reporting Limits for STL Laboratories Using QuantIMS
P-T-001	3	9/8/04	Selection of Calibration Points
Sample Receiving			
KNOX-SC-0001	6	5/7/04	Canister Cleaning and Preparation
KNOX-SC-0003	7	5/24/04	Samples Receipt and Log In
KNOX-SC-0004	4	10/6/03	Internal Chain of Custody
KNOX-SC-0005	3	10/6/03	Sample Disposal, Return and Archive
KNOX-SC-0006	1	7/31/03	Bottle and Cooler Preparation
Wet Chemistry Laboratory			
KNOX-WC-0001	5	3/12/04	Cyanide Analysis
KNOX-WC-0003	1	1/21/04	Analysis of Hexavalent Chromium Based on SW-846 Methods 0061/7199
KNOX-WC-0005	5	3/23/04	Anion Analysis by Ion Chromatography
KNOX-WC-0006	1	11/18/02	Method 0050/5 Train Particulate
KNOX-WC-0007	3	3/20/03	Ph Analysis
KNOX-WC-0010	1	11/13/03	Heat of Combustion (Gross Calorific Value)
KNOX-WC-0011	1	11/12/03	Determination of Viscosity
KNOX-WC-0012	2	1/9/04	Percent Moisture

Table 8-2 Standard Operating Procedures

SOP No.	Rev. No.	Rev. Date	Title
KNOX-WC-0013	1	11/12/03	Ash Determination
KNOX-WC-0014	4	3/24/04	Determination of Perchlorate by Ion Chromatography
KNOX-WC-0015	1	11/14/03	Density
KNOX-WC-0016	1	11/14/03	Halogen Determination
KNOX-WC-0028	4	11/27/02	Total Suspended Particulate (TSP) and PM-10

TABLE 8-3 Instrument List

Instrument Type	Manufacturer/ Serial Number (S/N)[1]	Model	Purchase/ Installation Date	Condition When Purchased	Autosampler
GCMS	Hewlett Packard S/N 3435A01974-MT	5972A	1999	New	Yes
	Hewlett Packard S/N US82321805-MA	5973	1999	New	Yes
	Hewlett Packard S/N US80310976-MZ	5973	1998	New	Yes
	Hewlett Packard S/N US80210991-MX	5973	1998	New	Yes
	Hewlett Packard S/N US91911868-MJ	5973	2000	New	Yes
	Agilent Technologies S/N US10129076-ME	5973 Network	2001	New	Yes
	Agilent Technologies S/N US10451834-MD	5973 Network	2001	New	Yes
	Agilent Technologies S/N US10345111-MK	5973 Network	2003	New	Yes (Solatek 72 autosampler (Tekmar/ Dohrmann)
	Agilent Technologies S/N US44621247-MG	6890	2005	New	Yes
GCMS Specialty Organics	Hewlett Packard S/N US94260093-MY	5973	2000	New	Yes
	Finnigan S/N 2631	MAT-95	1991	New	Yes
	Finnigan S/N 2725	MAT-95S	1998	New	Yes

TABLE 8-3 Instrument List

Instrument Type	Manufacturer/ Serial Number (S/N)[1]	Model	Purchase/ Installation Date	Condition When Purchased	Autosampler
GCMS Specialty Organics, continued	Finnigan S/N (GC) US00001760	MAT-90S	2001	Used	Yes
Prep Specialty Organics	Isco S/N 212287 (Pump)	Combi Flash Sq 1600	2001	New	Yes
GC	Varian S/N 3961-GR	3400 TCD	1989	New	Yes
	Hewlett Packard S/N US00021272-ST	6890 ECD	1987	New	Yes
	Agilent Technologies S/N US00041050-GH	6890 ECD	2001	New	Yes
	Hewlett Packard S/N 2618A07840-MN	5890 ECD	1986	Used	Yes
	Agilent Technologies S/N US10346012-CD	6890 ECD	2003	New	Yes
	Varian S/N 4644 GTO	3400 FID	1987	Used	No
Metals	Leeman Labs, Inc. Install #62434	Hydra AA	2001	New	Yes
	Thermo Jarrell Ash S/N 512990	ICAP 61E Trace	2000	New	Yes
	Thermo Jarrell Ash S/N 248490	ICAP 61E Trace	1994	New	Yes
	Thermo Elemental S/N X0344	X Series ICP-MS	2004	New	Yes

TABLE 8-3 Instrument List

Instrument Type	Manufacturer/ Serial Number (S/N)[1]	Model	Purchase/ Installation Date	Condition When Purchased	Autosampler
HPLC	Hewlett Packard S/N DE91606293-Ace	Series 1100	1999	New	Yes
	Hewlett Packard S/N US72102530-Semeka	Series 1100	1998	New	Yes
Wet Chemistry	Dionex S/N 8540706	2000i	1987	New	No
	Lachat S/N A83000-2135	Quick Chem 8000	2003	New	Yes
	Dionex S/N 00070167	DX 320	2000	New	Yes
	Dionex S/N 02070458	DX 600	2002	New	Yes
	Dionex S/N 03100244	ICS-1500	2003	New	Yes
Organic Prep	J_2 Scientific S/N 03K-1091-3.0	GPC Accuprep	2003	New	Yes
	Accumet S/N C0025140	Model 15 pH meter	1998	New	No
ACS	Varian S/N 0295	3600 FID	1988	New	No
	Varian S/N 3890	3300 FID	1987	New	No
	Parr S/N M5650	1266 Calorimeter	2003	New	No

[1] Information about preventive maintenance can be found in the STL Knoxville SOP KNOX-QA-0003, current revision, Preventive Maintenance.

Table 8-4-1
Anion Methods and Reporting Limits (RL) [1]

Method 300.0/9056			
Parameter	**CAS Number**	**Water RL (mg/L, except as noted)**	**Solid RL[1] (mg/Kg, except as noted)**
Bromide	24959-67-9	0.5	5.0
Chloride	16887-00-6	1.0	10
Fluoride	16984-48-8	1.0	10
Nitrate	---	0.50	5.0
Nitrite	---	0.50	5.0
Orthophosphate	---	1.0	10
Sulfate	14808-79-8	1.0	10

Methods 9057Mod, 0050/26A Mod[2]	
Parameter	**Air RL ug**
Chlorine	100
Hydrogen Chloride	100

(1) Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.
(2) Reporting limits for anions for Methods 26A (Mod)/9057 (Mod) are dependent on the impinger volume. RLs represent 100 mL impinger volume.
NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-2
Physical Parameter Methods and Reporting Limits (RL) [1]

Parameter	Method	RL[1] (mg/Kg, except as noted)
Ash	D482	200
Density	D1963, D854	0.01 g/cm^3
Heat of Combustion (Btu)	D240, D5865	1800 Btu/lb
Viscosity	D445	0.35 cSt
Total Halogens	E442, SW-846 5050 & 9056	200

(1) Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis. NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-3
Wet Chemistry Methods
Reporting Limits

Parameter	CAS Number	Method	Water RL (mg/L, except as noted)	Solid RL[1] (mg/Kg, except as noted)	Air RL (ug)[2]
Cyanide	57-12-5	335.4/ 9012A (LACHAT)	0.010	0.5	--
		ILM04.0 (LACHAT)	0.010	2.0	--
Cyanide, amenable	--	335.1/ 9012A (LACHAT)	0.010	NA	--
Hexavalent Chromium	18540-29-9	0061/7199	--	--	0.05 ug
Perchlorate	14797-73-0	314.0	4.0 ug/L	40 ug/kg	--
		314.0 Mod (low level)	1.0 ug/L	10 ug/kg	--
Percent Moisture	-	160.3 Mod/ ILM04.0, OLM03.2	NA	0.1%	--
pH	-	150.1/ 9040B	0.10 Standard Units	NA	--
	-	9045C	NA	0.10 Standard Units	--

(1) Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.
NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

(2) Air reporting limit is based on 100 mL impinger volume

Table 8-4-4
Particulate Reporting Limits (RL)

Parameter	Method	RL
Particulate Matter as PM-10	PM-10, 40 CFR Part 50, App. J and App. B	5000 ug
Particulate, total	40 CFR Part 60, App. A/ 0050/5	0.5 mg

Table 8-4-5
ICP Metals by EPA Methods 6010B, 200.7[1], 0060, 29 and IO-3.1
Reporting Limits (RL)

Element	CAS Number	Water RL 6010B/200.7 (µg/L)	Soil RL[2] 6010B (mg/Kg)	Air RL, Front Half of Air Train 0060/29 (ug)	Air RL, Back Half of Air Train[3] 0060/29 (ug)	PM-10 Filter RL IO-3.1 (ug)
Aluminum	7429-90-5	200	20	20	20.5	90.0
Antimony	7440-36-0	60	6	6	6.2	13.5
Arsenic	7440-38-2	10	1.0	1.0	1.0	2.3
Barium	7440-39-3	200	20	20	20.5	45.0
Beryllium	7440-41-7	5	0.5	0.5	0.51	1.1
Boron	7440-42-8	200	20	---	---	180
Cadmium	7440-43-9	5	0.5	0.5	0.51	1.1
Calcium	7440-70-2	5000	500	500	51.3	2250
Chromium	7440-47-3	10	1	1.0	1.0	9.0
Cobalt	7440-48-4	50	5	5.0	5.1	11.3
Copper	7440-50-8	25	2.5	2.5	2.6	5.6
Iron	7439-89-6	100	10	10	10.3	180
Lead	7439-92-1	3	0.3	1.0	1.0	0.68
Lithium	7439-93-2	50	5	5.0	5.1	---
Magnesium	7439-95-4	5000	500	500	51.3	1130
Manganese	7439-96-5	15	1.5	1.5	1.5	3.4
Molybdenum	7439-98-7	40	4	4.0	4.1	---
Nickel	7440-02-0	40	4	4.0	4.1	9.0
Phosphorus	7723-14-0	300	30	30	30.8	540
Potassium	7440-09-7	5000	500	500	51.3	1130
Selenium	7782-49-2	5	0.5	1.0	1.0	1.1
Silicon	7440-21-3	500	50	---	---	---
Silver	7440-22-4	10	1	2.0	2.1	2.3
Sodium	7440-22-4	5000	500	500	51.3	4500
Strontium	7440-24-6	50	5	5.0	5.1	---
Thallium	7440-28-0	10	1	2.0	2.1	2.3
Tin	7440-31-5	100	10	10	10.3	90
Titanium	7440-32-6	50	5	5.0	5.1	---
Vanadium	7440-62-2	50	5	5.0	5.1	18.0
Zinc	7440-66-6	20	2	2.0	2.1	18.0

[1] Method 200.7 is for waters only.
[2] Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.
[3] The reporting limits s were based on a total sample volume of 1000 ml, with 25 ml removed for mercury analysis. The toal ug reporting limit will vary, based on the total sample volume and the aliquot of sample removed for mercury analysis.
NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-6
Hardness by Standard Methods 2340B
Reporting Limit (RL)

Element	Water RL (mg/L)
Hardness	33

Table 8-4-7
CVAA Mercury[1] Reporting Limits (RL)

Element	CAS Number	Method	Water RL (ug/L)	Soil RL[2] (mg/kg)
Mercury	7439-97-6	245.1/245.5, 7470A/7471A	0.2	0.033

Ontario Hydro						
Element	CAS Number	Method	Front Half RL (Filter) (ug)	Back Half RL[3] HNO_3/H_2O_2 (ug)	Back Half RL[3] $KMnO_4$ (ug)	Back Half RL[3] KCl (ug)
Mercury	7439-97-6	ASTM D6784-02	0.01	0.5	0.2	0.2

Method 29/0060							
Element	CAS Number	Method	Front Half RL (Filter) (ug)	Back Half RL Empty[3] (ug)	Back Half RL HNO_3/H_2O_2[3] (ug)	Back Half RL $KMnO_4$[3] (ug)	Back Half RL HCl[3] (ug)
Mercury	7439-97-6	29/0060	0.40	4.0	4.0	4.0	4.0

PM-10 Filter			
Element	CAS Number	Method	Reporting Limit (ug)
Mercury	7439-97-6	IO-3.1/7470A	0.45

[1] Mercury is analyzed by cold vapor atomic absorption spectroscopy.
[2] Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.
[3] Back Half Reporting limits in ug depends on the impinger volume. The reporting limits presented are based on a 1 liter volume.

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.
RLs and MDLs for source air testing are also available upon request.

Table 8-4-8
Pesticides by GC EPA Method 8081A
Reporting Limits (RL)

Analyte	CAS Number	Water RL (µg/L)	Soil RL [1] (µg/Kg)
α -BHC	319-84-6	0.05	1.7
β -BHC	319-85-7	0.05	1.7
δ -BHC	319-86-8	0.05	1.7
γ -BHC(Lindane)	58-89-9	0.05	1.7
Heptachlor	76-44-8	0.05	1.7
Aldrin	309-00-2	0.05	1.7
Heptachlor Epoxide	1024-57-3	0.05	1.7
Endosulfan I	959-98-8	0.05	1.7
Dieldrin	60-57-1	0.05	1.7
4,4'-DDE	72-55-9	0.05	1.7
Endrin	72-20-8	0.05	1.7
Endosulfan II	33213-65-9	0.05	1.7
4,4'-DDD	72-54-8	0.05	1.7
Endosulfan sulfate	1031-07-8	0.05	1.7
4,4'-DDT	50-29-3	0.05	1.7
Methoxychlor	72-43-5	0.1	3.3
Endrin Aldehyde	7421-93-4	0.05	1.7
Endrin Ketone	53494-70-5	0.05	1.7
Chlordane (Technical)	57-74-9	0.5	17
Toxaphene	8001-35-2	2.0	67

[1] Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-9
PCBs by GC EPA Methods 8082 and TO-4A
Reporting Limits (RL)

Analyte	CAS Number	Water RL (µg/L)	Soil RL [1] (µg/Kg)	Air RL (ug)
Aroclor 1016	12674-11-2	1.0	33	1.0
Aroclor 1221	11104-28-2	1.0	33	1.0
Aroclor 1232	11141-16-5	1.0	33	1.0
Aroclor 1242	53469-21-9	1.0	33	1.0
Aroclor 1248	12672-29-6	1.0	33	1.0
Aroclor 1254	11097-69-1	1.0	33	1.0
Aroclor 1260	11096-82-5	1.0	33	1.0

[1] Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-10
PCB Congeners by GC EPA Method 8082
Reporting Limits (RL)

Analyte	CAS Number	BZ Number	Aqueous ug/L	Low-level Aqueous ug/L	Solid ug/kg dry	Tissue ug/kg Total	Waste ug/kg
2-Chlorobiphenyl	2051-60-7	1	0.2	0.02	20	20	2000
4-Chlorobiphenyl	2051-62-9	3	0.2	0.02	20	20	2000
2,3-dichlorobiphenyl	16605-91-7	5	0.01	0.001	1	1	100
2,4'-Dichlorobiphenyl	34883-43-7	8	0.01	0.001	1	1	100
4,4'-Dichlorobiphenyl	2050-68-2	15	0.05	0.005	5	5	500
2,2',5-Trichlorobiphenyl	37680-65-2	18	0.01	0.001	1	1	100
2,4,4'-Trichlorobiphenyl	7012-37-5	28	0.01	0.001	10	10	100
2,4',5-trichlorobiphenyl	16606-02-3	31	0.01	0.001	10	10	100
3,4,4'-Trichlorobiphenyl	38444-90-5	37	0.01	0.001	1	1	100
2,2',3,5'-Tetrachlorobiphenyl	41464-39-5	44	0.01	0.001	1	1	100
2,2',4,5'-Tetrachlorobiphenyl	41464-40-8	49	0.01	0.001	1	1	100
2,2',5,5'-Tetrachlorobiphenyl	35693-99-3	52	0.01	0.001	1	1	100
2,3',4,4'-Tetrachlorobiphenyl	32598-10-0	66	0.01	0.001	1	1	100
2,3',4',5-Tetrachlorobiphenyl	32598-11-1	70	0.01	0.001	1	1	100
2,4,4',5-Tetrachlorobiphenyl	32690-93-0	74	0.01	0.001	1	1	100
3,3',4,4'-Tetrachlorobiphenyl	32598-13-3	77	0.01	0.001	1	1	100
3,4,4',5-Tetrachlorobiphenyl	70362-50-4	81	0.01	0.001	1	1	100
2,2',3,4,5'-Pentachlorobiphenyl	38380-02-8	87	0.01	0.001	1	1	100
2,2',3,4',5-Pentachlorobiphenyl	68194-07-0	90	0.01	0.001	1	1	100
2,2',4,4',5-Pentachlorobiphenyl	38380-01-7	99	0.01	0.001	1	1	100
2,2',4,5,5'-Pentachlorobiphenyl	37680-73-2	101	0.01	0.001	1	1	100
2,3,3',4,4'-Pentachlorobiphenyl	32598-14-4	105	0.01	0.001	1	1	100
2,3,3',4',6-Pentachlorobiphenyl	38380-03-9	110	0.01	0.001	1	1	100
2,3,4,4',5-Pentachlorobiphenyl	74472-37-0	114	0.01	0.001	1	1	100
2,3,4,4',6-Pentachlorobiphenyl	74472-38-1	115	0.01	0.001	1	1	100
2,3',4,4',5-Pentachlorobiphenyl	31508-00-6	118	0.01	0.001	1	1	100
2,3',4,4',6-Pentachlorobiphenyl	56558-17-9	119	0.01	0.001	1	1	100
2,3',4,4',5'-Pentachlorobiphenyl	65510-44-3	123	0.01	0.001	1	1	100
3,3',4,4',5-Pentachlorobiphenyl	57465-28-8	126	0.01	0.001	1	1	100
2,2',3,3',4,4'-Hexachlorobiphenyl	38380-07-3	128	0.01	0.001	1	1	100
2,2',3,4,4',5'-Hexachlorobiphenyl	35065-28-2	138	0.01	0.001	1	1	100
2,2',3,4,5,5'-hexachlorobiphenyl	52712-04-6	141	0.01	0.001	1	1	100
2,2',3,4',5',6-Hexachlorobiphenyl	38380-04-0	149	0.01	0.001	1	1	100
2,2',3,5,5',6-Hexachlorobiphenyl	52663-63-5	151	0.01	0.001	1	1	100
2,2',4,4',5,5'-Hexachlorobiphenyl	35065-27-1	153	0.01	0.001	1	1	100
2,3,3',4,4',5-Hexachlorobiphenyl	38380-08-4	156	0.01	0.001	1	1	100
2,3,3',4,4',5'-Hexachlorobiphenyl	69782-90-7	157	0.01	0.001	1	1	100
2,3,3',4,4',6-Hexachlorobiphenyl	74472-42-7	158	0.01	0.001	1	1	100
2,3',4,4',5,5'-Hexachlorobiphenyl	52663-72-6	167	0.01	0.001	1	1	100
2,3',4,4',5',6-Hexachlorobiphenyl	59291-65-5	168	0.01	0.001	1	1	100
3,3',4,4',5,5'-Hexachlorobiphenyl	32774-16-6	169	0.01	0.001	1	1	100
2,2',3,3',4,4',5-Heptachlorobiphenyl	35065-30-6	170	0.01	0.001	1	1	100
2,2',3,3',4,5',6'-Heptachlorobiphenyl	52663-70-4	177	0.01	0.001	1	1	100
2,2',3,4,4',5,5'-Heptachlorobiphenyl	35065-29-3	180	0.01	0.001	1	1	100
2,2',3,4,4',5',6-Heptachlorobiphenyl	52663-69-1	183	0.01	0.001	1	1	100
2,2',3,4,4',6,6'-Heptachlorobiphenyl	74472-48-3	184	0.01	0.001	1	1	100
2,2',3,4',5,5',6-Heptachlorobiphenyl	52663-68-0	187	0.01	0.001	1	1	100
2,3,3',4,4',5,5'-Heptachlorobiphenyl	39635-31-9	189	0.01	0.001	1	1	100
2,2',3,3',4,4',5,5'-Octachlorobiphenyl	35694-08-7	194	0.01	0.001	1	1	100
2,2',3,3',4,4',5,6-Octachlorobiphenyl	52663-78-2	195	0.01	0.001	1	1	100
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	40186-71-8	200	0.01	0.001	1	1	100
2,2',3,3',4,5,5',6'-Octachlorobiphenyl	52663-75-9	201	0.01	0.001	1	1	100
2,2',3,3',5,5',6,6'-Octachlorobiphenyl	2136-99-4	202	0.01	0.001	1	1	100
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	40186-72-9	206	0.01	0.001	1	1	100
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	52663-79-3	207	0.01	0.001	1	1	100
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	2051-24-3	209	0.01	0.001	1	1	100

Table 8-4-11
Fixed Gases by GC
Method D1946-90
Reporting Limits

Analyte	CAS Number	RL (%)
Carbon Dioxide	124-38-9	0.1
Carbon Monoxide	630-08-0	0.1
Methane	74-82-8	0.1
Nitrogen	7727-37-9	0.1
Oxygen	7782-44-7	0.1

Table 8-4-12
Total Chromatographable Organics/Gravimetric Analsis (TCO Grav)
Method TCO/Grav
Reporting Limits

Analyte	Filter/Rinse Matrix RL (mg)	XAD/Rinse Matrix RL (mg)	Condensate RL (mg)
Total Chromatographable Organics	0.050	0.050	0.050
Gravimetric Analysis	0.5	0.5	0.5

Table 8-4-13
Method 0040 Condensate
Reporting Limits

Analyte	Whole Sample RL* (ng)
C4	40
C5	40
C6	40
C7	40

* Based on 40 ml sample volume.

Table 8-4-14
Explosives by HPLC
EPA Method 8330
Reporting Limits

Analyte	CAS Number	Low-Level Water RL, SPE[1] (µg/L)	Soil RL (mg/Kg, dry weight)[2]
HMX	2691-41-0	0.50	0.50
RDX	121-82-4	0.50	0.50
1,3,5-Trinitrobenzene	99-35-4	0.20	0.25
1,3-Dinitrobenzene	99-65-0	0.20	0.25
Tetryl	479-48-8	0.20	0.65
Nitrobenzene	98-95-3	0.20	0.25
2,4,6-Trinitrotoluene	118-96-7	0.20	0.25
2,6-Dinitrotoluene	606-20-2	0.20	0.25
2,4-Dinitrotoluene	121-14-2	0.20	0.25
2-Nitrotoluene	88-72-2	0.20	0.25
4-Nitrotoluene	99-99-0	0.20	0.25
3-Nitrotoluene	99-08-1	0.20	0.25
4-Amino-2,6-Dinitrotoluene	1946-51-0	0.20	0.25
2-Amino-4,6-Dinitrotoluene	35572-78-2	0.20	0.25
Nitroglycerin	55-63-0	2.5	2.5
PETN	78-11-5	2.5	2.5

[1] SPE = Solid phase extraction
[2] Soil samples are analyzed on a dry weight basis.

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-15
Nitroglycerin by HPLC
EPA Method 8332
Reporting Limits

Analyte	CAS Number	Water RL (µg/L)	Soil RL (mg/Kg dry weight) [1]
Nitroglycerin	55-63-0	500	2.5

(1) Soil samples are analyzed on a dry weight basis.

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-16
Volatiles by GCMS EPA Method 8260B
Water Reporting Limits (RL)

Analyte	CAS Number	Water RL (µg/L)
Acetone	67-64-1	10
Benzene	71-43-2	1.0
Bromobenzene	108-86-1	1.0
Bromochloromethane	74-97-5	1.0
Bromodichloromethane	75-27-4	1.0
Bromoform	75-25-2	1.0
Bromomethane	74-83-9	2.0
2-Butanone	78-93-3	5.0
n-Butylbenzene	104-51-8	1.0
sec-Butylbenzene	135-98-8	1.0
tert-Butylbenzene	98-06-6	1.0
Carbon Disulfide	75-15-0	1.0
Carbon Tetrachloride	56-23-5	1.0
Chlorobenzene	108-90-7	1.0
Chlorodibromomethane	124-48-1	1.0
Chloroethane	75-00-3	2.0
Chloroform (Trichloromethane)	67-66-3	1.0
Chloromethane	74-87-3	2.0
2-Chlorotoluene	95-49-8	1.0
4-Chlorotoluene	106-43-4	1.0
1,2-Dibromo-3-chloropropane	96-12-8	2.0
1,2-Dibromoethane	106-93-4	1.0
Dibromomethane	74-95-3	1.0
1,2-Dichlorobenzene	95-50-1	1.0
1,3-Dichlorobenzene	541-73-1	1.0
1,4-Dichlorobenzene	106-46-7	1.0

Table 8-4-16
Volatiles by GCMS EPA Method 8260B
Water Reporting Limits (RL)
(continued)

Analyte	CAS Number	Water RL (µg/L)
Dichlorodifluoromethane	75-71-8	2.0
1,1-Dichloroethane	75-34-3	1.0
1,2-Dichloroethane	107-06-2	1.0
1,1-Dichloroethene	75-35-4	1.0
cis-1,2-Dichloroethene	156-59-2	1.0
trans-1,2-Dichloroethene	156-60-5	1.0
1,2-Dichloroethene (total)	540-59-0	1.0
1,2-Dichloropropane	78-87-5	1.0
1,3-Dichloropropane	142-28-9	1.0
2,2-Dichloropropane	594-20-7	1.0
1,1-Dichloropropene	563-58-6	1.0
cis-1,3-Dichloropropene	10061-01-5	1.0
trans-1,3-Dichloropropene	10061-01-5	1.0
Ethyl Benzene	100-41-4	1.0
Hexachlorobutadiene	87-68-3	1.0
2-Hexanone	591-78-6	5.0
Isopropylbenzene	98-82-8	1.0
p-Isopropyltoluene	99-87-6	1.0
Methylene Chloride	75-09-2	1.0
4-methyl-2-pentanone	108-10-1	5.0
Naphthalene	91-20-3	1.0
n-Propylbenzene	103-65-1	1.0
Styrene	100-42-5	1.0
1,1,1,2-Tetrachloroethane	630-20-6	1.0
1,1,2,2-Tetrachloroethane	79-34-5	1.0

Table 8-4-16
Volatiles by GCMS EPA Method 8260B
Water Reporting Limits (RL)
(continued)

Analyte	CAS Number	Water RL (µg/L)
Tetrachloroethene	127-18-4	1.0
Toluene	108-88-3	1.0
1,2,3-Trichlorobenzene	87-61-6	1.0
1,2,4-Trichlorobenzene	120-82-1	1.0
1,1,1-Trichloroethane	71-55-6	1.0
1,1,2-Trichloroethane	79-00-5	1.0
Trichloroethene	79-01-6	1.0
Trichlorofluoromethane	75-69-4	2.0
1,2,3-Trichloropropane	96-18-4	1.0
1,2,4-Trimethylbenzene	95-63-6	1.0
1,3,5-Trimethylbenzene	108-67-8	1.0
Vinyl chloride	75-01-4	2.0
o-Xylene	95-47-6	1.0
p-/m-Xylenes	136777-61-2	2.0
Xylenes (total)	1330-20-7	3.0

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-17
Volatiles by GCMS EPA Method 8260B
Low Level and Medium Level Encore Soil Samples
Reporting Limits (RL)

Analyte	CAS Number	Low Level RL[1] (µg/Kg)	Medium Level RL[1] (µg/Kg)
Acetone	67-64-1	20	1000
Benzene	71-43-2	5.0	250
Bromobenzene	108-86-1	5.0	250
Bromochloromethane	74-97-5	5.0	250
Bromodichloromethane	75-27-4	5.0	250
Bromoform	75-25-2	5.0	250
Bromomethane	74-83-9	10	500
2-Butanone	78-93-3	20	1000
n-Butylbenzene	104-51-8	5.0	250
sec-Butylbenzene	135-98-8	5.0	250
tert-Butylbenzene	98-06-6	5.0	250
Carbon Disulfide	75-15-0	5.0	250
Carbon Tetrachloride	56-23-5	5.0	250
Chlorobenzene	108-90-7	5.0	250
Chlorodibromomethane	124-48-1	5.0	250
Chloroethane	75-00-3	10	500
Chloroform (Trichloromethane)	67-66-3	5.0	250
Chloromethane	74-87-3	10	500
2-Chlorotoluene	95-49-8	5.0	250
4-Chlorotoluene	106-43-4	5.0	250
1,2-Dibromo-3-chloropropane	96-12-8	10	500
1,2-Dibromoethane	106-93-4	5.0	250
Dibromomethane	74-95-3	5.0	250
1,2-Dichlorobenzene	95-50-1	5.0	250

Table 8-4-17
Volatiles by GCMS EPA Method 8260B
Low Level and Medium Level Encore Soil Samples
Reporting Limits (RL)
(continued)

Analyte	CAS Number	Low Level RL[1] (µg/Kg)	Medium Level RL[1] (µg/Kg)
1,3-Dichlorobenzene	541-73-1	5.0	250
1,4-Dichlorobenzene	106-46-7	5.0	250
Dichlorodifluoromethane	75-71-8	10	500
1,1-Dichloroethane	75-34-3	5.0	250
1,2-Dichloroethane	107-06-2	5.0	250
1,1-Dichloroethene	75-35-4	5.0	250
cis-1,2-Dichloroethene	156-59-2	5.0	250
trans-1,2-Dichloroethene	156-60-5	5.0	250
1,2-Dichloroethene (total)	540-59-0	5.0	250
1,2-Dichloropropane	78-87-5	5.0	250
1,3-Dichloropropane	142-28-9	5.0	250
2,2-Dichloropropane	594-20-7	5.0	250
1,1-Dichloropropene	563-58-6	5.0	250
cis-1,3-Dichloropropene	10061-01-5	5.0	250
trans-1,3-Dichloropropene	10061-01-5	5.0	250
Ethyl Benzene	100-41-4	5.0	250
Hexachlorobutadiene	87-68-3	5.0	250
2-Hexanone	591-78-6	20	1000
Isopropylbenzene	98-82-8	5.0	250
p-Isopropyltoluene	99-87-6	5.0	250
4-Methyl-2-pentanone	108-10-1	20	1000
Methylene Chloride	75-09-2	5.0	250
Naphthalene	91-20-3	5.0	250

Table 8-4-17
Volatiles by GCMS EPA Method 8260B
Low Level and Medium Level Encore Soil Samples
Reporting Limits (RL)
(continued)

Analyte	CAS Number	Low Level RL[1] (µg/Kg)	Medium Level RL[1] (µg/Kg)
n-Propylbenzene	103-65-1	5.0	250
Styrene	100-42-5	5.0	250
1,1,1,2-Tetrachloroethane	630-20-6	5.0	250
1,1,2,2-Tetrachloroethane	79-34-5	5.0	250
Tetrachloroethene	127-18-4	5.0	250
Toluene	108-88-3	5.0	250
1,2,3-Trichlorobenzene	87-61-6	5.0	250
1,2,4-Trichlorobenzene	120-82-1	5.0	250
1,1,1-Trichloroethane	71-55-6	5.0	250
1,1,2-Trichloroethane	79-00-5	5.0	250
Trichloroethene	79-01-6	5.0	250
Trichlorofluoromethane	75-69-4	10	500
1,2,3-Trichloropropane	96-18-4	5.0	250
1,2,4-Trimethylbenzene	95-63-6	5.0	250
1,3,5-Trimethylbenzene	108-67-8	5.0	250
Vinyl chloride	75-01-4	10	500
o-Xylene	95-47-6	5.0	250
p-/m-Xylenes	136777-61-2	10	500
Xylenes (total)	1330-20-7	15	750

[1] Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-18
Volatile Organics by GCMS EPA Method TO-14A/TO-15
Reporting Limits (RL)

Analyte	CAS Number	Air RL ppb (V/V)
Dichlorodifluoromethane	75-71-8	0.20
Chlorodifluoromethane	75-45-6	0.20
1,2-Dichlorotetrafluoroethane	76-14-2	0.20
Chloromethane	74-87-3	0.50
Vinyl chloride	75-01-4	0.20
n-Butane	106-97-8	0.20
1,3-Butadiene	106-99-0	0.20
Bromomethane	74-83-9	0.20
Chloroethane	75-00-3	0.20
Trichlorofluoromethane	75-69-4	0.20
Pentane	109-66-0	0.50
1,1-Dichloroethene	75-35-4	0.20
1,1,2-Trichlorotrifluoroethane	76-13-1	0.20
Carbon disulfide	75-15-0	0.20
3-Chloropropene	107-05-1	0.20
Methylene Chloride	75-09-2	0.50
trans-1,2-Dichloroethene	156-60-5	0.20
n-Hexane	110-54-3	0.20
1,1-Dichloroethane	75-34-3	0.20
cis-1,2-Dichloroethene	156-59-2	0.20
Chloroform	67-66-3	0.20
1,1,1-Trichloroethane	71-55-6	0.20
Cyclohexane	110-82-7	0.20
Carbon Tetrachloride	56-23-5	0.20
Benzene	71-43-2	0.20
1,2-Dichloroethane	107-06-2	0.20
n-Heptane	142-82-5	0.20

Table 8-4-18
Volatile Organics by GCMS EPA Method TO-14A/TO-15
Reporting Limits (RL)
(continued)

Analyte	CAS Number	Air RL ppb (V/V)
Trichloroethene	79-01-6	0.20
1,2-Dichloropropane	78-87-5	0.20
Dibromomethane	74-95-3	0.20
Bromodichloromethane	75-27-4	0.20
cis-1,3-Dichloropropene	10061-01-5	0.20
Toluene	108-88-3	0.20
n-Octane	111-65-9	0.20
trans-1,3-Dichloropropene	10061-01-5	0.20
1,1,2-Trichloroethane	79-00-5	0.20
Tetrachloroethene	127-18-4	0.20
Dibromochloromethane	124-48-1	0.20
1,2-Dibromoethane	106-93-4	0.20
Chlorobenzene	108-90-7	0.20
Ethyl Benzene	100-41-4	0.20
p-/m-Xylenes	136777-61-2	0.20
Nonane	111-84-2	0.20
o-Xylene	95-47-6	0.20
Styrene	100-42-5	0.20
Bromoform	75-25-2	0.20
Cumene	98-82-8	0.20
1,1,2,2-Tetrachloroethane	79-34-5	0.20
n-Propylbenzene	103-65-1	0.20
1,3,5-Trimethylbenzene	108-67-8	0.20
n-Decane	124-18-5	0.20
alpha-Methlystyrene	98-83-9	0.20
1,2,4-Trimethlybenzene	95-63-6	0.20

Table 8-4-18
Volatile Organics by GCMS EPA Method TO-14A/TO-15
Reporting Limits (RL)
(continued)

Analyte	CAS Number	Air RL ppb (V/V)
1,3-Dichlorobenzene	541-73-1	0.20
1,4-Dichlorobenzene	106-46-7	0.20
Benzyl Chloride	100-44-7	0.20
1,2-Dichlorobenzene	95-50-1	0.20
n-Undecane	1120-21-4	0.20
n-Dodecane	112-40-3	1.0
1,2,4-Trichlorobenzene	120-82-1	1.0
Hexachlorobutadiene	87-68-3	1.0
Naphthalene	91-20-3	0.50
Methanol	67-56-7	10
Ethyl ether	60-29-7	0.50
Acetone	67-64-1	5.0
Acrylonitrile	107-13-1	0.50
Vinyl acetate	108-05-4	0.50
2-Butanone	78-93-9	0.50
1-Butanol	71-36-3	0.50
4-Methyl-2-pentanone	108-10-1	0.50
2-Hexanone	591-78-6	0.50
Methyl-tert-butyl ether	1634-04-4	0.50
Acrolein	107-02-8	0.50
Acetonitrile	75-05-8	1.0

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-19
Volatiles by GCMS EPA Method 0031/5041A (VOST)
Reporting Limits (RL)

Analyte	CAS Number	VOST RL ug
Acetone	67-64-1	0.100
Benzene	71-43-2	0.025
Bromobenzene	108-86-1	0.025
Bromochloromethane	74-97-5	0.025
Bromodichloromethane	75-27-4	0.025
Bromoform	75-25-2	0.025
Bromomethane	74-83-9	0.050
2-Butanone	78-93-9	0.100
n-Butylbenzene	104-51-8	0.025
sec-Butylbenzene	135-98-8	0.025
tert-Butylbenzene	98-06-6	0.025
Carbon disulfide	*75-15-0*	*0.025*
Carbon Tetrachloride	56-23-5	0.025
Chlorobenzene	108-90-7	0.025
Chlorodibromomethane	124-48-1	0.025
Chloroethane	75-003	0.050
Chloroform	67-66-3	0.025
Chloromethane	74-87-3	0.050
2-Chlorotoluene	95-49-8	0.025
4-Chlorotoluene	106-43-4	0.025
1,2-Dibromoethane	106-93-4	0.025
Dibromomethane	74-95-3	0.025
1,2-Dichlorobenzene	95-50-1	0.025
1,3-Dichlorobenzene	541-73-1	0.025

Table 8-4-19
Volatiles by GCMS EPA Method 0031/5041A (VOST)
Reporting Limits (RL)
(continued)

Analyte	CAS Number	VOST RL ug
1,4-Dichlorobenzene	106-46-7	0.025
Dichlorodifluoromethane	75-71-8	0.025
1,1-Dichloroethane	75-34-3	0.025
1,2-Dichloroethane	107-06-2	0.025
cis-1,2-Dichloroethene	156-59-2	0.025
trans-1,2-Dichloroethene	156-60-5	0.025
1,1-Dichloroethene	75-35-4	0.025
1,2-Dichloropropane	78-87-5	0.025
1,3-Dichloropropane	142-28-9	0.025
2,2-Dichloropropane	594-20-7	0.025
cis-1,3-Dichloropropene	10061-01-5	0.025
trans-1,3-Dichloropropene	10061-01-5	0.025
1,1-Dichloropropene	563-58-6	0.025
Ethylbenzene	100-41-4	0.025
Hexachlorobutadiene	87-68-3	0.025
2-Hexanone	591-78-6	0.100
Isopropylbenzene	98-82-8	0.025
p-Isopropyltoluene	99-87-6	0.025

Table 8-4-19
Volatiles by GCMS EPA Method 0031/5041A (VOST)
Reporting Limits (RL)
(continued)

Analyte	CAS Number	VOST RL ug
Methylene chloride	75-09-2	0.025
4-Methyl-2-pentanone	108-10-1	0.100
Naphthalene	91-20-3	0.025
1,2-Dibromo-3-chloropropane	96-12-8	0.050
n-Propylbenzene	103-65-1	0.025
Styrene	100-42-5	0.025
1,1,1,2-Tetrachloroethane	630-20-6	0.025
1,1,2,2-Tetrachloroethane	79-34-5	0.025
Tetrachloroethene	127-18-4	0.025
Toluene	108-88-3	0.025
1,2,3-Trichlorobenzene	87-61-6	0.025
1,2,4-Trichlorobenzene	120-82-1	0.025
1,1,1-Trichloroethane	71-55-6	0.025
1,1,2-Trichloroethane	79-00-5	0.025
Trichloroethene	79-01-6	0.025
Trichlorofluoromethane	75-69-4	0.050
1,2,3-Trichloropropane	96-18-4	0.025
1,2,4-Trimethylbenzene	95-63-6	0.025
1,3,5-Trimethylbenzene	108-67-8	0.025
Vinyl chloride	75-01-4	0.050
m- &p-xylene	136777-61-2	0.050
o-xylene	95-47-6	0.025

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request.

Table 8-4-20
Semivolatile Organics by GCMS Method 8270C
Reporting Limits (RL)

Analyte	CAS Number	Water RL (µg/L)	Soil RL [1] (µg/Kg)
Acenaphthene	83-32-9	10	330
Acenaphthylene	208-96-8	10	330
Anthracene	120-12-7	10	330
Benzo(a)anthracene	56-55-3	10	330
Benzo(b)fluoranthene	205-99-2	10	330
Benzo(k)fluoranthene	207-08-9	10	330
Benzo(g,h,i)perylene	191-24-2	10	330
Benzo(a)pyrene	50-32-8	10	330
bis(2-Chloroethoxy)methane	111-91-1	10	330
bis(2-Chloroethyl)ether	111-44-4	10	330
bis(2-chloroisopropyl)ether	108-60-1	10	330
Bis(2-ethylhexyl)phthalate	117-81-7	10	330
4-Bromophenyl-phenylether	101-55-3	10	330
Butyl benzyl phthalate	85-68-7	10	330
Carbazole	86-74-8	10	330
4-Chloroaniline	106-47-8	10	330
4-Chloro-3-Methylphenol	59-50-7	10	330
2-Chloronaphthalene	91-58-7	10	330
2-Chlorophenol	95-57-8	10	330
4-Chlorophenyl phenylether	7005-72-36	10	330
Chrysene	218-01-9	10	330
Dibenzo(a,h)anthracene	53-70-3	10	330
Dibenzofuran	132-64-9	10	330
Di-n-butylphthalate	84-74-2	10	330

Table 8-4-20
Semivolatile Organics by GCMS Method 8270C
Reporting Limits (RL)
(continued)

Analyte	CAS Number	Water RL (µg/L)	Soil RL [1] (µg/Kg)
1,2-Dichlorobenzene	95-50-1	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
3,3'-Dichlorobenzidine	91-94-1	50	1600
2,4-Dichlorophenol	120-83-2	10	330
Diethylphthalate	84-66-2	10	330
2,4-Dimethylphenol	105-67-9	10	330
Dimethyl Phthalate	131-11-3	10	330
4,6-Dinitro-2-Methylphenol	534-52-1	50	1600
2,4-Dinitrophenol	51-28-5	50	1600
2,4-Dinitrotoluene	121-14-2	10	330
2,6-Dinitrotoluene	606-20-2	10	330
Di-n-Octylphthalate	117-84-0	10	330
Fluoranthene	206-44-0	10	330
Fluorene	86-73-7	10	330
Hexachlorobenzene	118-74-1	10	330
Hexachlorobutadiene	87-68-3	10	330
Hexachlorocyclopentadiene	77-47-4	50	1600
Hexachloroethane	67-72-1	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330
Isophorone	78-59-1	10	330
2-Methylnaphthalene	91-57-6	10	330
2-Methylphenol	95-48-7	10	330
4-Methylphenol	106-44-5	10	330

Table 8-4-20
Semivolatile Organics by GCMS Method 8270C
Reporting Limits (RL)
(continued)

Analyte	CAS Number	Water RL (µg/L)	Soil RL [1] (µg/Kg)
Naphthalene	91-20-3	10	330
2-Nitroaniline	88-74-4	50	1600
3-Nitroaniline	99-09-2	50	1600
4-Nitroaniline	100-01-6	50	1600
Nitrobenzene	98-95-1	10	330
2-Nitrophenol	88-75-5	10	330
4-Nitrophenol	100-02-7	50	1600
n-Nitrosodiphenylamine	86-30-6	10	330
n-Nitroso-di-n-propylamine	621-64-7	10	330
Pentachlorophenol	87-86-5	50	1600
Phenanthrene	85-01-8	10	330
Phenol	108-95-2	10	330
Pyrene	129-00-0	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330
2,4,5-Trichlorophenol	95-95-4	10	330
2,4,6-Trichlorophenol	88-06-2	10	330

[1] Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.

NOTE: Method detection limits (MDLs) are subject to updating. Current MDLs are available upon request. RLs and MDLs for source air testing are also available upon request.

Table 8-4-21
Semivolatile Organics by GCMS Method TO-13A
Reporting Limits (RL)

Analyte	CAS Number	Air RL (µg)
Acenaphthene	83-32-9	5
Acenaphthylene	208-96-8	5
Anthracene	120-12-7	5
Benzo(a)anthracene	56-55-3	5
Benzo(a)pyrene	50-32-8	5
Benzo(b)fluoranthene	205-99-2	5
Benzo(g,h,i)perylene	191-24-2	5
Benzo(k)fluoranthene	207-08-9	5
Chrysene	218-01-9	5
Dibenzo(a,h)anthracene	53-70-3	5
Fluoranthene	206-44-0	5
Fluorene	86-73-7	5
Indeno(1,2,3-cd)pyrene	193-39-5	5
Naphthalene	91-20-3	5
Phenanthrene	85-01-8	5
Pyrene	129-00-0	5

Table 8-4-22
Modified Method 5 Train (0010/3542/8270C)
Reporting Limits (RL)

Analyte	CAS Number	Filter/Rinse RLs (ug)	Back Half RLs (ug)	Condensate RLs (ug)
Acenaphthene	83-32-9	10	10	10
Acenaphthylene	208-96-8	10	10	10
Acetophenone	98-86-2	10	10	10
Aniline	62-53-3	20	20	20
Anthracene	120-12-7	10	10	10
Benzidine	92-87-5	100	100	100
Benzoic acid	65-85-0	100	100	50
Benzo(a)anthracene	56-55-3	10	10	10
Benzo(a)pyrene	50-32-8	10	10	10
Benzo(b)fluoranthene	205-99-2	10	10	10
Benzo(ghi)perylene	191-24-2	10	10	10
Benzo(k)fluoranthene	207-08-9	10	10	10
Benzyl alcohol	100-51-6	100	100	10
bis(2-Chloroethoxy)methane	111-91-1	10	10	10
bis(2-Chloroethyl) ether	111-44-4	10	10	10
bis(2-Ethylhexyl) phthalate	117-81-7	10	20	10
4-Bromophenyl phenyl ether	101-55-3	10	10	10
Butyl benzyl phthalate	85-68-7	10	10	10
Carbazole	86-74-8	10	10	10
4-Chloro-3-methylphenol	59-50-7	10	10	10
4-Chloroaniline	106-47-8	10	20	10
2-Chloronaphthalene	91-58-7	10	10	10
2-Chlorophenol	95-57-8	10	10	10
4-Chlorophenyl phenyl ether	7005-72-36	10	10	10
Chrysene	218-01-9	10	10	10
Di-n-butyl phthalate	84-74-2	10	20	10
Di-n-octyl phthalate	117-84-0	10	10	10

Table 8-4-22
Modified Method 5 Train (0010/3542/8270C)
Reporting Limits (RL), continued

Analyte	CAS Number	Filter/Rinse RLs (ug)	Back Half RLs (ug)	Condensate RLs (ug)
Dibenz(a,h)anthracene	53-70-3	10	10	10
Dibenzofuran	132-64-9	10	10	10
1,2-Dichlorobenzene	95-50-1	10	10	10
1,3-Dichlorobenzene	541-73-1	10	10	10
1,4-Dichlorobenzene	106-46-7	10	10	10
3,3'-Dichlorobenzidine	91-94-1	50	50	50
2,4-Dichlorophenol	120-83-2	10	10	10
Diethyl phthalate	84-66-2	10	10	10
Dimethyl phthalate	84-66-2	10	10	10
2,4-Dimethylphenol	105-67-9	10	10	10
4,6-Dinitro-2-methylphenol	534-52-1	50	50	50
2,4-Dinitrophenol	51-28-5	50	50	50
2,4-Dinitrotoluene	121-14-2	10	10	10
2,6-Dinitrotoluene	606-20-2	10	10	10
1,2-Diphenylhydrazine	122-66-7	10	10	10
Fluoranthene	206-44-0	10	10	10
Fluorene	86-73-7	10	10	10
Hexachlorocyclopentadiene	77-47-4	50	50	50
Hexachlorobenzene	118-74-1	10	10	10
Hexachlorobutadiene	87-68-3	10	10	10
Hexachloroethane	67-72-1	10	10	10
Indeno(1,2,3-cd)pyrene	193-39-5	10	10	10
Isophorone	78-59-1	10	10	10
2-Methylnaphthalene	91-57-6	10	10	10
2-Methylphenol	95-48-7	10	10	10
3-Methylphenol & 4-Methylphenol	108-39-4 & 106-44-5	10	10	10
N-Nitrosodi-n-propylamine	621-64-7	10	10	10

Table 8-4-22
Modified Method 5 Train (0010/3542/8270C)
Reporting Limits (RL), continued

Analyte	CAS Number	Filter/Rinse RLs (ug)	Back Half RLs (ug)	Condensate RLs (ug)
N-Nitrosodimethylamine	62-75-9	10	10	10
N-Nitrosodiphenylamine	86-30-6	10	10	10
Naphthalene	91-20-3	10	10	10
2-Nitroaniline	88-74-4	50	50	50
3-Nitroaniline	99-09-2	50	50	50
4-Nitroaniline	100-01-6	50	50	50
Nitrobenzene	98-95-1	10	10	10
2-Nitrophenol	88-75-5	10	10	10
4-Nitrophenol	100-02-7	50	50	50
2,2'-Oxybis(1-Chloropropane)*	108-60-1	10	10	10
Pentachlorobenzene	608-93-5	10	10	10
Pentachloronitrobenzene	82-68-8	10	50	10
Pentachlorophenol	87-86-5	50	50	50
Phenanthrene	85-01-8	10	10	10
Phenol	108-95-2	10	10	10
Pyrene	129-00-0	10	10	10
Pyridine	110-86-1	20	20	20
1,2,4-Trichlorobenzene	120-82-1	10	10	10
2,4,5-Trichlorophenol	95-95-4	10	10	10
2,4,6-Trichlorophenol	88-06-2	10	10	10

*bis(2-chloro)isopropylether

Table 8-4-23
Dioxins/Furans by HRGC/HRMS EPA Method 1613B
Reporting Limits (RL) [1]

Analyte	CAS Number	Water RL (pg/L)	Soil RL [2] (pg/g)	Whole Sample RL (pg)
2,3,7,8-TCDD	1746-01-6	10	1.0	10
Total-TCDD	41903-57-5	10	1.0	10
1,2,3,7,8-PeCDD	40321-76-4	50	5.0	50
Total-PeCDD	36088-22-9	50	5.0	50
1,2,3,4,7,8-HxCDD	39227-28-6	50	5.0	50
1,2,3,6,7,8-HxCDD	57653-85-7	50	5.0	50
1,2,3,7,8,9-HxCDD	19408-74-3	50	5.0	50
Total-HxCDD	34465-46-8	50	5.0	50
1,2,3,4,6,7,8-HPCDD	35822-46-9	50	5.0	50
Total-HPCDD	37871-00-4	50	5.0	50
OCDD	3268-87-9	100	10	100
2,3,7,8-TCDF	51207-31-9	10	1.0	10
Total-TCDF	55722-27-5	10	1.0	10
1,2,3,7,8-PECDF	57117-41-6	50	5.0	50
2,3,4,7,8-PECDF	57117-31-4	50	5.0	50
Total-PECDF	30402-15-4	50	5.0	50
1,2,3,4,7,8-HXCDF	70648-26-9	50	5.0	50
1,2,3,6,7,8-HXCDF	57117-44-9	50	5.0	50
2,3,4,6,7,8-HXCDF	60851-34-5	50	5.0	50
1,2,3,7,8,9-HXCDF	72918-21-9	50	5.0	50
Total-HXCDF	55684-94-1	50	5.0	50
1,2,3,4,6,7,8-HPCDF	67562-39-4	50	5.0	50
1,2,3,4,7,8,9-HPCDF	55673-89-7	50	5.0	50
Total-HPCDF	38998-75-3	50	5.0	50
OCDF	39001-02-0	100	10	100

[1] The reporting limit is equivalent to the concentration of the lowest calibration standard, assuming all method-specific sample weights and volumes have been employed (i.e., 1 L for waters, 10 gr for soil, entire sample for whole sample RL, e.g., wipe, sampling module)
[2] Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.

Table 8-4-24
Dioxins/Furans by HRGC/HRMS EPA Methods 8290, 23/8290 and 0023A/8290
Reporting Limits (RL)[1]

Analyte	CAS Number	Water RL (pg/L)	Soil/Tissue RL [2] (pg/g)	Whole Sample RL (pg)
2,3,7,8-TCDD	1746-01-6	10	1.0	10
Total-TCDD	41903-57-5	10	1.0	10
1,2,3,7,8-PeCDD	40321-76-4	50	5.0	50
Total-PeCDD	36088-22-9	50	5.0	50
1,2,3,4,7,8-HxCDD	39227-28-6	50	5.0	50
1,2,3,6,7,8-HxCDD	57653-85-7	50	5.0	50
1,2,3,7,8,9-HxCDD	19408-74-3	50	5.0	50
Total-HxCDD	34465-46-8	50	5.0	50
1,2,3,4,6,7,8-HPCDD	35822-46-9	50	5.0	50
Total-HPCDD	37871-00-4	50	5.0	50
OCDD	3268-87-9	100	10	100
2,3,7,8-TCDF	51207-31-9	10	1.0	10
Total-TCDF	55722-27-5	10	1.0	10
1,2,3,7,8-PECDF	57117-41-6	50	5.0	50
2,3,4,7,8-PECDF	57117-31-4	50	5.0	50
Total-PECDF	30402-15-4	50	5.0	50
1,2,3,4,7,8-HXCDF	70648-26-9	50	5.0	50
1,2,3,6,7,8-HXCDF	57117-44-9	50	5.0	50
2,3,4,6,7,8-HXCDF	60851-34-5	50	5.0	50
1,2,3,7,8,9-HXCDF	72918-21-9	50	5.0	50
Total-HXCDF	55684-94-1	50	5.0	50
1,2,3,4,6,7,8-HPCDF	67562-39-4	50	5.0	50
1,2,3,4,7,8,9-HPCDF	55673-89-7	50	5.0	50
Total-HPCDF	38998-75-3	50	5.0	50
OCDF	39001-02-0	100	10	100

[1] The reporting limit is equivalent to the concentration of the lowest calibration standard, assuming all method-specific sample weights and volumes have been employed (i.e., 1 L for waters, 10 gr for soil, entire sample for whole sample RL, e.g., wipe, sampling module)
[2] Soil reporting limits are based on wet weight of sample and will be higher when converted to a dry weight basis.

Table 8-4-25
PCBs by HRGC/HRMS Method 1668A
Estimated Minimum Levels

Parameter	Water ng/L	Solids ng/g	Tissues ng/g	Solid Wastes ng/g	100 uL Extract ng/mL
PCB 1	0.1	0.01	0.01	0.01	1.0
PCB 2	0.1	0.01	0.01	0.01	1.0
PCB 3	0.1	0.01	0.01	0.01	1.0
PCB 4	0.2	0.02	0.02	0.02	2.0
PCB 5	0.1	0.01	0.01	0.01	1.0
PCB 6	0.1	0.01	0.01	0.01	1.0
PCB 7	0.1	0.01	0.01	0.01	1.0
PCB 8	0.2	0.02	0.02	0.02	2.0
PCB 9	0.1	0.01	0.01	0.01	1.0
PCB 10	0.1	0.01	0.01	0.01	1.0
PCB 11	0.2	0.02	0.02	0.02	2.0
PCB 12/PCB 13	0.1	0.01	0.01	0.01	1.0
PCB 14	0.1	0.01	0.01	0.01	1.0
PCB 15	0.1	0.01	0.01	0.01	1.0
PCB 16	0.1	0.01	0.01	0.01	1.0
PCB 17	0.1	0.01	0.01	0.01	1.0
PCB 18/PCB 30	0.2	0.02	0.02	0.02	2.0
PCB 19	0.1	0.01	0.01	0.01	1.0
PCB 20/PCB 28	0.2	0.02	0.02	0.02	2.0
PCB 21/PCB33	0.1	0.01	0.01	0.01	1.0
PCB 22	0.1	0.01	0.01	0.01	1.0
PCB 23	0.1	0.01	0.01	0.01	1.0
PCB 24	0.1	0.01	0.01	0.01	1.0
PCB 25	0.1	0.01	0.01	0.01	1.0
PCB 26/PCB 29	0.1	0.01	0.01	0.01	1.0
PCB 27	0.1	0.01	0.01	0.01	1.0
PCB 31	0.2	0.02	0.02	0.02	2.0
PCB 32	0.1	0.01	0.01	0.01	1.0
PCB 34	0.1	0.01	0.01	0.01	1.0
PCB 35	0.1	0.01	0.01	0.01	1.0
PCB 36	0.1	0.01	0.01	0.01	1.0
PCB 37	0.1	0.01	0.01	0.01	1.0
PCB 38	0.1	0.01	0.01	0.01	1.0
PCB 39	0.1	0.01	0.01	0.01	1.0
PCB 40/PCB41/PCB 71	0.1	0.01	0.01	0.01	1.0
PCB 42	0.1	0.01	0.01	0.01	1.0
PCB 43/PCB 73	0.1	0.01	0.01	0.01	1.0
PCB 44/PCB 47/PCB 65	0.1	0.01	0.01	0.01	1.0
PCB 45/PCB 51	0.1	0.01	0.01	0.01	1.0
PCB 46	0.1	0.01	0.01	0.01	1.0
PCB 48	0.1	0.01	0.01	0.01	1.0
PCB 49/PCB 69	0.1	0.01	0.01	0.01	1.0
PCB 50/PCB 53	0.1	0.01	0.01	0.01	1.0
PCB 52	0.1	0.01	0.01	0.01	1.0
PCB 54	0.1	0.01	0.01	0.01	1.0
PCB 55	0.1	0.01	0.01	0.01	1.0
PCB 56	0.1	0.01	0.01	0.01	1.0
PCB 57	0.1	0.01	0.01	0.01	1.0
PCB 58	0.1	0.01	0.01	0.01	1.0
PCB 59/PCB 62/PCB 75	0.1	0.01	0.01	0.01	1.0
PCB 60	0.1	0.01	0.01	0.01	1.0
PCB 61/PCB 70/PCB 74/PCB 76	0.2	0.02	0.02	0.02	2.0
PCB 63	0.1	0.01	0.01	0.01	1.0
PCB 64	0.1	0.01	0.01	0.01	1.0
PCB 66	0.1	0.01	0.01	0.01	1.0
PCB 67	0.1	0.01	0.01	0.01	1.0
PCB 68	0.1	0.01	0.01	0.01	1.0
PCB 72	0.1	0.01	0.01	0.01	1.0

Table 8-4-25
PCBs by HRGC/HRMS Method 1668A
Estimated Minimum Levels, continued

Parameter	Water ng/L	Solids ng/g	Tissues ng/g	Solid Wastes ng/g	100 uL Extract ng/mL
PCB 77	0.1	0.01	0.01	0.01	1.0
PCB 78	0.1	0.01	0.01	0.01	1.0
PCB 79	0.1	0.01	0.01	0.01	1.0
PCB 80	0.1	0.01	0.01	0.01	1.0
PCB 81	0.1	0.01	0.01	0.01	1.0
PCB 82	0.1	0.01	0.01	0.01	1.0
PCB 83	0.1	0.01	0.01	0.01	1.0
PCB 84	0.1	0.01	0.01	0.01	1.0
PCB 85/PCB 116/PCB 117	0.1	0.01	0.01	0.01	1.0
PCB 86/PCB 87/PCB 97/PCB 109/PCB 119/PCB 125	0.1	0.01	0.01	0.01	1.0
PCB 88/PCB 91	0.1	0.01	0.01	0.01	1.0
PCB 89	0.1	0.01	0.01	0.01	1.0
PCB 90/PCB 101/PCB 113	0.1	0.01	0.01	0.01	1.0
PCB 92	0.1	0.01	0.01	0.01	1.0
PCB 93/PCB 100	0.1	0.01	0.01	0.01	1.0
PCB 94	0.1	0.01	0.01	0.01	1.0
PCB 95	0.1	0.01	0.01	0.01	1.0
PCB 96	0.1	0.01	0.01	0.01	1.0
PCB 98/PCB 102	0.1	0.01	0.01	0.01	1.0
PCB 99/PCB 112	0.1	0.01	0.01	0.01	1.0
PCB 103	0.1	0.01	0.01	0.01	1.0
PCB 104	0.1	0.01	0.01	0.01	1.0
PCB 105	0.1	0.01	0.01	0.01	1.0
PCB 106	0.1	0.01	0.01	0.01	1.0
PCB 107	0.1	0.01	0.01	0.01	1.0
PCB 108/PCB 124	0.1	0.01	0.01	0.01	1.0
PCB 110/PCB 115	0.1	0.01	0.01	0.01	1.0
PCB 111	0.1	0.01	0.01	0.01	1.0
PCB 114	0.1	0.01	0.01	0.01	1.0
PCB 118	0.1	0.01	0.01	0.01	1.0
PCB 120	0.1	0.01	0.01	0.01	1.0
PCB 121	0.1	0.01	0.01	0.01	1.0
PCB 122	0.1	0.01	0.01	0.01	1.0
PCB 123	0.1	0.01	0.01	0.01	1.0
PCB 126	0.1	0.01	0.01	0.01	1.0
PCB 127	0.1	0.01	0.01	0.01	1.0
PCB 128/PCB 166	0.1	0.01	0.01	0.01	1.0
PCB 129/PCB 138/PCB 163	0.1	0.01	0.01	0.01	1.0
PCB 130	0.1	0.01	0.01	0.01	1.0
PCB 131	0.1	0.01	0.01	0.01	1.0
PCB 132	0.1	0.01	0.01	0.01	1.0
PCB 133	0.1	0.01	0.01	0.01	1.0
PCB 134/PCB 143	0.1	0.01	0.01	0.01	1.0
PCB 135/PCB 151	0.1	0.01	0.01	0.01	1.0
PCB 136	0.1	0.01	0.01	0.01	1.0
PCB 137/PCB 164	0.1	0.01	0.01	0.01	1.0
PCB 139/PCB 140	0.1	0.01	0.01	0.01	1.0
PCB 141	0.1	0.01	0.01	0.01	1.0
PCB 142	0.1	0.01	0.01	0.01	1.0
PCB 144	0.1	0.01	0.01	0.01	1.0
PCB 145	0.1	0.01	0.01	0.01	1.0
PCB 146	0.1	0.01	0.01	0.01	1.0
PCB 147/PCB 149	0.1	0.01	0.01	0.01	1.0
PCB 148	0.1	0.01	0.01	0.01	1.0
PCB 150	0.1	0.01	0.01	0.01	1.0
PCB 152	0.1	0.01	0.01	0.01	1.0
PCB 153/PCB 168	0.1	0.01	0.01	0.01	1.0
PCB 154	0.1	0.01	0.01	0.01	1.0

Table 8-4-25
PCBs by HRGC/HRMS Method 1668A
Estimated Minimum Levels, continued

Parameter	Water ng/L	Solids ng/g	Tissues ng/g	Solid Wastes ng/g	100 uL Extract ng/mL
PCB 155	0.1	0.01	0.01	0.01	1.0
PCB 156/PCB 157	0.1	0.01	0.01	0.01	1.0
PCB 158	0.1	0.01	0.01	0.01	1.0
PCB 159	0.1	0.01	0.01	0.01	1.0
PCB 160	0.1	0.01	0.01	0.01	1.0
PCB 161	0.1	0.01	0.01	0.01	1.0
PCB 162	0.1	0.01	0.01	0.01	1.0
PCB 165	0.1	0.01	0.01	0.01	1.0
PCB 167	0.1	0.01	0.01	0.01	1.0
PCB 169	0.1	0.01	0.01	0.01	1.0
PCB 170	0.1	0.01	0.01	0.01	1.0
PCB 171/PCB 173	0.1	0.01	0.01	0.01	1.0
PCB 172	0.1	0.01	0.01	0.01	1.0
PCB 174	0.1	0.01	0.01	0.01	1.0
PCB 175	0.1	0.01	0.01	0.01	1.0
PCB 176	0.1	0.01	0.01	0.01	1.0
PCB 177	0.1	0.01	0.01	0.01	1.0
PCB 178	0.1	0.01	0.01	0.01	1.0
PCB 179	0.1	0.01	0.01	0.01	1.0
PCB 180/PCB 193	0.1	0.01	0.01	0.01	1.0
PCB 181	0.1	0.01	0.01	0.01	1.0
PCB 182	0.1	0.01	0.01	0.01	1.0
PCB 183/PCB 185	0.1	0.01	0.01	0.01	1.0
PCB 184	0.1	0.01	0.01	0.01	1.0
PCB 186	0.1	0.01	0.01	0.01	1.0
PCB 187	0.1	0.01	0.01	0.01	1.0
PCB 188	0.1	0.01	0.01	0.01	1.0
PCB 189	0.1	0.01	0.01	0.01	1.0
PCB 190	0.1	0.01	0.01	0.01	1.0
PCB 191	0.1	0.01	0.01	0.01	1.0
PCB 192	0.1	0.01	0.01	0.01	1.0
PCB 194	0.1	0.01	0.01	0.01	1.0
PCB 195	0.1	0.01	0.01	0.01	1.0
PCB 196	0.1	0.01	0.01	0.01	1.0
PCB 197/PCB 200	0.1	0.01	0.01	0.01	1.0
PCB 198/PCB 199	0.1	0.01	0.01	0.01	1.0
PCB 201	0.1	0.01	0.01	0.01	1.0
PCB 202	0.1	0.01	0.01	0.01	1.0
PCB 203	0.1	0.01	0.01	0.01	1.0
PCB 204	0.1	0.01	0.01	0.01	1.0
PCB 205	0.1	0.01	0.01	0.01	1.0
PCB 206	0.1	0.01	0.01	0.01	1.0
PCB 207	0.1	0.01	0.01	0.01	1.0
PCB 208	0.1	0.01	0.01	0.01	1.0
PCB 209	0.1	0.01	0.01	0.01	1.0

The estimated minimum level (EML) is defined as the lowest concentration at which an analyte can be measured reliably with common laboratory interferences present assuming a sample is extracted at the recommended weight or volume and is carried through all normal extraction and analysis procedures. Deviations from the extraction amounts or final volumes listed results in corresponding changes in the actual sample ML. The EMLs provided are based on the mean plus 2 standard deviations for matrix-pooled historical blank data and calibration data obtained while performing EPA 1668A. The survey period was fourteen months, ending in February 2004

Table 8-4-26
Polynuclear Aromatic Hydrocarbons by HRGC/LRMS
Reporting Limits (RLs)

Analyte	CAS Number	Water RL (ng/L)	Soil RL [2] (ng/g)	Whole Sample RL (ng)
Acenaphthene	83-32-9	10	1.0	10
Acenaphthylene	208-96-8	10	1.0	10
Anthracene	120-12-7	10	1.0	10
Benz[a]anthracene	56-55-3	10	1.0	10
Benzo[b]fluoranthene	205-99-2	10	1.0	10
Benzo[k]fluoranthene	207-08-9	10	1.0	10
Benzo[g.h,i]perylene	191-24-2	10	1.0	10
Benzo[a]pyrene	50-32-8	10	1.0	10
Benzo[e]pyrene	192-97-2	10	1.0	10
Biphenyl	92-52-4	10	1.0	10
Chrysene	218-01-9	10	1.0	10
Dibenz[a,h]anthracene	53-70-3	10	1.0	10
1,4 Dichlorobenzene	106-46-7	10	1.0	10
2,6-Dimethylnaphthalene	581-42-0	10	1.0	10
Fluoranthene	206-44-0	10	1.0	10
Fluorene	86-73-7	10	1.0	10
Indeno[1,2,3-c,d]-pyrene	193-39-5	10	1.0	10
1-Methylnaphthalene	90-12-0	10	1.0	10
2-Methylnaphthalene	91-57-6	10	1.0	10
1-Methylphenanthrene	832-69-9	10	1.0	10
Naphthalene	91-20-3	10	1.0	10
Phenanthrene	85-01-8	10	1.0	10
Perylene	198-55-0	10	1.0	10
Pyrene	129-00-0	10	1.0	10
2,3,5-Trimethylnaphthalene	2245-38-7	10	1.0	10
Stationary Source Analytes				
1-Chloronaphthalene	90-13-1	10	1.0	10
2-Chloronaphthalene	91-58-7	10	1.0	10
Dibenzo (a,e) pyrene	192-65-4	10	1.0	10

TABLE 8-5
Precision and Accuracy Measurements

Measurement	Definition
Accuracy	The degree of agreement of a measurement with an accepted reference or true value. The only true or known values in the laboratory are spiked samples. Expressed as laboratory control sample (LCS) percent recovery (% R): $$LCS\ \%\ Recovery = \frac{X}{t} x\ 100$$ where: X = observed concentration t = concentration of spike added Expressed as matrix spike/matrix spike duplicate (MS/MSD) sample percent recovery (% R): $$MS\ /\ MSD\ \%\ Recovery = \frac{X_s - X}{t} x\ 100$$ where: X_s = observed concentration in spiked sample X = observed concentration in unspiked sample t = concentration of spike added
Precision	The measure of analytical reproducibility of two values. Expressed as the relative percent difference (RPD) of two values. $$RPD = \left[\frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2} \right)} \right] x\ 100$$ where: X_1 = first observed concentration or recovery X_2 = second observed concentration or recovery Can also be expressed as the relative standard deviation (RSD). $$RSD = \left(\frac{s}{\bar{x}} \right) x\ 100$$ where: s = the standard deviation (see next page) $\bar{x}$ = the mean of the values.

TABLE 8-5
Precision and Accuracy Measurements
(Continued)

Measurement	Definition
Arithmetic mean	The average of a set of values. $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ where: $\bar{x}$ = the mean x_i = the ith data value n = number of data values
Standard Deviation	A measure of the random (probable) error associated with a single measurement within a data set. $s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$ where: s = sample standard deviation $\bar{x}$ = the mean x_i = the ith data value n = number of data values
Relative Standard Deviation	A measure of precision (relative dispersion). It is equal to the standard deviation (s) divided by the mean ($\bar{x}$) and multiplied by 100 to give a percentage value.
ACCURACY	
Upper Control Limit (UCL)	$UCL = \bar{x} + 3s$
Lower Control Limit (LCL)	$LCL = \bar{x} - 3s$
PRECISION	
RPD	Zero to (mean RPD + 3s)

TABLE 8-6
Inorganic Laboratory Quality Control Samples

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Methods 300.0, 9056, 26A/0050, 9057 Mod (Anions: bromide, chloride, fluoride, iodide, nitrate, nitrite, ortho-phosphate, sulfate)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration must be less than the reporting limit	Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Percent recovery must be within laboratory control limits	If not within control limits, rerun all associated samples
	Matrix Spike/ Matrix Spike Duplicate	300.0: 1 pair per 10 samples, minimum of one pair per batch of samples processed 9056: 1 pair with each batch of samples processed not to exceed 20 samples 26A/0050, 9057 Mod: 1 pair per impinger type per batch	90-110% recovery, 20% RPD(1) 26A/0050, 9057 Mod: 75-125% recovery	Flag data associated with MS/MSD outside of limit
	Duplicate	As requested by the client	As requested by the client	As requested by the client
Methods 335.1, 335.4, 9012A (Cyanide)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration must be less than the reporting limit	Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Percent recovery must be within laboratory control limits	Rerun all samples associated with unacceptable LCS
	Matrix Spike	335.1, 335.4: 1 per 10 samples, minimum of one per batch of samples processed 9012A: 1 with each batch of samples processed not to exceed 20 samples	335.1, 335.4: Percent recovery must be within laboratory control limits 9012A: Advisory limits are 75% - 125% recovery	Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	335.1, 335.4: Not applicable 9012A: 1 with each batch of samples processed not to exceed 20 samples	335.1, 335.4: Not applicable 9012A: Limit is 75% - 125% recovery	335.1, 335.4: Not applicable 9012A: Flag data associated with unacceptable Matrix Spike
	Duplicate	As requested by the client		

Footnotes

(1) RPD-Relative Percent Difference

(2) The perchlorate method requires that a pretreated method blank, LCS and MS is prepared and analyzed if pretreated samples are included in a batch.

(3) Air methods may not include MS/MSD.

TABLE 8-6
Inorganic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method PM-10, 40CFR50 App. J and App. B (Particulate)	Balance Zero Check	At the end of every ten weighings	+/- 5mg of zero	Reweigh filters since last acceptable zero check
	Filter Tare Weight Check	Re-weigh 10% of tared filters	Within 2.8 mg.	Reweigh tare for all associated filters
	Exposed Filter Weight Check	Re-weigh 10% of exposed filters	Within 5 mg	Reweigh all associated filters
Method 0050/5, 40 CFR 50, App A (Particulate)	50 and 100 gram certified weights	Before any weighing session and after each group of no more than 10 filters or sample beakers	All weights must be within 0.5 mg of the true value	Reweigh filters since last acceptable weight check.
	Filter sample	All filter samples	Triplicate weights must agree within ± 0.5 mg or 1% of the total weight less the tare weight	Continue dessication until constant weight. If constant weight is not achieved, flag data.
	Acetone probe rinse sample	All acetone probe rinse samples	Triplicate weights must agree within ± 0.5 mg or 1% of the total weight less the tare weight	Continue dessication until constant weight. If constant weight is not achieved, flag data.
Method 314.0 (Perchlorate)	Method Blank[2]	1 with each batch of samples processed not to exceed 20 samples	Concentration must be ≤ ½ the reporting limit	Rerun all samples associated with unacceptable blank
	Laboratory Control Sample[2]	1 with each batch of samples processed not to exceed 20 samples all associated samples	85-115% recovery	If not within control limits, rerun
	Matrix Spike[2]	1 with each batch of samples processed not to exceed 20 samples	80-120% recovery	Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate or a Laboratory Duplicate	1 with each batch of samples processed not to exceed 20 samples	MSD: 80-120% recovery and RPD[1] ± 15% Laboratory Duplicate: RPD[1] ± 15%	Flag data

Footnotes

(1) RPD-Relative Percent Difference

(2) The perchlorate method requires that a pretreated method blank, LCS and MS is prepared and analyzed if pretreated samples are included in a batch.

(3) Air methods may not include MS/MSD

TABLE 8-6
Inorganic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Methods 150.1, 9040B, 9045C (pH)	Method Blank	Not Applicable	Not Applicable	Not Applicable
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Sample provided by external source, must be within ± 0.05 pH units	If not within laboratory control limits, rerun all associated samples
	Matrix Spike	Not Applicable	Not Applicable	Not Applicable
	Matrix Spike Duplicate	Not Applicable	Not Applicable	Not Applicable
	Duplicate	1 with each batch of samples processed not to exceed 20 samples	≤ 25 % RPD[1] limit for results ≥18% R. For results < 18%R, ≤ 4% moisture	Reanalyze the batch.
Methods 245.1, 245.5, 7470A, 7471A, 0060/7470A, ASTMD6784-02, EPA IO-3.1/7470A, EPA 29/7470A (Mercury)[3]	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than ½ reporting limit. Less than RL for air samples.	Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	LCS waters and solids: 90-110%R LCS Ontario Hydro, MMT, PM-10: 80-120%	Rerun all samples associated with unacceptable LCS
	Matrix Spike/ Matrix Spike Duplicate	1 pair with each batch of samples processed not to exceed 20 samples	MS/MSD waters and solids: 85-115% recovery MS/MSD Ontario Hydro, MMT, PM-10: 80-120% recovery, 20% RPD	Flag data
	Duplicate and MS	PM-10, IO-3.1: One duplicate of a client-supplied sample filter must be processed for each prep batch.	75-125 % recovery and 20 % RPD	Flag data
	Post Digestion Spikes	Post Digestion Spike is performed upon client request and one with each front-half air train batch	75-125 % recovery	Narrate recovery

Footnotes

(1) RPD-Relative Percent Difference

(2) The perchlorate method requires that a pretreated method blank, LCS and MS is prepared and analyzed if pretreated samples are included in a batch.

(3) Air methods may not include MS/MSD.

TABLE 8-6
Inorganic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Methods 200.7, 6010B, 0060/6010B, EPA IO-3.1/6010B, EPA 29/6010B (ICP Metals) [3]	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than reporting limit	Rerun all samples associated with unacceptable blank.
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	6010B: In-house control limits within 80-120% recovery. 200.7: 85-115% recovery 0060/29, IO-3.1: 80-120% recovery.	Rerun all samples associated with unacceptable LCS
	Matrix Spike/ Matrix Spike Duplicate	6010B, 200.7: 1 pair with each batch of samples processed not to exceed 20 samples	75-125% recovery, 20% RPD.	Flag data associated with unacceptable MS/MSD
	Post Digestion Spikes	0060/29: 1 with each front-half and back-half air train batch	75-125% recovery	Narrate recovery
	Duplicate	As requested by the client.	20% RPD	Flag data
	Duplicate and MS	IO-3.1: 1 MS and 1 duplicate per batch	75-125 % recovery and 20 % RPD	Flag data
	Serial Dilution	1 with each batch of samples processed not to exceed 20 samples	10 % Difference for results > 50x IDL.	Flag data associated with unacceptable Serial Dilution

Footnotes

(1) RPD-Relative Percent Difference

(2) The perchlorate method requires that a pretreated method blank, LCS and MS is prepared and analyzed if pretreated samples are included in a batch.

(3) Air methods may not include MS/MSD.

TABLE 8-6
Inorganic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
ASTM Method D482 (Ash)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	The result must be less than the RL. **Exception**: If all sample results are greater than 10x the blank concentration or less than the RL, do not reanalyze.	Return all of the samples to the muffle furnace and re-fire them. Re-weigh after cooling.
	Laboratory Control Sample/ Laboratory Control Sample Duplicate	1 pair with each batch of samples processed not to exceed 20 samples	90-110% recovery RPD ≤ 10 %	Re-fire all associated samples and reanalyze if recovery exceeds upper limit. If recovery is less than lower limit, terminate analysis and reanalyze all associated samples. If RPD value continues to exceed 10%, reanalyze all related samples.
	Laboratory Duplicate	Every 10 samples, once per sample batch. Once for each trial burn project.	RPD ≤ 10 % of mean value.	Flag data.
ASTM Method D1963, D854 (Density)	Laboratory Control Sample (LCS)	One per sample preparation batch of up to 20 samples.	Percent accuracy within 99 - 101%	Determine cause and reanalyze all associated samples.
	Analytical Duplicate	One every 10 samples (minimum one per trial burn).	RPD ≤ 1%	Flag the data.
	Laboratory Control Sample (LCS)	One per sample preparation batch of up to 20 samples.	Percent accuracy within 99 - 101%	Determine cause and reanalyze all associated samples.
	Analytical Duplicate	One every 10 samples (minimum one per trial burn).	RPD ≤ 1%	Flag the data.

Footnotes

(1) RPD-Relative Percent Difference

(2) The perchlorate method requires that a pretreated method blank, LCS and MS is prepared and analyzed if pretreated samples are included in a batch.

(3) Air methods may not include MS/MSD.

TABLE 8-6
Inorganic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
ASTM Method E442/ SW-846 Method 5050 (Totals halogens)	Method Blank	One per sample preparation batch of up to 20 samples.	The result should be less than or equal to the RL. Sample results greater than 20x the blank concentration or samples for which the contaminant is < RL do not require reprep.	Reprep and reanalyze samples.
	Laboratory Control Sample (LCS)	One per sample preparation batch of up to 20 samples.	80-120% Recovery	Reprep and/or reanalyze all samples associated with the LCS.
	Laboratory Duplicate	One per sample preparation batch of up to 10 samples. (Minimum one duplicate per trial burn)	RPD ≤ 10%	Flag the data if RPD > 10%.
	Matrix Spike	One per sample preparation batch of up to 20 samples. For trial burn samples, one per trial burn.	80-120% Recovery	Flag the data if % Recovery is outside QC acceptance limits
	Matrix Spike Duplicate	One per sample preparation batch of up to 20 samples. For trial burn samples, one per trial burn.	RPD ≤ 10%	Flag the data if RPD > 10%.
ASTM Method D5865/D240 (Heat of Combustion)	Laboratory Control Sample/ Laboratory Control Sample Duplicate	One pair per sample batch of up to 20 samples	98-102% of accepted value. RPD ≤ 2.0%.	Retest. If the re-test fails, correct the cause and retest all samples.
	Laboratory Duplicate	One per sample batch of up to 20 samples or one per trial burn.	RPD ≤ 10.0%.	Flag the data, note in narrative.

Footnotes

(1) RPD-Relative Percent Difference

(2) The perchlorate method requires that a pretreated method blank, LCS and MS is prepared and analyzed if pretreated samples are included in a batch.

(3) Air methods may not include MS/MSD.

TABLE 8-6
Inorganic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Hexavalent Chromium	Method Blank	One per sample batch of up to 20 samples	The result must be less than or equal to the RL.	Terminate analysis; Correct the problem; Reanalyze all samples associated with the method blank.
	Laboratory Control Sample	One per sample preparation batch of up to 20 samples.	90 - 110 % recovery	Terminate analysis; Correct the problem; Reanalyze all samples associated with the LCS.
	Laboratory Duplicate	All samples	RPD <10	Flag data.
	Matrix Spike	One per batch of up to 20 samples	75 - 125 % recovery or in-house control limits.	Evaluate LCS; if LCS is acceptable, flag MS data.
Viscosity	Calibration Check Sample	Before sample analysis begins, analyze one calibration check standard per batch of up to 20 samples, for each viscometer used in the batch.	Percent difference ≤ 1%.	Correct the problem. Obtain an acceptable result before beginning sample analysis.
	Laboratory Duplicate	One per batch of up to 10 samples, minimum of one per trail burn.	RPD ≤ 10%	Flag data.

Footnotes

(1) RPD-Relative Percent Difference

(2) The perchlorate method requires that a pretreated method blank, LCS and MS is prepared and analyzed if pretreated samples are included in a batch.

(3) Air methods may not include MS/MSD.

TABLE 8-7
Organic Laboratory Quality Control Samples

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Methods 1613B[1], 8290, TO-9A, 23, 0023A (Dioxins/Dibenzofurans by HRGC/HRMS)[3]	Method Blank	1 per batch ≤ 20 samples extracted	1613B: Concentration less than reporting level or one third regulatory level whichever is greater 8290: Concentration less than reporting limit	Reextract/reanalyze all positive samples associated with unacceptable blank
	Laboratory Control Sample (Ongoing Precision and Recovery - OPR)	1 per batch ≤ 20 samples extracted	1613B: Percent recovery must be within acceptance limits given in method for each analyte 8290: Percent recovery for each analyte must be within laboratory acceptance limits	1613B: Reextract/reanalyze all samples associated with unacceptable LCS (OPR) 8290: Rerun all samples associated with unacceptable LCS
	Matrix Spike	1613B: Not Applicable 8290: 1 per analytical batch of ≤ 20 samples	8290: Percent recovery for each analyte should be within laboratory acceptance limits	8290: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	1613B: Not Applicable 8290: 1 per analytical batch of ≤ 20 samples	8290: Percent recovery for each analyte should be within laboratory acceptance limits	8290: Flag data associated with unacceptable matrix spike duplicate
	Duplicate	Not Applicable	Not Applicable	Not Applicable
	Surrogates	Not Applicable	Not Applicable	Not Applicable
	Internal Standards (Labeled Compounds and Cleanup Standards)	1613B: Labeled internal standards and cleanup standards are added to all samples (QC samples included). 8290: Internal standards are added to all samples (QC samples included).	1613B: Recovery of each labeled standard should be within the method limits. 8290: Internal standard recovery should be between 40 % - 135 %. Use limits in laboratory SOP.	

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method 1668A[(2)] (PCBs by HRGC/HRMS)	Method Blank	1 per batch ≤ 20 samples extracted	Concentration less than reporting level or one third regulatory level whichever is greater	Reextract/reanalyze all positive samples associated with unacceptable blank
	Laboratory Control Sample (Ongoing Precision and Recovery - OPR)	1 per batch ≤ 20 samples extracted	Percent recovery must be within acceptance limits given in method for each analyte	Reextract/reanalyze all samples associated with unacceptable LCS (OPR)
	Matrix Spike	Not Applicable	Not Applicable	Not Applicable
	Matrix Spike Duplicate	Not Applicable	Not Applicable	Not Applicable
	Duplicate	Not Applicable	Not Applicable	Not Applicable
	Surrogates	Not Applicable	Not Applicable	Not Applicable
	Internal Standards (Labeled Compounds and Cleanup Standards)	Labeled internal standards and cleanup standards are added to all samples (QC samples included).	Recovery of each labeled standard should be within the method limits.	

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method KNOX-ID-0016, CARB 429 Mod (PAHs by HRGC/LRMS)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than RL	Re-extract and re-analyze all samples associated with unacceptable blank if possible. Otherwise, flag samples associated with unacceptable blank.
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Percent recovery for each spike must be within limits as defined in SOP	Re-extract and re-analyze samples associated with unacceptable spike. Otherwise, flag samples associated with unacceptable spike.
	Internal Standards	Internal Standards spiked into all samples and QC samples	Percent recovery for the internal standards must be within limits as defined in SOP	Re-extract and re-analyze sample with unacceptable internal standards
Method 8330 (Nitroaromatics by HPLC)	Method Blank	1 with each extraction batch of samples not to exceed 20 samples	Concentration less than ½ reporting limit	Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each analyte must be within laboratory acceptance limits	Rerun all samples associated with unacceptable LCS
	Matrix Spike	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike Duplicate
	Surrogates	Surrogates spiked into method blank and all samples (QC included).	All surrogates in method blank & LCS must fall within laboratory established control limits before sample analysis may proceed	Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method 8332 (Nitroglycerin by HPLC)	Method Blank	1 with each extraction batch of samples not to exceed 20 samples	Concentration less than ½ reporting limit	Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each analyte must be within laboratory acceptance limits	Rerun all samples associated with unacceptable LCS
	Matrix Spike	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike Duplicate
	Surrogates	Surrogates spiked into method blank and all samples (QC included).	All surrogates in method blank & LCS must fall within laboratory established control limits before sample analysis may proceed	Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
Method 8081A (Pesticides)	Method Blank	1 with each extraction batch of samples not to exceed 20 samples	Concentration less than reporting limit	Reprepare and reanalyze all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte must be within laboratory acceptance limits	Rerun all samples associated with unacceptable LCS
	Matrix Spike	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike Duplicate
	Surrogates	Surrogates spiked into method blank and all samples (QC included)	Results for blank & LCS must fall within laboratory acceptance limits	Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
	Internal Standards	Spiked into all samples, QC samples and standards	50-150% of response of previous CCV	Reanalyze or flag data

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method 8082 (PCBs and Congeners)	Method Blank	1 with each extraction batch of samples not to exceed 20 samples	Concentration less than ½ reporting limit	Reprepare and reanalyze all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte must be within laboratory acceptance limits	Rerun all samples associated with unacceptable LCS
	Matrix Spike	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike Duplicate
	Surrogates	Surrogates spiked into method blank and all samples (QC included)	Results for blank & LCS must fall within laboratory acceptance limits	Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
Method TO-4A (PCBs)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than ½ reporting limit	Flag samples associated with unacceptable blank
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Percent recovery for each spike must be within limits as defined in SOP	Flag samples associated with unacceptable spike
	Duplicate	1 with each batch of samples processed as provided by the client; should not to exceed 20 field samples	Relative Percent Difference for analyte must be within limits as defined in SOP or LIMS	Flag samples associated with unacceptable duplicate
	Surrogates	Surrogates spiked onto all samples and QC samples	Percent recovery for the surrogate must be within limits as defined in SOP	Reanalyze sample with unacceptable surrogate

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method 0040 (Condensates)	Method Blank	1 with each batch of samples processed not to exceed 20 samples :	Concentration less than RL	Re-analyze all samples associated with unacceptable blank
	Laboratory Control Sample	1 LCS/LCSD pair with each batch of samples processed not to exceed 20 samples	50-150% recovery	Re-analyze samples associated with unacceptable spike
	Surrogates	Surrogates spiked onto all samples and QC samples	Percent recovery for each surrogate must be within limits as defined in SOP	Re-analyze sample with unacceptable surrogate
Method ASTM D1946-90 (Gases)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than the reporting limit	Re-analyze all samples associated with unacceptable blank
	Laboratory Control Sample	1 LCS with each batch of samples processed not to exceed 20 samples	70-130% recovery	Re-analyze samples associated with unacceptable spike
	Duplicate	1 Duplicate per 20 samples	30% RPD	Re-analyze duplicate, evaluate impact on associated samples.
Method TCO/Grav (Semivolatiles by GC)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than 5x RL	Flag samples associated with unacceptable blank
	Laboratory Control Sample & Laboratory Control Sample Duplicate	1 LCS/LCSD with each batch of samples processed not to exceed 20 samples	50-150% recovery, 35% RPD until laboratory acceptance limits are established	Flag samples associated with unacceptable LCS/LCSD
	Surrogates	Surrogates spiked onto all samples and QC samples	50-150% recovery until laboratory control limits are established	Reanalyze sample with unacceptable surrogate, flag samples with unacceptable surrogate results

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method 8270C (Semivolatiles by GCMS) [3]	Method Blank	1 with each extraction batch of samples not to exceed 20 samples	Concentration less than ½ reporting limit (< RL for common contaminants)	Reextract and reanalyze all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte must be within laboratory acceptance limits	Reextract and reanalyze all samples associated with unacceptable LCS
	Matrix Spike	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	1 with each extraction batch of samples not to exceed 20 samples	Percent recovery for each control analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike Duplicate
	Surrogates	Surrogates spiked into method blank and all samples (QC included)	All surrogates in method blank & LCS must be in control. Refer to SOP for sample surrogate acceptance criteria.	Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
	Internal Standards (IS)	Internal Standards are added to all samples (QC samples included).	Internal Standard areas must be within -50% to + 200% and ± 30 seconds from the last daily calibration verification	Refer to SOP for corrective action.

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method TO-13A (Semivolatiles by GCMS)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than reporting limit	Flag samples associated with unacceptable blank
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Percent recovery for each spike must be within limits as defined in SOP	Flag samples associated with unacceptable spike
	Duplicate	1 with each batch of samples processed as provided by the client; should not to exceed 20 field samples	Relative Percent Difference for analyte must be within limits as defined in SOP or LIMS	Flag samples associated with unacceptable duplicate
	Surrogates	Surrogates spiked onto all samples and QC samples	Percent recovery for the surrogate must be within limits as defined in SOP	Reanalyze sample with unacceptable surrogate
	Internal Standards (IS)	Internal Standards spiked into all sample extracts and QC sample extracts	Percent recovery for the internal standards must be within limits as defined in SOP	Re-analyze sample with unacceptable internal standards
Method 8260B (Volatiles by GCMS)	Method Blank	1 with each batch of samples processed not to exceed 20 samples	Concentration less than reporting limit	Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Percent recovery for each control analyte must be within laboratory acceptance limits	Rerun all samples associated with unacceptable LCS
	Matrix Spike	1 with each batch of samples processed not to exceed 20 samples	Percent recovery for each control analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	1 with each batch of samples processed not to exceed 20 samples	Percent recovery for each control analyte should be within laboratory acceptance limits	Flag data associated with unacceptable Matrix Spike

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method 8260B (Volatiles by GCMS), continued	Surrogates	Surrogates spiked into method blank and all samples (QC included)	All surrogates in blank and LCS must be in control.	Re-extract and reanalyze samples or flag sample data not meeting surrogate criteria
	Internal Standards	Internal Standards are added to all samples (QC samples included).	Internal Standard areas must be within -50% to + 200% and ± 30 seconds from the last daily calibration verification	Refer to SOP for corrective action.
Methods TO14A,TO15	Method Blank	1 with each batch of samples processed not to exceed 20 samples or 1 per 24 tune whichever is more frequent	Concentration less than RL	Re-analyze all samples associated with unacceptable blank
	Laboratory Control Sample	1 with each batch of samples processed not to exceed 20 samples	Percent recovery for each spike analyte must be within limits as defined in SOP	Re-analyze samples associated with unacceptable spike
	Duplicate	1 per 20 samples analyzed	Relative Percent Difference (RPD) analyte must be within limits as defined in SOP	Re-analyze duplicate. Evaluate impact on associated samples.
	Surrogates	Surrogates spiked onto all samples and QC samples	70-130% recovery	Re-analyze samples with unacceptable surrogate or flag data if obvious matrix effect.
	Internal Standards	Internal Standards are spiked onto all samples and QC samples	Internal Standard areas must be within ± 40% recovery and ± 20 seconds of the last daily calibration check standard	Re-analyze samples associated with unacceptable internal standard or flag data if obvious matrix effect.

TABLE 8-7
Organic Laboratory Quality Control Samples
(Continued)

Method (Analysis)	QC Sample	Frequency	Criteria	Corrective Action
Method 0030/5041A (VOST)	Method Blank	1 with each batch of samples processed not to exceed 20 samples or 1 per 12 hour tune whichever is more frequent	Concentration less than RL	Re-analyze all samples associated with unacceptable blank or flag data if reanalysis is not possible.
	Laboratory Control Sample	1 LCS/LCSD pair with each batch of samples processed not to exceed 20 samples	Percent recovery for each control analyte must be within limits as defined in SOP	Analyze back-up sample or flag data.
	Surrogates	Surrogates spiked onto all samples and QC samples	Percent recovery for each surrogate must be within limits as defined in SOP	Analyze back-up sample or flag data.
	Internal Standards	Internal Standards are spiked onto all samples and QC samples	Internal Standard areas must be within -50% to + 200% and ± 30 seconds from the last daily calibration verification	Refer to SOP for corrective action.

Footnotes

(1) Method 1613, Rev B, October 1994, EPA 821-B-94-005, "Tetra-Through Octa-Chlorinated Dioxins and Furans by Isotope [3] Dilution HRGC/HRMS". Method 1668, Draft, October 4, 1995, "Toxic PCBs by Isotope Dilution HRGC/HRMS".

(2) Method 1668, Toxic Polychlorinated Biphenyls by Isotope Dilution High Resolution Gas Chromatography/High Resolution Mass Spectrometry [Draft], EPA#: 821/R-97-001, 1997.

(3) Air methods may not include MS/MSD.

TABLE 8-8
Field Quality Control Samples

Type	Applicability		Accuracy and Precision Application	Introduced By
	Inorganic	Organic		
Trip Blank (volatiles)	No	Yes	Accuracy	Whoever supplies containers to the field
Field Blank	Yes	Yes	Accuracy	Field Sampler
Rinsate Blank	Yes	Yes	Accuracy	Field Sampler
Collocated Sample	Yes	Yes	Precision	Field Sampler
Split Sample	Yes	Yes	Precision	Field Sampler
Field Duplicate	Yes	Yes	Precision	Field Sampler
Field Matrix Spike	Yes	Yes	Accuracy	Field Sampler

TABLE 8-9
Laboratory Quality Control Samples

Type	Frequency	Applicability		Accuracy and Precision Application	Introduced By
		Inorganic	Organic		
Analytical Spike	As specified in methods, or as needed	Yes	No	Accuracy	Analyst/ Prep
Duplicate	As specified in methods, or as needed	Yes	Yes	Precision	Analyst/ Prep
Instrument Blank	As specified methods, or as needed	Yes	Yes	Accuracy	Analyst
Interference Check Sample	As specified in methods	Yes	No	Accuracy	Analyst
Internal Standard	Each sample and standard	Yes	Yes Method Dependent	Both	Analyst/ Prep
Laboratory Control Sample	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Matrix Spike	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Matrix Spike Duplicate	1 per each group of samples processed up to 20 samples.	Yes	Yes	Both	Analyst/ Prep
Method Blank	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Surrogate	All standards, method blanks, LCS, and samples.	No	Yes Method Dependent	Accuracy	Analyst/ Prep
Post Digestion Spike	At client request and 1 with each ICP air train batch, 1 with each Hg front-half batch	Yes	No	Accuracy	Analyst

TABLE 8-10
Laboratory Performance Quality Control Samples

Sample/Measurement	Purpose
Method Blanks	Demonstrates that the laboratory systems (*e.g.*, glassware cleaning procedures) and laboratory reagents used for the preparation and analysis of samples have not contributed to a false positive or negative measurement.
Instrument Blank	Demonstrates that the analytical system has not contributed to a false positive or negative measurement.
Laboratory Control Sample	Demonstrates the laboratory's ability to perform an analysis within the performance requirements of the method.

TABLE 8-11
Matrix Specific Quality Control Samples

Quality Control Sample	Purpose
Duplicate Samples	Estimates the ability of the laboratory to obtain precise measurements on a sample. This measure is dependent on the homogeneity of the sample being duplicated. Solid samples often portray poor sample homogeneity and therefore often have poor duplication with regards to the sample result.
Matrix Spike Sample	Estimates the ability of the laboratory to obtain accurate measurements on a sample. The measure is dependent on the bias a sample matrix may cause regarding a given analyte.
Matrix Spike Duplicate Sample	In addition to verifying the accuracy of the matrix spike sample, the matrix spike duplicate can be used with the matrix spike sample as a measure of precision by calculating the relative percent difference (RPD).

TABLE 8-12
Inorganic Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix[3]	Minimum Sample Size[1]	Method	Requirements[2]	Method	Requirements[2]
Anions (Bromide, Chloride, Fluoride, Nitrite, Nitrate, Nitrite/Nitrate, ortho-Phosphate, Sulfate)	Water	100 mL	300.0	250 mL plastic or glass, Cool, 4°C, analyze ASAP after collection, within 28 days(Bromide, Chloride, Nitrate/Nitrite, Sulfate), 48 hours (Nitrate, Nitrite, ortho-phosphate)	9056	250 mL plastic or glass, Cool, 4°C, analyze ASAP after collection, within 28 days(Bromide, Chloride, Nitrate/Nitrite, Sulfate), 48 hours (Nitrate, Nitrite, ortho-phosphate)
	Solid	10 g	300.0	60 mL plastic or glass, Cool, 4°C, No preservative required, 28 days after leaching(Bromide, Chloride, Nitrate/Nitrite, Sulfate), 48 hours (Nitrate, Nitrite, ortho-phosphate) after leaching	9056	60 mL plastic or glass, Cool, 4°C, analyze ASAP after collection, within 28 days of leaching (Bromide, Chloride, Nitrate/Nitrite, Sulfate), 48 hours (Nitrate, Nitrite, ortho-phosphate)after leaching
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Cyanide (Amenable)	Water	250 mL	335.1	250 mL plastic or glass, NaOH to pH >12 0.6g ascorbic acid[4] Cool, 4°C, 14 days.	9012A	250 mL plastic or glass, NaOH to pH >12 0.6g ascorbic acid[4] Cool, 4°C, 14 days
Cyanide (Total)	Water	250 mL	335.4	250 mL plastic or glass, NaOH to pH >12 0.6g ascorbic acid[4] Cool, 4°C, 14 days	9012A	250 mL plastic or glass, NaOH to pH >12 0.6g ascorbic acid[4] Cool, 4°C, 14 days
	Solid	10g	--	Not Applicable	9012A	2 oz glass Teflon-lined lids, Cool, 4°C, 14 days
	Waste	10g	--	Not Applicable	9012A	4 oz glass Teflon-lined lids, Cool, 4°C, 14 days
Hardness (Total)	Water	50 mL	2340B	250 mL glass or plastic, HNO_3 to pH < 2, 6 months	---	Not Applicable

TABLE 8-12
Inorganic Sample Containers, Preservatives, and Holding Times
(Continued)

Analytical Parameters	Matrix[3]	Minimum Sample Size[1]	Method	Requirements[2]	Method	Requirements[2]
Perchlorate	Water	250 ml	314.0	250 mL plastic or glass. Analyze within 28 days	--	--
	Solid	10 g	314.0	2 oz. plastic or glass. Analyze within 28 days of leaching	--	--
pH	Water	250 mL	150.1	250 mL plastic or glass. Analyze immediately. **This test should be performed in the field[5].**	9040B	250 mL plastic or glass. Analyze immediately. **This test should be performed in the field.[5]**
	Solid	20 g	---	Not Applicable	9045C	2 oz glass or plastic, Cool, 4°C, Analyze as soon as possible.[5]
	Waste	20 g	---	Not Applicable	9045C	2 oz glass or plastic, Cool, 4°C, Analyze as soon as possible.[5]
Metals (excludes Hg)	Water	100 mL	200.7	250 mL glass or polyethylene container, HNO_3 to pH $\leq$ 2, 6 months	6010B	250 mL glass or polyethylene container, HNO_3 to pH $\leq$ 2, 6 months
	Solid	10 g	200.7	2 oz glass or polyethylene container storage at 4 °C, 6 months	6010B	2 oz glass or polyethylene container, storage at 4°C, 6 months
	Waste	10 g	200.7	Not Applicable	6010B	2 oz glass or polyethylene container, storage at 4°C, 6 months

TABLE 8-12
Inorganic Sample Containers, Preservatives, and Holding Times
(Continued)

Analytical Parameters	Matrix[3]	Minimum Sample Size[1]	Method	Requirements[2]	Method	Requirements[2]
Mercury (CVAA)	Water	100 mL	245.1	125 mL glass or polyethylene container, HNO_3 to pH $\leq$ 2, 28 days	7470A	125 mL glass or polyethylene container, HNO_3 to pH $\leq$ 2, 28 days
	Solid	10 g	245.5	2 oz glass or polyethylene container, Cool, 4°C, 28 days	7471A	2 oz glass or polyethylene container, Cool, 4°C, 28 days
	Waste	10 g	--	Not Applicable	7471A	2 oz glass or polyethylene container, Cool, 4°C, 28 days

TABLE 8-12
Inorganic Sample Containers, Preservatives, and Holding Times
(Continued)

Analytical Parameters	Matrix[3]	Minimum Sample Size[1]	Method	Requirements[2]
Ash	Aqueous Waste Feed	10 g	ASTM D482	Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Organic Liquid Waste Feed	10 g		Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Soil, Sludge, Sediment, or Solid Waste Feed	10 g		Wide-mouth glass jar with Teflon™-lined closure (minimum 4 oz.). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
Density	Aqueous Waste Feed		ASTM D1963, D854	Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Organic Waste Feed			Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Soil, Sediment, Sludge or Other Solid Waste Feed			Wide-mouth glass jar with Teflon™-lined closure (minimum 4 oz.). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
Halogens	Aqueous Waste Feed	2 g	Methods 5050, ASTM Method E442	Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Organic Waste Feed	2 g		Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Soil, Sediment, Sludge or Other Solid Waste Feed	2 g		Wide-mouth glass jar with Teflon™-lined closure (minimum 4 oz.). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.

TABLE 8-12
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix[3]	Minimum Sample Size[1]	Method	Requirements[2]
Heat of Combustion	Aqueous Waste Feed	2 g	D5865, D240	Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Organic Waste Feed	2 g		Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Soil, Sediment, Sludge or Other Solid Waste Feed	2 g		Wide-mouth glass jar with Teflon™-lined closure (minimum 4 oz.). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
Hexavalent Chromium	Stack gas samples	5 mL	0061/ 7199	Samples are collected in polypropylene containers. Samples must be stored at 4°C. The holding time is 14 days.
Viscosity	Aqueous Waste Feed		D445	Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Organic Waste Feed			Amber glass Boston round bottle with Teflon™-lined closure (minimum: 1 x 250 mL). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.
	Soil, Sediment, Sludge or Other Solid Waste Feed			Wide-mouth glass jar with Teflon™-lined closure (minimum 4 oz.). No preservation required. Recommended to cool to 4°C if high volatile content is suspected. No holding time specified.

Footnotes

(1) Minimum sample size indicates sample amount needed for a single analysis. Matrix spikes or duplicates will require an additional sample amount of at least this amount for each additional QC sample aliquot required.
(2) Holding times are calculated from date of collection.
(3) Solid matrix type includes soil, sediment, sludge and other solid materials not classified as waste.
(4) Samples to be analyzed for cyanide should be field-tested for residual chlorine. If residual chlorine is detected, ascorbic acid should be added.
(5) If not done in the field (ASAP) per the method and requested by client, it should be analyzed in lab within 48 hours.

TABLE 8-13
Organic Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix[3]	Minimum Sample Size[1]	Method	Requirements[2]	Method	Requirements[2]
Dioxins/Dibenzo -furans (HRGC/HRMS)	Water	1 L	1613B	1 liter amber glass w/fluoropolymer-lined screw cap. Add sodium thiosulfate if residual chlorine. If pH > 9, H_2SO_4 to pH 7-9. Cool, 0-4°C in the dark. Extraction , 1 year. Analysis, within 40 days of extraction.	8290	1 liter glass amber with Teflon®-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction
	Solid	10g	1613B	2 oz. amber wide, mouth, glass w/fluoropolymer-lined screw cap. Cool, <4°C in the dark until receipt in Lab, then <-10°C in the dark. Extraction , 1 year. Analysis, within 40 days of extraction.	8290	2 oz. glass amber wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction
	Waste	10g	1613B	2 oz. amber wide, mouth, glass w/fluoropolymer-lined screw cap. Cool, <4°C in the dark until receipt in Lab, then <-10°C in the dark. Extraction , 1 year. Analysis, within 40 days of extraction.	8290	2 oz. glass amber wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction

TABLE 8-13
Organic Sample Containers, Preservatives, and Holding Times
(Continued)

Analytical Parameters	Matrix[3]	Minimum Sample Size[1]	Method	Requirements[2]
PCBS By HRGC/HRMS	Water	1 L	1668A	1 liter amber glass w/fluoropolymer-lined screw cap. Add sodium thiosulfate if residual chlorine. H_2SO_4 to pH 2-3. Cool, 0-4°C in the dark. Extraction , 1 year. Analysis, 1 year.
	Solid	10g	1668A	2 oz. amber wide, mouth, glass w/fluoropolymer-lined screw cap. Cool, <4°C in the dark until receipt in Lab, then <-10°C in the dark. Extraction , 1 year. Analysis, 1 year.
	Waste	10g	1668A	2 oz. amber wide, mouth, glass w/fluoropolymer-lined screw cap. Cool, <4°C in the dark until receipt in Lab, then <-10°C in the dark. Extraction , 1 year. Analysis, 1 year.
Nitroaromatics	Water	1L	8330 8332	1 liter amber glass with Teflon®-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	2 g	8330 8332	2 oz. glass widemouth with Teflon®-lined lid Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
	Waste	2 g	8330 8332	2 oz. glass widemouth with Teflon®-lined lid Cool, 4 °C, Extraction, 14 days Analysis, 40 days of the start of the extraction
Pesticides/ PCBs	Water	1L	8081A 8082	1 liter amber glass with Teflon®-lined lid, If residual chlorine present, add 3 mL 10% sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	50 g	8081A 8082	4 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
	Waste	1 g	8081A 8082	2 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C Extraction, 14 days Analysis, 40 days of the start of the extraction
Semivolatiles	Water	1L	8270C	1 liter amber glass with Teflon®-lined lid, If residual chlorine present, add 3 mL sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, within 40 days of extraction
	Solid	50 g	8270C	4 oz glass wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 14 days Analysis, within 40 days of extraction
	Waste	1 g	8270C	2 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days, Analysis, within 40 days of extraction

TABLE 8-13
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix[3]	Minimum Sample Size[1]	Method	Requirements[2]
Volatile Organics	Water	40 mL	8260B	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 1:1 HCl to pH ≤ 2, 14 days with pH ≤ 2[4]
	Solid	5 g or 25 g	8260B	2 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C [5].
	Waste	5 g or 25 g	8260B	2 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C [5].

Footnotes

(1) Minimum sample size indicates sample amount needed for a single analysis. Matrix spikes or duplicates will require an additional sample amount of at least this amount for each additional QC sample aliquot required.

(2) Holding times are calculated from the date of collection.

(3) Solid matrix type includes soil, sediment, sludge or other solids not classified as waste.

(4) For acrolein and acrylonitrile the pH should be adjusted to 4-5.

(5) Depending on regulatory programs, EnCore™ samplers may be preserved for up to 14 days from sampling by freezing at -5 to -12°C until analysis. Alternatively the EnCore™ sample may be transferred to a 40-ml VOA vial and preserved by freezing at -5 to -12°C until analysis. Some regulatory agencies may require 4 or 8 oz glass with Teflon®-lined lid, Cool 4°C, 14 days. This technique is not recommended, but will be supported where required. (Preservation and holding times are subject to client specifications.)

TABLE 8-14
Sample Containers, Preservatives, and Holding Times for TCLP[1] and SPLP[2]

Analytical Parameters	Matrix	Minimum Sample Size[3]	TCLP Method 1311 and SPLP Method 1312 Requirements	
			From Field Collection to TCLP/SPLP Extraction	From TCLP/SPLP Extraction to Analysis
Mercury	Liquid Solid Waste	1L	1L glass, 28 days	Glass or polyethylene 28 days
Metals (except mercury)	Liquid Solid Waste	1L	1L glass, 180 days	Glass or polyethylene 180 days
Semivolatiles	Liquid Solid Waste	1L	1L glass, Cool 4°C, 14 days	1L glass Extraction of leachate within 7 days of TCLP extraction, Analyze extract within 40 days
Volatiles	Liquid Solid Waste	6 oz	4 oz glass, Cool 4°C, 14 days	40 mL glass, 14 days

Footnotes

(1) TCLP = Toxicity Characteristic Leaching Procedure

(2) SPLP = Synthetic Precipitation Leaching Procedure

(3) Smaller sample size is adequate for solid samples or individual fractions. A combined volume of 32 oz. is recommended for semivolatiles and metals. A separate 4 oz. container should always be used for the volatile fraction. Volatile fractions should be stored with minimal headspace.

TABLE 8-15
Periodic Equipment Calibrations

Type of Equipment	Calibration Requirements
Balances	• Must be serviced and calibrated annually by an approved vendor. • Calibration must be checked daily or before use by analyst with weight(s) classified as Class 1 (formerly termed Class S) by NIST or Class 1 traceable. Acceptance criteria vary according to weight used and accuracy of balance. Acceptance criteria must be documented in the log. • All Class 1 weights must be certified by an outside vendor every three years. • All non-Class 1 weights must be checked annually against NIST Class 1 weights.
Thermometers	• Working glass mercury thermometers must be calibrated against a certified NIST thermometer at least annually as described in operation-specific SOPs. • Working non-mercury glass thermometers must be calibrated against a certified NIST thermometer quarterly as described in operation-specific SOPs. • The NIST thermometer must be recertified every three years.
Refrigerators/Freezers	• Thermometers must be immersed in a liquid such as mineral oil or glycol • Temperature of units used for sample or standard storage must be checked daily as described in operation-specific SOPs. Refrigerator acceptance limits: 4°C ± 2°C Freezer acceptance limits: - 10°to - 20°C
Ovens	• Temperature of units must be checked daily or before use. • Acceptance limits vary according to use as described in operation-specific SOPs and must be documented in the temperature log.
Micropipettors	• Calibrations are checked gravimetrically as required by the operation specific SOP at a monthly frequency.
Syringes, Volumetric Glassware and Graduated Glassware	• All syringes and volumetric glassware are purchased as Class A items. • Class A items are certified by the manufacturer to be within ± 1% of the measured volume, therefore, calibration of these items by STL laboratories is not required. • All analysts are trained in the proper use and maintenance of measuring devices to ensure the measurement of standards, reagents and sample volumes are within method tolerances.

TABLE 8-16
Summary of Inorganic Method Calibrations

Method (Analysis)	Calibration	Requirement	Criteria
Methods 300.0, 9056, 26A/0050, 9057 (Mod) (Anions: Bromide, Chloride, Fluoride, Iodide, Nitrate, Nitrite, Nitrate/Nitrite Ortho-Phosphate, Sulfate)	Initial	5 levels plus a blank	$r^{(1)} \geq 0.995$
	Continuing	1 level every 10 samples	± 10% of true value
	Ending	1 level	± 10% of true value
Methods 335.1, 335.4, 9012A (Total and amenable Cyanide)	Initial	7 levels plus blank	" $r^{n(1)} \geq 0.995$
	Continuing	1 mid-level every 10 samples	± 10 % of true value (335.1, 335.4), ± 15% of true value (9012A)
	Ending	1 mid-level	± 10 % of true value (335.1, 335.4), ± 15% of true value (9012A)
Method 314.0 (Perchlorate)	Initial	5 levels plus a blank	% RSD <15% or $r^{(1)} > 0.995$
	QCS	2nd source standard	± 10% of the true value
	Instrument Performance Check	Standard within ± 10% MCT	Conductance ± 10% of original value A/H %D < 25% %R 80-120%, < 5%RT shift
	Continuing	Alternate concentration from mid to high level every 10 samples	85-115% recovery
	ICCS	Lowest level calibration standard	75-125% of the true value
	Ending	Alternate concentration from mid to high level every 10 samples	85-115% recovery
Method PM-10, 40 CFR Part 50, App. J and App. B (Particulate)	Initial	Check the balance using 1, 5, and 10 gram weights	Weights must be within 1 mg of the true value (i.e., 1 g ±0.0010 g, 5 g ±0.0010 g and 10 g ±0.0010 g.)
	Continuing	Every 15 filters, check the balance using 1, 5, and 10 g weights.	Weights must be within 1 mg of the true value (i.e., 1 g ±0.0010 g, 5 g ±0.0010 g and 10 g ±0.0010 g.)
	Ending	Check the balance using 1, 5, and 10 gram weights	Weights must be within 1 mg of the true value (i.e., 1 g ±0.0010 g, 5 g ±0.0010 g and 10 g ±0.0010 g.)

TABLE 8-16
Summary of Inorganic Method Calibrations
(Continued)

Method (Analysis)	Calibration	Requirement	Criteria
Method 0050, 5, 40 CFR Part 60, App. A (Particulate)	Initial	Check the balance using 50 and 100 gram weights.	Weights must be within 0.5 mg of the true value.
	Continuing	After each group of ≤ 10 filters or sample beakers, check the balance using 50 and 100 gram weights.	Weights must be within 0.5 mg of the true value.
	Ending	Check the balance using 50 and 100 gram weights.	Weights must be within 0.5 mg of the true value.
Methods 150.1, 9040B, 9045C (pH)	Initial	2 level calibration that bracket the expected pH of the sample Third point check	No criteria, used to calibrate the instrument ± 0.05 pH units of the true value
	Continuing	1 buffer check every 10 samples	± 0.2 pH units of true value
	Ending	1 buffer check	± 0.2 pH units of true value
Methods 200.7, 6010B, 0060/6010B, EPA IO-3.1/6010B, EPA 29/6010B (ICP Metals)	Initial	1 level and blank Rerun high calibration standard	Verify quantitation at ± 5% of true value, ICV RSD < 3% from replicate (200.7) ± 10% of true value, ICV RSD < 5% from replicate (6010B)
	Continuing	Every 10 samples, mid-level calibration standard	95-105% R (CWA 200.7) 90-100% R , CCV RSD < 5% from replicate (SDWA 200.7, 6010B)
	Ending	Mid-level calibration standard	95-105% R (CWA 200.7) 90-100% R , CCV RSD < 5% from replicate (SDWA 200.7, 6010B)
	Other	ICSA, ICSAB: Analyze at beginning of run	For ICSA, AB criteria, see ICP analytical SOP
Methods 245.1, 245.5, 7470A, 7471A, 0060/7470A, ASTMD6784-02, EPA IO-3.1/7470A, EPA 29/7470A (Mercury)	Initial	5 levels plus blank	ICV ± 5% of true value (245.1, 245.5) ICV ± 10% of true value (7470A, 7471A) $"r"^{(1)} \geq 0.995$
	Continuing	Every 10 samples	± 10% of true value (245.1, 245.5) ± 20% of true value (7470A, 7471A)
	Ending	End of sequence	± 10% of true value (245.1, 245.5) ± 20% of true value (7470A, 7471A)

TABLE 8-16
Summary of Inorganic Method Calibrations
(Continued)

Method (Analysis)	Calibration	Requirement	Criteria
ASTM Method A4422, D482, E830 (Ash)	Daily	Check balance using 5, 50 and 100 gram weights	± 0.0001 g for 5 g, ± 0.0002 g for 50 g, ± 0.0003 g for 100 g weights
ASTM Method D1963, D854 (Density)	Initial	Triplicate volume measurements of pycnometer	<0.5% RSD
	Continuing	Weigh dry pycnometer	Within 0.1 g of initial average weight
ASTM Method D5865/D240 (Heat of Combustion)	Initial	A rolling average derived from 10 calibrations performed over time.	%RSD < 1%
	Continuing	Daily check	%D < 1%
Method 0061/7199 (Hexavalent Chromium)	Initial	Minimum three standards ICV/ICB	$r^2 \geq 0.998$ ICV ±10% of the established value; ICB < RL.
	Continuing	Every 10 samples, CCV/CCB	CCV ≤10%; CCB < RL.
	Ending	CCV/CCB	CCV ≤10%; CCB < RL.

Footnotes

(1) "r" = correlation coefficient

TABLE 8-17
Summary of Organic Method Calibrations

Method (Analysis)	Calibration	Requirement	Criteria
Methods 1613B, 8290, TO-9A, 23, 0023A (Dioxins/ Dibenzofurans)	Initial	5 levels plus window defining solution.	Method 1613B: %RSD for compounds calibrated by isotope dilution ≤ 20%. %RSD for compounds calibrated by internal standard ≤ 35%. Method 8290: %RSD ≤ 20% for natives; %RSD ≤ 30% for labeled compounds from initial
	Continuing	1 level every 12 hour shift plus window defining solution and mass resolution documentation.	Method 1613B: Calculated concentrations must be within method acceptance criteria. (1613 Table 6) Method 8290: RFs with %D ≤ 20% for natives; %D ≤ 30% for labeled compounds
	Ending	Method 8290: 1 level plus mass resolution documentation at the end of the 12 hour shift	Method 8290: RFs with %D ≤ 25% for natives; %D ≤ 35% for labeled compounds
	Other		Isotope ratios in calibration standards must meet criteria in method. Valley between 2,3,7,8-TCDD[(1)] and all other TCDDs must be ≤ 25% of the 2,3,7,8-TCDD height.
Method 1668A (PCBs by HRGC/HRMS)	Initial	5 or 6 levels plus mass resolution check	%RSD for compounds calibrated by isotope dilution < 20%. %RSD for compounds calibrated by internal standard < 35%.
	Continuing	1 level every 12 hours plus mass resolution check	Calculated concentrations must be within method acceptance criteria. (1668 Table 6)
	Ending	Not Applicable	Not Applicable
	Other	Isotope ratios in calibration standards.	Must meet criteria in method.
Method KNOX-ID-0016 (CARB 429 Mod) (PAHs by HRGC/LRMS)	Initial	7 levels	% RSD ≤ 30%; S/N ≥10 (Refer to SOP for more details)
	Continuing	At beginning of every 12 hour shift	%D or %Drift ≤ 30%; S/N ≥10 (Refer to SOP for more details)
	Ending	Not Applicable	Not Applicable
	Other	DFTPP tuning at the beginning of every 12 hour shift	Must meet criteria in SOP.

TABLE 8-17
Summary of Organic Method Calibrations
(Continued)

Method (Analysis)	Calibration	Requirement	Criteria
Method 8330 (Nitroaromatics by HPLC	Initial	5 levels.	Curve should be linear with zero intercept. % RSD < 20% or r >0.995
	Continuing	Midpoint calibration standard after every 10 samples or 12 hours	%D ≤ 15% of predicted response
	Ending	Midpoint calibration standard.	%D: ≤ 15% of predicted response
Method 8332 (Nitroglycerine)	Initial	5 levels	Curve should be linear with zero intercept. % RSD ≤ 20% or r >0.995
	Continuing	Midpoint calibration standard after every 10 samples or 12 hours	%D ≤ 15% of predicted response
	Ending	Midpoint calibration standard	%D: ≤ 15% of predicted response
Methods 8081A (Pesticides)	Initial	5 levels.	% RSD ≤ 20%, r ≥ 0.995
	PEM	Column degradation evaluation every 12 hours	The degradation of DDT & endrin must be ≤ 15%.
	Continuing	Mid-level calibration standard analyzed every 12 hours or 20 samples.	% D ≤ 15% of predicted response
	Ending	Mid-level calibration standard	% D ≤ 15% of predicted response
Methods 8082, TO-4A (PCBs)	Initial	5 levels of Aroclors 1016/1260; other Aroclors, mid-level single point	% RSD ≤ 20%
	Continuing	Mid-level calibration standard analyzed every 12 hours.	% D ≤ 15%
	Ending	Mid-level calibration standard	% D ≤ 15%

TABLE 8-17
Summary of Organic Method Calibrations
(Continued)

Method (Analysis)	Calibration	Requirement	Criteria
Method 8082 (Congeners)	Initial	5 levels	The average response factor may be used if the percent relative standard deviation (%RSD) of the response factors is ≤ 20%. ICV must be within +/- 25% of its expected value with allowance for up to two analytes within +/- 35%.
	Continuing	Mid-level every 12 hours Mid-level after every 20 samples	%D ≤15%
	Ending	Not applicable	Not applicable
Method 0040 Condensates (Volatiles by GC)	Initial	5 levels	Quadratic or linear least squares fit to the data, r ≥ 0.995
	Continuing	Daily, mid-level standard	85-115% Recovery
	Ending	Mid-level standard	85-115% Recovery
Method ASTM D1946-90 (Permanent gases) (Volatiles by GC)	Initial	3 levels	RSD≤15%
	Continuing	Daily, mid-level standard	85-115% Recovery
	Ending	Mid-level standard	85-115% Recovery
Method TCO (Semivolatiles by GC)	Initial	5 levels	Quadratic or linear least squares fit to the data, r ≥ 0.995
	Continuing	Daily and every 10 samples	85 – 115% Recovery
	Ending	Mid-level standard	85 – 115% Recovery

TABLE 8-17
Summary of Organic Method Calibrations
(Continued)

Method (Analysis)	Calibration	Requirement	Criteria
Method 8270C (Semivolatiles)	Initial	5 levels	% RSD for RF for CCCs[2] < 30% SPCCs[3]: RF > 0.050
	Continuing	Mid-level standard every 12 hours (after tuning)	%D for CCCs[2] < 20 % between RF from standard and avg RF from initial. All analytes %D ≤30% SPCCs[3]: RF > 0.050
	Ending	Not Applicable	Not Applicable
	Other	DFTPP[5] tuning at the beginning of every 12 hour shift.	Key abundance criteria in method met.
Method TO-13A (Semivolatiles)	Initial	5 levels	% RSD ≤ 30%; RRF > minimum RRF in SOP.
	Continuing	At the beginning of every 12 hour shift.	%D or %Drift ≤ 30%
	Ending	Not Applicable	Not Applicable
	Other	DFTPP[5] tuning at the beginning of every 12 hour shift.	Key abundance criteria in method met.
Methods TO-14 A, TO-15 (Volatiles)	Initial	5 levels	RSD≤30% with two allowed up to ≤40%; IS Area within 40% of mean response and IS RT shift <20 seconds from mid level.
	Continuing	Mid-level each 24 hours after tuning check	%D <30% with four allowed up to <40%
	Ending	Not Applicable	Not Applicable
	Other	BFB tuning at the beginning of every 24 hour shift	Must meet key abundance criteria in method.

TABLE 8-17
Summary of Organic Method Calibrations
(Continued)

Method (Analysis)	Calibration	Requirement	Criteria
Method 8260B (Volatiles)	Initial	5 levels	%RSD for RF for CCCs[2] ≤ 30% SPCCs[3]: RF ≥ 0.300 for Chlorobenzene and 1,1,2,2-tetrachloroethane, and RF ≥ 0.100 for Chloromethane, 1,1-dichloroethane, Bromoform
	Continuing	Mid-level standard every 12 hours (after tuning)	%Drift for CCCs[2] ≤ 20% between RF from standard and avg RF from initial SPCCs[3]: RF ≥ 0.300 for Chlorobenzene and 1,1,2,2-tetrachloroethane, and RF ≥ 0.100 for Chloromethane and 1,1-dichloroethane, Bromoform
	Ending	Not Applicable	Not Applicable
	Other	BFB[4] tuning at the beginning of every 12 hour shift	Must meet key abundance criteria in method.
Method 0031/5041A (VOST)	Initial	5 levels	RSD≤30% for CCCs; RRF for SPCCs (Chloromethane, 1,1-dichloroethane, bromoform ≥0.100; 1,1,2,2-Tetrachloroethane, chlorobenzene ≥0.300) Refer to SOP for more details
	Continuing	Mid-level standard every 12 hours (after tuning)	RSD≤20% for CCCs; RRF for SPCCs (Chloromethane, 1,1-dichloroethane, bromoform ≥0.100; 1,1,2,2-Tetrachloroethane, chlorobenzene ≥0.300) Refer to SOP for more details
	Ending	Not Applicable	Not Applicable
	Other	BFB tuning at the beginning of every 12 hour shift	Must meet key abundance criteria in method.

Footnotes

(1) TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
(2) CCC - Continuing Calibration Compounds
(3) SPCC - System Performance Check Compound
(4) BFB – Bromofluorobenzene
(5) DFTPP - Decafluorotriphenylphosphine

TABLE 9-1
Proficiency Testing Programs

PT Sample Program Description	Analysis Performed	Frequency of Participation
Water Pollution Program Samples provided by Environmental Resource Associates, a NIST-approved PT Provider	Trace Metals, Minerals, PCBs, Chlorinated Hydrocarbon, Pesticides, Volatile Halocarbons, Volatile Aromatics, Total CN	Semi-annual
Water Supply Program Samples provided by Environmental Resource Associates, a NIST-approved PT Provider	pH, Sodium, Trace Metals, Cyanide, 2,3,7,8-TCDD.	Semi-annual
Hazardous Waste Program Samples provided by Environmental Resource Associates, a NIST-approved PT Provider	Semivolatile Organics (BNA), Pesticides, Herbicides, Volatile Organics, Metals, Anions, PAH, Explosives	Semi-annual
Department of Energy Mixed Analyte Performance Evaluation Program (MAPEP)	Trace Metals, Semivolatile Organics	Annual
STL Corporate Double Blind	May include Volatile Organics, Metals, General Chemistry, Base/Neutral Acid Extractables, Pesticides/PCBs.	Annual

APPENDIX
B

Appendix B –

Data Validation Qualifiers

Document List

1. Pace Analytical Data Validation Qualifiers
2. STL Data Validation Qualifiers

Qualifier Codes

Flag	Applies To	Explanation
A	Inorganic	Analyte is detected in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
B	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
B	Organic	Analyte is present in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
C	All	Elevated detection limit.
D	All	Analyte value from diluted analysis or surrogate result not applicable due to sample dilution.
E	Inorganic	Estimated concentration due to matrix interferences. During the metals analysis the serial dilution failed to meet the established control limits of 0-10%. The sample concentration is greater than 50 times the IDL for analysis done on the ICP or 100 times the IDL for analysis done on the ICP-MS. The result was flagged with the E qualifier to indicate that a physical interference was observed.
E	Organic	Analyte concentration exceeds calibration range.
F	Inorganic	Due to potential interferences for this analysis by Inductively Coupled Plasma techniques (SW-846 Method 6010), this analyte has been confirmed by and reported from an alternate method.
F	Organic	Surrogate results outside control criteria.
H	All	Preservation, extraction or analysis performed past holding time.
HF	Inorganic	This test is considered a field parameter, and the recommended holding time is 15 minutes from collection. The analysis was performed in the laboratory beyond the recommended holding time.
J	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
J	Organic	Concentration detected is greater than the method detection limit but less than the reporting limit.
K	Inorganic	Sample received unpreserved. Sample was either preserved at the time of receipt or at the time of sample preparation.
K	Organic	Detection limit may be elevated due to the presence of an unrequested analyte.
L	All	Elevated detection limit due to low sample volume.
M	Organic	Sample pH was greater than 2
N	All	Spiked sample recovery not within control limits.
O	Organic	Sample received overweight.
P	Organic	The relative percent difference between the two columns for detected concentrations was greater than 40%.
Q	All	The analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
S	Organic	The relative percent difference between quantitation and confirmation columns exceeds internal quality control criteria. Because the result is unconfirmed, it has been reported as a non-detect with an elevated detection limit.
U	All	The analyte was not detected at or above the reporting limit.
V	All	Sample received with headspace.
W	All	A second aliquot of sample was analyzed from a container with headspace.
X	All	See Sample Narrative.
&	All	Laboratory Control Spike recovery not within control limits.
*	All	Precision not within control limits.
<	All	The analyte was not detected at or above the reporting limit.
1	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses passed QC based on precision criteria.
2	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses failed QC based on precision criteria.
3	Inorganic	BOD result is estimated due to the BOD blank exceeding the allowable oxygen depletion.
4	Inorganic	BOD duplicate precision not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
5	Inorganic	BOD result is estimated due to insufficient oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
6	Inorganic	BOD laboratory control sample not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
7	Inorganic	BOD result is estimated due to complete oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.

STL-Knoxville Laboratory

Data Qualifier Codes

The following flags are used to qualify results for HRMS PCB results:

J – The reported result is an estimate. The amount reported is below the Estimated Minimum Level (EML).

E – The reported result is an estimate. The amount reported is above the UCL.
B – The analyte is present in the associated method blank at a reportable level.
Q – Estimated maximum possible concentration.
S – Ion suppression evident.
C – Coeluting Isomer.
X – Other.

APPENDIX
C

Appendix C –

Field Standard Operating Procedures

Document List

1. Shaw SOP- Decontamination of Contact Sampling Equipment
2. Shaw Field Change Request Form
3. Shaw SOP- Field Logbook
4. Shaw SOP- Field Logsheet
5. Shaw SOP- Fish Tissue Collection and Processing
6. Shaw SOP- Location Control Fish Sampling
7. Shaw SOP- Shipping and Packaging of Non-Hazardous Samples
8. Shaw SOP- Surface Water Sampling
9. Shaw SOP-Location Control Water Quality Monitoring
10. Shaw SOP- Measuring Positions with Global Positioning System (GPS)
11. Shaw SOP- Water Quality Meter Use

STANDARD OPERATING PROCEDURE

Subject: Decontamination of Contact Sampling Equipment

1. PURPOSE

This procedure defines the Shaw E & I standard that must be implemented for decontamination of contact sampling equipment. Contact sampling equipment is equipment that comes in direct contact with the sample or portion of sample that will undergo chemical analyses or physical testing. This SOP is intended to provide minimum guidelines and general procedures for decontaminating contact sampling equipment used during field sampling activities. The benefits of its use include the following:

- Minimizing the spread of contaminants within a study area and from site to site
- Reducing the potential for worker exposure by means of contact with contaminated sampling equipment
- Improved data quality and reliability

2. SCOPE

This procedure applies to all instances where non-disposable direct contact sampling equipment is utilized for sample collection. This procedure is not intended to address decontamination of peristaltic or other sampling pumps and tubing. The steps outlined in this procedure must be executed between each distinct sample data point.

3. REFERENCES

- U.S. Environmental Protection Agency, Region 4, 2001, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, 980 College Station Road, Athens, Georgia. November.
- US Army Corp of Engineers, Washington, D.C., 2001, Requirements for the Preparation of Sampling and Analysis Plans (EM-200-1-3), February.

4. DEFINITIONS

- **Soap**—A standard brand of phosphate-free laboratory detergent, such as Liquinox®.
- **Organic Desorbing Agent**—A solvent used for removing organic compounds. The specific solvent would depend upon the type of organic compound to be removed. See Attachment 1 for recommendations.
- **Inorganic Desorbing Agent**—An acid solution for use in removing trace metal compounds. The specific acid solution would depend upon the type of inorganic compound to be removed. See Attachment 1 for recommendations.
- **Tap water**—Water obtained from any municipal water treatment system. An untreated potable water supply can be used as a substitute for tap water if the water does not contain the constituents of concern.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

- **Analyte-free water (deionized water)**—Water that has been treated by passing through a standard deionizing resin column, and for organics either distillation or activated carbon units. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds, and/or no detectable organic compounds (i.e., at or above analytical detection limits). Analyte-free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.

  Other solvents may be substituted for a particular purpose if required. For example, removal of concentrated waste materials may require the use of either pesticide-grade hexane or petroleum ether. After the waste material is removed, the equipment must be subjected to the standard cleaning procedure. Because these solvents are not miscible with water, the equipment must be completely dry prior to use.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be sent to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

6. PROCEDURE

6.1 Health and Safety

Minimum Health and Safety Procedures should be implemented based on the site-specific decontamination protocol that is designed. Health and Safety procedures should take into consideration the potential use of either dangerous solvents or corrosive liquids.

6.2 Implementation

A decontamination area should be established. A separate tub needs to be available for each of the first four steps. Each type of water and soap solution can be placed in hand-held sprayers made of an inert material. The analyte-free water needs to be placed in a container that will be free of any compounds of concern. Special containers will be needed if solvents or acid solutions are used. For example, an acid solution cannot be placed in a sprayer that has any metal parts that will come in contact with the acid solution.

The minimum steps for decontamination are as follows:

1. Remove particulate matter and other surface debris using appropriate tools such as a brush or hand-held sprayer filled with tap water.

2. Scrub the surfaces of the contact sampling equipment using tap water and soap solution and a second brush made of inert material.

3. Rinse contact sampling equipment thoroughly with tap water.

4. Rinse contact sampling equipment thoroughly with analyte-free water (not necessary if sampling for disposal profiling purposes).

5. Place contact sampling equipment on a clean surface appropriate for the compounds of concern and allow to air dry.

It is Shaw E & I policy to containerize all decontamination fluids. This policy will be followed unless an the client specifically directs an alternate procedure in writing.

The use of solvents and/or acid solutions will be dependent on the site-specific conditions. A site with a high probability of high concentrations of compounds or with waste material present will require additional decontamination procedures. Attachment 1 provides some guidance for additional decontamination procedures.

7. ATTACHMENTS

- **Attachment 1**—Recommended Decontamination Procedures.

8. FORMS

None.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

ATTACHMENT 1
RECOMMENDED DECONTAMINATION PROCEDURES

Compound	Detergent Wash	Tap Water	Inorganic Desorbing Agent	Tap Water	Organic Desorbing Agent[1]	Deionized Water	Air Dry
Organics							
Volatile Organic Compounds	✓	✓			Methanol Purge & Trap grade	✓	✓
Base Neutrals/Acid Extractables/PCBs/Pesticides	✓	✓			Hexane	✓	✓
Organic Bases[2]	✓	✓	1% nitric acid	✓	Isopropyl Alcohol	✓	✓
Organic Acids[3]	✓	✓	1% nitric acid		Isopropyl Alcohol	✓	✓
Inorganics							
Trace Metals and Radio Isotopes	✓	✓	10% Nitric acid -Trace metals grade	✓		✓	✓
Cations/Anions	✓	✓				✓	✓
Acidic Compounds	✓	✓				✓	✓
Basic Compounds (caustic)	✓	✓	1% nitric acid	✓		✓	✓

1 – All organic solvents must be Pesticide Grade or better. The selection of appropriate solvent rinses should first consider if a *known or suspected* contaminant requires removal from sampling equipment. Secondly, identify whether the subsequent analytical protocol would be impacted by the proposed solvent or an impurity thereof (e.g., residual acetone present in isopropyl alcohol would be measured with certain volatile organics analysis).

2 - Organic bases include amines, hydrazines.

3 - Organic acids include phenols, thiols, nitro and sulfonic compounds.

Adapted from: Appendix E, Requirements for the Preparation of Sampling and Analysis Plans (EM-200-1-3), February 2001. US Army Corp of Engineers, Washington, D.C.

LOWER FOX RIVER PRE-DESIGN

Field Change Request (FCR) Form

Project Name: Lower Fox River Pre-Design Sampling **Request Number:** FCR-_____

Field Change Request Title: _____

To: _____

Date: _____

Description:

Reason for Change:

Recommended Disposition:

Field Team Leader (or designee): _____

Signature Date

Disposition:

Project Manager: _____

Signature Date

Distribution:
Project QA Officer
Shaw E & I Project Coordinator
Anchor Technical Lead
Field Operations Lead
Other:

STANDARD OPERATING PROCEDURE

Subject: Field Logbook

1. PURPOSE

The objective of this Standard Operating Procedure (SOP) is to set criteria for content entry and form of field logbooks.

2. SCOPE

This procedure is applicable during all Shaw E & I site operations.

3. REFERENCES

- Nielsen Environmental Field School, 1997, *Field Notebook Guidelines.*

4. DEFINITIONS

4.1 **Site Logbook**—Logbook that is an index of all activities performed at the site. Specific entries are summaries of each day's activities. It is part of the project file.

4.2 **Field Logbook**—Logbooks used at field sites that contain detailed information regarding site activities including dates, times, personnel names, activities conducted, equipment used, weather conditions, etc. Field logbooks are used by a variety of different field personnel and are part of the project file.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be sent to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

6. PROCEDURE

6.1 General

Each site or operation, as applicable, will have one current Site Logbook, which will serve as an index of all activities performed at the site. It is initiated at the start of the first on-site activity. Summary entries are made for every day that on-site activities take place. The details of all field activities shall be recorded in separate field logbooks. Multiple field logbooks may be used depending upon the number of different types of field personnel conducting activities at the site. These field logbooks and the site logbook shall be made part of the project files.

Information recorded in field logbooks includes observations, data, calculations, time, weather, and descriptions of the data collection activity, methods, instruments, and results. Additionally, the field logbook may contain descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

6.2 Equipment and Materials

- Site logbook
- Site-specific plans
- Hard-covered, waterproof field logbook(s)
- Indelible black ink pen
- Ruler or similar scale

6.3 Preparation

Site personnel responsible for maintaining field logbooks must be familiar with the SOPs for all tasks to be performed.

The field logbook will be assigned to an individual responsible for its care and maintenance.

Field logbooks are project files and should remain with project documentation when not in use.

Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the field logbook.

The following information shall be recorded inside the front cover of the field logbook:

- Person and organization to whom the book is assigned
- Phone number(s)
- Start date
- Project Name
- Shaw E & I Job Number
- Project Superintendent's Name
- Sequential Book Number (if applicable)

The first five pages of the field logbook shall be reserved for a table of contents. Mark the first page with the heading and enter the following:

TABLE OF CONTENTS

Date/Description	Page
(Start Date/Reserved for TOC)	1-5

The remaining pages of the Table of Contents will be designated as such with "TOC" written on the top center of each page.

6.4 Operation

The following requirements must be met when using a field logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the field logbook. If data-collection forms are specified by an activity-specific work plan, the information on the form need not be duplicated in the field logbook. However, any forms used to record site information must be referenced in the field logbook.
- Information should be factual and unbiased.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Write in black, indelible ink. Do not write in pencil unless working in wet conditions.
- Do not erase or blot out any entry. Before an entry has been signed and dated, changes may be made; however, care must be taken not to obliterate what was written originally. Indicate any deletion by a single line through the material to be deleted. A change should be initiated and coded using one of the common data error codes shown in Attachment 1. All error codes should be circled.
- Do not remove any pages from the book.
- Do not use loose paper and copy into the field logbook later.
- Record sufficient information to completely document field activities.
- All entries should be neat and legible.

Specific requirements for field logbook entries include the following:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- Multiple authors must sign out the field logbook by inserting the following:

  Above notes authored by:

  _____ (Sign name)

  _____ (Print name)

  _____ (Date)

- A new author must sign and print his/her name before additional entries are made.

- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:

  a) Date and time

  b) Name of individual making entry

  c) Description of activity being conducted including well, boring, sampling, location number as appropriate

  d) Unusual site conditions

  e) Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data

  f) People on site

  g) Level of personal protection to be used

  h) Arrival/departure of site visitors

  i) Arrival/departure of equipment

  j) Sample pickup (chain-of-custody form numbers, carrier, time)

  k) Sampling activities/sample log sheet numbers

  l) Start and completion of borehole/trench/monitoring well installation or sampling activity

  m) Health and Safety issues

  n) Instrumentation calibration details

Entries into the field logbook shall be preceded with the time of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In such cases, the field logbook must reference the automatic data record or form.

While sampling, record observations such as color and odor. Indicate the locations from which samples are being taken, sample identification numbers, the order of filling bottles, sample volumes, and parameters to be analyzed. If field duplicate samples are being collected, note the duplicate pair sample identification numbers. If samples are collected that will be used for matrix spike and/or matrix spike/matrix spike duplicate analysis, record that information in the field logbook.

A sketch of the station location may be warranted. All maps or sketches made in the field logbook should have descriptions of the features shown and a direction indicator. Maps and sketches should be oriented so that north is towards the top of the page.

Other events and observations that should be recorded include (but are not limited to) the following:

- Changes in weather that impact field activities
- Subcontractor activities
- Deviations from procedures outlined in any governing documents, including the reason for the deviation
- Problems, downtime, or delays
- Upgrade or downgrade of personal protective equipment

6.5 Post-Operation

To guard against loss of data due to damage or disappearance of field logbooks, copies of completed logbooks shall be securely stored by the project.

At the conclusion of each activity or phase of site work, the individual responsible for the field logbook will ensure that all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed, coded, and dated). The completed field logbook shall be submitted to the project records file.

6.6 Restrictions/Limitations

Field logbooks constitute the official record of on-site technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations carried out by Shaw personnel and their subcontractors. They are documents that may be used in court to indicate and defend dates, personnel, procedures, and techniques employed during site activities. Entries made in these notebooks should be factual, clear, precise, and as non-subjective as possible. Field logbooks, and entries within, are not to be utilized for personal use.

7. ATTACHMENTS

- Attachment 1—Common Data Error Codes.

8. FORMS

None.

ATTACHMENT 1
COMMON DATA ERROR CODES

COMMON DATA ERROR CODES

- RE Recording Error
- CE Calculation Error
- TE Transcription Error
- SE Spelling Error
- CL Changed for Clarity
- DC Original Sample Description Changed After Further Evaluation
- WO Write Over
- NI Not Initialed and Dated at Time of Entry
- OB Not Recorded at the Time of Initial Observation

All Error Codes should be circled

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

STANDARD OPERATING PROCEDURE

Subject: Field Logsheet

1. PURPOSE

The purpose of this procedure is to identify the minimum information that should be collected during sampling activities. Samples can be collected at a project site for various reasons, including nature & extent determination, risk assessment, permit compliance, and confirmation of site cleanup. Information regarding sampling locations and techniques is just as important as sample collection, since it allows future data users to determine whether the sample data is appropriate for its intended use.

2. SCOPE

This procedure is applicable to all Shaw E & I projects where vapor, surface water, or solid samples are collected.

3. REFERENCES

3.1 U.S. Environmental Protection Agency, 1998, *EPA Guidance for Quality Assurance Project Plans*, EPA/600/R-98/018, Washington, D.C.

3.2 U.S. Army Corps of Engineers, 2001, *Requirements for the Preparation of Sampling and Analysis Plans*, EM200-1-3, Washington, D.C.

4. DEFINITIONS

None.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments or suggestions regarding this technical SOP should be sent to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

6. PROCEDURE

Field logsheets can be prepared to address the specific needs of each project. All field logsheets are to completed in black indelible ink. Any corrections are to be made by single line cross-out of the incorrect information and placement of the edited data above or beside the incorrect data. The following information is the minimum that should be included on the logsheet:

6.1 Site Information

- Site Name
- Project Number
- Weather conditions

6.2 Sample Information

- Date
- Time of sample collection
- Name of field technician
- Media being sampled
- Sample location (sketch as appropriate)
- Associated photograph log number (as appropriate)
- GPS reading (as appropriate)
- Sample Number
- Sample Description
- Preservative (if any)
- Comments/Observations
- QC samples collected

6.3 Equipment Information

- Equipment used to collect sample
- Equipment decontamination technique
- Field instrument calibration
- Field instrument readings

6.4 Analytical

- Analysis to be performed
- Analytical Laboratory

7. ATTACHMENTS

None.

8. FORMS

- Container Field Logsheet
- Soil/Sediment Field Logsheet
- Surface Water Field Logsheet
- Air Field Logsheet

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

STANDARD OPERATING PROCEDURES
FISH TISSUE COLLECTION AND PROCESSING
LOWER FOX RIVER BASELINE MONITORING

This document describes the Standard Operating Procedures to be implemented to collect fish for tissue analysis as part of the Lower Fox River Baseline Monitoring Plan. As outlined in the Baseline Monitoring Work Plan, five target species (walleye, carp, gizzard shad, white/smallmouth bass, and white sucker) will be collected at eight locations in Lake Winnebago, the Lower Fox River, and inner Green Bay. The primary methods of collection are boat-based electrofishing and fyke net sampling gear. To the extent practical, these procedures are consistent with fish monitoring procedures employed by EPA (2000) and WDNR (Lyons, 2001).

This SOP describes:

- Electrofishing procedures
- Fyke net sampling procedures
- Field processing procedures
- Fish Compositing procedures
- Laboratory processing procedures
- Field generated waste disposal

1 ELECTROFISHING PROCEDURES

1.1 Sampling Crew and Health and Safety

Electrofishing activities will be conducted by a crew of three. A Field Supervisor will be in charge of all sampling activities. Two additional crew members will participate in the boat operation and/or dipnetting activities.

Prior to electrofishing all crew members will have reviewed and be familiar with the site Health and Safety Plan in regards to boat and electrofisher operations. At all times that the boat is actively electrofishing, all crew members will wear rubber boots and the netters will wear rubber gloves rated for 5,000 volt protection.

1.2 Equipment

Fish will be collected using an 18-ft boat fitted with a Smith-Root Type VI-A electrofisher. The unit has been modified for improved collection of fish from "channel border" habitats—shallow-water shoreline habitats adjacent to deep-water river channels that carry a majority of the flow. A standard Smith-Root Type VI-A can be set to 60 and 120 pulses per second (pps) DC, whereas the modified unit can be set at 15, 30, 60, and 120 pps.

All vessels will have up to date U.S. Coast Guard-approved and required safety equipment, personal floatation devices (PFDs), fire extinguishers, fixed marine 25-watt output VHF communications equipment, and other equipment as described in the Health and Safety Plan. If nighttime sampling activities are conducted, all personnel onboard vessels will wear strobe lights attached to their PFDs.

Prior to electrofishing the Field Supervisor will run through the materials and equipment check list to ensure that all gear is accounted for and in good working order and that all boat equipment required by the Health and Safety Plan are on board the vessel. The boat and electrofisher specifications are provided in Table 1.

Table 1.
Boat and Electrofishing Equipment Specifications

BOAT	ELECTROFISHER	OTHER EQUIPMENT
Grumman 1988 aluminum johnboat	Smith-Root Type VI-A	Bow & stern-mounted safety switches
Length: 18 ft / 5.5 m	Volts DC: 168-1008	Wisconsin ring & dropper electrodes:
Beam: 71 in / 1.8 m	Volts AC: 120-720	Bow & stern mounted collection lights
Depth: 21 in / .53 m	Pulse/second:15,30,60, & 120	Navigation lights
Max capacity: 1250 lb /568 kg	Pulse width: 1-7 ms	Deck work lights
Bare hull weight: 277 lb / 126 kg	Generator: 5000 watt	Fiberglass-insulated scapping nets
Engine: 1996 Evinrude 25 hp		USGS-required safety equipment
VHF marine radio 25 watt output		50-g aerated live well
WAAS GPS Garmin model 128		

Electrofishing equipment will include:

- (1) Smith-Root Electrofisher with extra fuses
- (1) Generator rated at least 4,500 watts output
- (1) Generator to electrofisher power cord
- (2) Foot operated voltage cut-off safety switches
- (1) Electrofisher output power cord
- (1) Electrode array

- (2) Fiberglass handle dip nets
- (2) Sets of rubber gloves rated for 5,000 volts
- (2) Pairs of rubber boots
- (1) 50 gallon live well
- (2) Headlamps
- Extra lights for night electrofishing
- (1) Hand-held spotlight

1.3 Collection Procedures

Electrofishing may be conducted during the day or night to obtain the necessary sample sizes of each target fish species. At the outset of sampling, electrofishing will be conducted during the day, because daytime sampling provides fewer logistical and health and safety issues than nighttime sampling. If daytime catch-per-unit effort is unacceptably low for one or more of the target fish species, extended daytime electrofishing or nighttime electrofishing may be conducted at the discretion of the Field Supervisor. Nighttime sampling may be conducted if the sampling area is determined to provide safe nighttime working conditions; daytime site reconnaissance is strongly encouraged.

The electrofishing unit will be fished in a downstream direction, where appropriate. Collection procedures are as follows:

- Position the boat upstream (or downstream if needed) of the station.
- Adjust electrofisher volts, pulse rate, and pulse width settings to maintain an average 4-5 amp output.
- Record water temperature, air temperature, weather conditions, conductivity, and the electrical output of the electrofishing unit.
- Record the starting location of electrofishing station using a Differential Global Positioning System (GPS) unit capable of delivering accuracy within 10 m.
- Place the boat in gear, turn on the electrofishing unit and collection lights, record the start time, and proceed at a slow speed along the collection area. Use the boat to position the electrode array near any instream cover such as overhanging vegetation, instream trees, rocky substates, etc.

- All target species within reach of the netter will be captured and placed in a 50-gallon holding tank.
- At the end of electrofishing, place the boat in neutral, turn off the electrofisher and collection lights, record the stop time and the end location from the GPS.
- Process the fish according to the protocols described in Section 3 – Field Processing.

2 FYKE NET SAMPLE COLLECTION PROCEDURES

2.1 Sampling Crew and Health and Safety

Fyke net sampling activities will be conducted by a crew of three. A Field Supervisor will be in charge of all sampling activities. Two additional crew members will participate in the sampling activities.

Prior to fyke netting all crew members will have reviewed and be familiar with the site Health and Safety Plan in regards to boat operations. Fyke nets will be used to sample in water depths up to approximately 20 feet, primarily in areas with slow to moderate current adjacent to deep water or the main river channel.

2.2 Equipment

Indiana-style fyke nets will have the following specifications:

- Front Box - two 6 feet wide and 3 feet tall (1.83 m wide by 0.91 m) high steel frames with center braces;
- Net Body - four 2.5 feet (76.3 cm) hoops with two 0.7 feet (20.3 cm) throats;
- Trap Length – 16 feet (4.88 m);
- Netting - No. 105 knotless, 0.5 inch (1.27 cm) square mesh throughout;
- Lead – 75 feet long by 3 feet high (22.86 m long by 0.91 m high);
- Wings – 40 feet long by 3 feet high (12.19 m long by 0.91 m high).

Netting will be treated with a black UV protectant and algaecide. Net will be anchored at the lead, wings, and cod end (back of the net body). All anchors will have an attached float with the name and address of the group deploying the nets along with the Scientific Collectors License number.

All vessels will have up to date U.S. Coast Guard-approved and required safety equipment, PFDs, fire extinguishers, fixed marine 25-watt output VHF communications equipment, and

other equipment as described in the Health and Safety Plan. All personnel onboard vessels engaged in nighttime activities will wear strobe lights attached to their PFDs.

Prior to fyke netting the Field Supervisor will go through the materials and equipment check list to ensure that all gear is accounted for and in good working order and that all boat equipment required by the Health and Safety Plan are on board the vessel.

2.3 Collection Procedures

Fyke nets are designed to capture fish that travel parallel to the shoreline by blocking their passage with the lead net. As the fish encounter the lead they typically will turn out to deeper water following the lead net where they become entrapped within the body of the net. The wings act to further guide the fish into the body of the net. Fyke nets are typically set perpendicular to the shore. The following procedures will be conducted to deploy the fyke nets:

- Fyke nets will be set during daylight hours and fished overnight
- Attach or anchor the lead net to shore then back the boat out so the net is deployed perpendicular to the shore. Ensure that the cod end (the back of the net body) is securely fastened.
- Set both fyke net's wings at an approximately 45° angle to the lead line.
- Use the boat to tighten the net by pulling on the back anchor attached to the cod end.
- The location of each net will be documented with a the GPS.

Fyke nets will be checked within 24 hours after they are set. The following procedures will be conducted to retrieve the fyke nets:

- Maneuver the boat to retrieve the anchor attached to the cod end of the net and pull the net into the boat.
- Remove the fish from the net by untying the cod end and using a dip net to remove the fish.
- Separate the target species and place them in a 50 gallon holding tank for processing. All other fish will be released alive at the point of capture.
- Check the net for holes or rips and patch any that are found in the body of the net. Net can be patched using twine or cable ties.

- After the net has been emptied, retie the cod end and reset the net by using the boat to pull cod end's anchor perpendicular to shore until the net is tight.

3 FIELD PROCESSING PROCEDURES

1) Harvested fish will be placed in clean tanks (large coolers) for sorting. Selected fish of appropriate species and size range will be culled and stunned with a sharp blow to the base of the skull with a wooden or metal club; the remaining fish will be immediately released. Fish will be inspected to ensure that skin and fins have not been damaged by the sampling equipment; damaged specimens will be discarded.
2) Selected fish will be rinsed in ambient site water to remove any foreign material from the surface, and placed in clean holding trays.
3) Fish length will be measured to the nearest 0.1 inch. Maximum body length is measured from the anterior-most part of the fish to the tip of the longest caudal fin ray (EPA, 2000). Fish will be weighed using a spring-loaded hand scale and described.
4) Species identification will be performed by experienced biologists with reference to taxonomic keys as needed.
5) The following information will be documented on fish collection forms:
    - Collection method
    - Collection location and water depth
    - Date and time
    - Fish species
    - Fish number (individuals are sequentially numbered by species)
    - Total catch (per species)
    - Fish length and weight
    - Description of any external marks or abnormalities (e.g., fin erosion, skin ulcers, skeletal abnormailities, tumors, parasites, etc.)
6) With the exception of young-of-year gizzard shad, each individual fish will be given a unique sample ID, as follows:

    LLLL-YY-SP-122

    where [LLLL] is the location code describing the operable unit or subunit (OU1, OU2A, OU2B, etc.), [YY] is the two-digit year (i.e., 05 is 2005), [SP] is the species identification code (WA = walleye, WB = white bass, SB = smallmouth bass, CA = carp, SU = white sucker, and GZ = gizzard shad), [1] is the station number in a given operable unit, and [22] is a sequential number assigned to each individual fish. For

example, OU4-05-WA-203 is the third walleye collected from the second station in OU 4 during the 2005 monitoring event.

7) Each fish will be individually wrapped in aluminum foil and placed in a watertight, resealable plastic bag with its sample identification label. Spines will be sheared to prevent puncturing. Fish samples will be securely packed in a cooler on ice or blue ice. All fish from a particular sampling station will be kept together in their own cooler or coolers as needed.

4 FISH COMPOSITING PROCEDURES

1) When a sufficient number of fish have been collected from a given operable unit or subunit, the Fish Processing Supervisor will review the length and weight information and form compositing groups for carp, white sucker, and gizzard shad. Compositing groups will be formed according to the specifications of the Baseline Monitoring Work Plan (i.e., 5 composites of 5 carp, 5 composites of 5 white sucker, and 5 composites of 25 gizzard shad for each operable unit or subunit).

2) Compositing groups will be formed from similarly sized individuals. According to EPA (2000) guidelines, the smallest individual in a composite sample should be no less than 75 percent of the total length of the largest individual. In general, fish will be sorted into 2-inch to 4-inch size classes, depending on the size of the fish and the target size range.

3) Composite sample ID's will follow a similar convention as the ID's assigned to individual fish (see Section 3.6), except the last digits will be changed to represent a composite sample:

   LLLL-YY-SP-C#

   where C# represents composite samples C1 through C5.

4) The composite sample ID's will be recorded on the fish collection form along with the individual sample ID's that comprise the composite samples.

5) Fish will be re-packaged into their compositing groups. Individual fish will remain individually bagged with their unique sample ID. All fish in a given compositing group will then be placed in a second oversized resealable plastic bag with the composite sample identification label.

6) Fish will be placed in a cooler with ice or blue ice and dispatched under proper chain-of-custody procedures to the resectioning lab or the analytical lab, as appropriate, for further processing.

5 LABORATORY PROCESSING PROCEDURES

5.1 Resectioning

Samples will be processed at the resectioning lab by a fish biologist. Scaling and filleting will be performed on a PTFE cutting board, or a cutting board covered with heavy duty aluminum foil. Scaling and skinning/filleting will be performed in separate and isolated areas, using separate cutting boards and utensils. Cutting boards and utensils will be rinsed with distilled water between fish; if aluminum foil is used to cover the cutting board, it will be replaced with a fresh sheet of foil between fish.

Walleye and bass and will be scaled and filleted with skin and belly flap included (skin-on fillets). Fillets will be weighed, wrapped in aluminum foil, placed inside resealable plastic bags with new labels, and frozen prior to shipping. The frozen fillets will be shipped to the analytical laboratory on dry ice under proper chain-of-custody procedures.

5.2 Sample Homogenization

At the analytical lab, fish tissues will be individually homogenized. Equal masses of tissue will be drawn from each individual sample to prepare the composite samples. The remainder of the individual samples will be archived for possible future analysis

6 FIELD-GENERATED WASTE DISPOSAL

Any fish collected that is not necessary for the baseline monitoring program will be returned to the river as close to the capture site as possible. All disposable sampling materials and personnel protective equipment used in sample processing, such as disposable gloves and paper towels, will be placed in heavy duty garbage bags or other appropriate containers. Disposable supplies will be placed in a normal refuse container for disposal as solid waste.

STANDARD OPERATING PROCEDURES
LOCATION CONTROL – FISH MONITORING

Lower Fox River Baseline Monitoring

This document describes the Standard Operating Procedures to be implemented for location control of the electroshocking vessel and fixed-gear deployments (e.g. Fyke nets) used to collect fish for tissue analysis as part of the Lower Fox River Baseline Monitoring Plan. As outlined in the Baseline Monitoring Work Plan, five target species (walleye, carp, gizzard shad, channel catfish, and drum; alternate species have also been identified if necessary) will be collected at nine locations in Lake Winnebago, the Lower Fox River, and inner Green Bay. The primary methods of collection are boat-based electrofishing and fyke net sampling gear. To the extent practical, these procedures are consistent with fish monitoring procedures employed by EPA (2000) and WDNR (Lyons, 2001).

This SOP describes:

- Location Control of Electroshocking Vessel
- Location Control of Fixed Gear Deployments

1 LOCATION CONTROL OF ELECTROSHOCKING VESSEL

The electrofishing unit will be fished in a downstream direction, where appropriate. Location Control procedures are as follows:

- Position the boat upstream (or downstream if needed) of the station.
- Record the starting location of electrofishing station using a WASS enabled GPS unit capable of delivering accuracy within 10 meters. Concurrently record the water depth of the starting location as determined by echosounder or lead line. In the field log, describe the start location referencing known landmarks and also note start location on a map of the fish sampling locations (Figures 2-1 through 2-9 in the Baseline Monitoring Plan) to back up and confirm the GPS positioning. Any turning points during the electrofishing run will also be measured and recorded using these same procedures. Start times, end times, and turning points will also be marked on the hard copy print out from the echosounder.

- Place the boat in gear, turn on the electrofishing unit and collection lights, record the start time, and proceed at a slow speed along the collection area. Use the boat to position the electrode array near any instream cover such as overhanging vegetation, instream trees, rocky substrates, etc.
- All target species within reach of the netter will be captured and placed in a 50-gallon holding tank.
- At the end of electrofishing place the boat in neutral, turn off the electrofisher, turn off the generator, and record the stop time and end location from the GPS, and water depth from the echosounder or lead line. In the field log, describe the end location referencing known landmarks and also note the end location on a map of the fish sampling locations (Figures 2-1 through 2-9 in the Baseline Monitoring Plan) to back up and confirm the GPS positioning.
- Process the fish according to the protocols described in Section 2.2.6 of the Baseline Monitoring Plan.

These same location control procedures will be followed when using other types of underway fishing techniques, such as trawling.

2 LOCATION CONTROL OF FIXED-GEAR DEPLOYMENTS

Fyke nets are a type of fixed-gear deployment designed to capture fish that travel parallel to the shoreline by blocking their passage with the lead net. Set lines and other types of nets (e.g. mini-Fyke) may also be used depending on field conditions and fish recovery rates observed during the fish monitoring program. The following procedures will be utilized for location control of fixed-gear deployments:

- The location of each net will be documented with a WASS GPS. The water depth will be documented with echosounder or lead line measurements. In the field log, record the coordinates and water depth of the gear, and describe the location of the gear referencing known landmarks and also note location on a map of the fish sampling locations (Figure 2-1 thru Figure 2-9) to back up and confirm the GPS positioning.

STANDARD OPERATING PROCEDURE

Subject: Shipping and Packaging of Non Hazardous Samples

1. PURPOSE

The purpose of this procedure is to provide general instructions in the packaging and shipping of non-hazardous samples. The primary use of this procedure is for the transportation of samples collected on site to be sent off site for physical, chemical, and/or radiological analysis.

2. SCOPE

This procedure applies to the shipping and packing of all non-hazardous samples. Non-hazardous samples are those that do not meet any hazard class definitions found in 49 CFR 107-178, including materials designated as Class 9 materials and materials that represent Reportable Quantities (hazardous substances).

In general most soil, air, and aqueous samples do not meet any of DOT's hazardous materials definitions. However, samples for which screening has shown a potential hazard sufficient to meet a DOT definition or that are derived from a source known or suspected to meet a DOT definition must be packaged and shipped in accordance with the applicable DOT and/or IATA requirements. Refer to Shaw E & I SOP T-FS-013.

3. REFERENCES

- U.S. Army Corps of Engineers, 2001, *Requirements for the Preparation of Sampling and Analysis Plans*, EM200-1-3, Washington, D.C.
- U.S. Department of Transportation Regulations, 49 CFR Parts 108-178
- International Air Transport Association (IATA), *Dangerous Goods Regulations*, current edition.

4. DEFINITIONS

- **Cooler/Shipping Container**—Any hard-sided insulated container meeting DOT's or IATA's general packaging requirements.
- **Bubble Wrap**—Plastic sheeting with entrained air bubbles for protective packaging purposes.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be sent to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

6. PROCEDURE

6.1 Packaging

- Use tape and seal off the cooler drain on the inside and outside to prevent leakage.
- Place packing material on the bottom on the shipping container (cooler) to provide a soft impact surface.
- Place a 55-gallon or equivalent plastic bag into the cooler (to minimize possibility of leakage during transit).
- Starting with the largest glass containers, wrap each container with sufficient bubble wrap to ensure the best chance to prevent breakage of the container.
- Pack the largest glass containers in bottom of the cooler, placing packing material between each of the containers to avoid breakage from bumping.
- Double-bag the ice (chips or cubes) in gallon or quart freezer zip-lock plastic bags and wedge the ice bags between the sample bottles.
- Add bagged ice across the top of the samples.
- When sufficiently full, seal the inner protective plastic bag, and place additional packing material on top of the bag to minimize shifting of containers during shipment.
- Tape a gallon zip-lock bag to the inside of the cooler lid, place the completed chain of custody document inside, and seal it shut.
- Tape the shipping container (cooler) shut using packing tape, duct tape, or other tear-resistant adhesive strips. Taping should be performed to ensure the lid cannot open during transport.
- Place a custody seal on two separate portions of the cooler, to provide evidence that the lid has not been opened prior to receipt by the intended recipient.

6.2 Labeling

- A "This Side Up" arrow must be adhered to all sides of the cooler.
- The name and address of the receiver and the shipper must be on the top of the cooler.
- The airbill must be attached to the top of the cooler.

6.3 Shipping Documentation

- A Cooler Shipment Checklist (Attachment 1) should be completed and kept in the project file.

7. ATTACHMENTS

- **Attachment 1**—Shaw E & I Cooler Shipment Checklist

8. FORMS

None.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

SAMPLE SHIPMENT CHECKLIST

Shaw™
Shaw E & I, Inc.

Project Name _____ Project Number _____
Address _____ Date _____ Time _____
City, State, Zip _____ Fax No. _____
Site Contact No. _____

SAMPLE CHECKLIST	YES	NO	COMMENTS
SAMPLE LIDS ARE TIGHT AND CUSTODY SEALS IN PLACE?	☐	☐	
ARE ALL SAMPLE NUMBERS, DATES, TIMES AND OTHER LABEL INFORMATION LEGIBLE AND COMPLETE?	☐	☐	
HAVE ALL SAMPLE NUMBERS, DATES, TIMES AND OTHER SAMPLING DATA BEEN LOGGED INTO THE SAMPLE LOG BOOK?	☐	☐	
DO SAMPLE NUMBERS AND SAMPLE DESCRIPTIONS ON THE LABELS MATCH THOSE ON THE COC?	☐	☐	
HAVE THE SAMPLES BEEN PROPERLY PRESERVED?	☐	☐	
HAVE THE CHAIN OF CUSTODIES BEEN FILLED OUT COMPLETELY AND CORRECTLY?	☐	☐	
DOES THE ANALYTICAL SPECIFIED ON THE COC MATCH THE ANALYTICAL SPECIFIED IN THE SCOPE OF WORK?	☐	☐	
HAVE THE COC'S BEEN PROPERLY SIGNED IN THE TRANSFER SECTION?	☐	☐	

PACKAGING CHECKLIST	YES	NO	COMMENTS
HAS EACH SAMPLE BEEN PLACED INTO AN INDIVIDUAL PLASTIC BAG?	☐	☐	
HAS THE DRAIN PLUG OF THE COOLER BEEN TAPED CLOSED WITH WATER PROFF TAPE FROM THE INSIDE?	☐	☐	
HAVE ALL THE SAMPLES BEEN PLACED INTO THE COOLER IN AN UPRIGHT POSITION?	☐	☐	
IS THERE ADEQUATE SPACING OF SAMPLES SO THAT THEY WILL NOT TOUCH DURING SHIPMENT?	☐	☐	
HAVE AN ADEQUATE NUMBER OF BLUE ICE PACKS OR WATER ICE BEEN PLACED AROUND AND ON TOP OF THE SAMPLE?	☐	☐	
HAS FRESH BLUE ICE OR WATER ICE BEEN ADDED TO THE COOLER THE DAY OF THE SHIPMENT?	☐	☐	
HAS THE COOLER BEEN FILLED WITH ADDITIONAL CUSHIONING MATERIAL?	☐	☐	
HAS THE COC BEEN PLACE IN A ZIPLOCK BAG AND TAPED TO THE INSIDE OF THE LID OF THE COOLER?	☐	☐	
HAVE CUSTODY SEALS BEEN PLACED ONTO THE LID?	☐	☐	
HAS THE COOLER BEEN LABELED "THIS SIDE UP"?	☐	☐	
IF REQUIRED, HAS THE COOLER BEEN LABELED WITH THE DOT PROPER SHIPPING NAME, UN NUMBER AND LABEL?	☐	☐	
HAS THE LABORATORY PERFORMING THE ANALYSES BEEN NOTIFIED OF THE SHIPMENT OF SAMPLES?	☐	☐	

PROBLEMS/RESOLUTIONS: _____

_____

_____

PREPARED BY: _____ SIGNATURE _____

STANDARD OPERATING PROCEDURE

Subject: Surface Water Sampling

1. PURPOSE

The purpose of this document is to provide methods, procedures, and guidance for sampling of surface waters or liquids in lakes, streams, pits, sumps, lagoons, and similar reservoirs for environmental analysis.

2. SCOPE

This procedure is applicable to all Shaw E & I projects where surface water sampling will be performed and where no project/program plan or procedure is in place to direct those activities.

The procedure presents two methods of sampling: direct immersion of sampling containers and use of a pond sampler.

3. REFERENCES

- U.S. Army Corps of Engineers, 2001, *Requirements for the Preparation of Sampling and Analysis Plans*, EM 200-1-3, Appendix C, Washington, D.C.
- U.S. Environmental Protection Agency, 1994, *Surface Water Sampling,* EPA/ERT SOP 2013.

4. DEFINITIONS

- **Pond Sampler**—A type of liquid sampling device consisting of an adjustable aluminum or fiberglass pole with an adjustable clamp to hold a container on one end. The pole allows for grab samples to be obtained at distances as far as 10 to 12 feet from the edge of the source without the need to contact the medium.
- **Grab Sample**—A single sample representative of a specific location at a given point in time.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be directed to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations,

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reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

6. PROCEDURE

Safety Note: Surface water sampling can sometimes require the use of boats or access into or across bodies of water. Observe all boating safety considerations in the HASP including donning of proper life jackets. If sampling from a bank, do not overreach; use a Pond Sampler whenever possible and do not attempt to remove the container from the clamp while still in contact or close proximity to the water body. Do not wade into a water body unless the depth is well known, currents are flowing at a safe speed, appropriate personnel have determined it is safe, and a spotter is available.

6.1 Direct Immersion

The following procedure shall be used for direct immersion sampling:

- Don a pair of clean gloves.
- Obtain the required sample container(s)
- If entering the water body, always do so with as little bottom disturbance as possible and wait for the water around the planned sampling area to return to its undisturbed state (clarity) before sampling.
- Collect each liquid sample by slowly submerging the sample container with minimal surface disturbance. If sampling in a stream or current, make sure the open end of the sample container is pointed upstream.
- Retrieve the container from the liquid with minimal disturbance; cap and wipe the outside of the container with a towel or cloth.
- If collecting samples for VOC analysis, make sure that the VOA vial is slightly overfilled before capping and check for bubbles or trapped air by inverting. If the sample integrity is compromised, discard the sample and repeat the collection process.
- Complete all required documentation, and place the sample containers into a cooler or other specified container.

6.2 Pond Sampler

The following procedure shall be used for sampling with a pond sampler:

- Don a pair of clean gloves.
- Place plastic sheeting around the area where the sampler will be emptied.
- Assemble the pond sampler and secure the sample container or collection jar/bottle/beaker in the adjustable clamp.
- If entering the water body, always do so with as little bottom disturbance as possible and wait for the water around the planned sampling area to return to its undisturbed state (clarity) before sampling.
- Collect each liquid sample by extending the container end outward and slowly submerging the sample container while holding the Pond Sampler handle with minimal surface disturbance. If sampling in a stream or current, make sure the open end is pointed upstream.

- Retrieve the container from the liquid with minimal disturbance, retract any extensions, transport the sample while still on the clamp to the emptying area, and remove it from the clamp.
- Alternatively, if sampling with a partner, the partner can remove the collection container from the clamp and carry it to the transfer area
- If the container is the one to be used for the sample, remove it from the clamp, cap, and label.
- If the sampler was used to collect a fill container, remove the lid(s) from the required sample containers and slowly transfer the sample into the appropriate containers; cap and label each one.
- Collect samples for VOC analysis, making sure that the VOA vial is slightly overfilled before capping, and check for bubbles or trapped air by inverting. If the sample integrity is compromised, discard the sample and repeat the vial filling process.
- Complete all required documentation, and place the samples into a cooler or other specified container.
- After each use (i.e. between sample locations), the pond sampler must be disassembled and decontaminated, especially at the clamp area.

Sample jars or beakers are attached to the pole using the clamps for collecting the sample. With a pond sampler device, sample jars can be attached directly to the sample pole and the sample directly filled into the sample jar or a sampling beaker can be attached to the pole and the collected sample would then be transferred to an appropriate sample jar. If sample jars are filled directly, they should be wiped clean prior to being placed in the cooler for shipment. If sampling beakers are used, they can be disposed of or decontaminated prior to reuse

7. ATTACHMENTS

None.

8. FORMS

None.

STANDARD OPERATING PROCEDURES
LOCATION CONTROL – WATER QUALITY MONITORING
Lower Fox River Baseline Monitoring

Purpose

To meet the goals of water quality monitoring activities during baseline monitoring, specifically for collection of water column samples for low-level PCB congener analysis, precise positioning of vessel location is required. Both accuracy (i.e., ability to define position) and repeatability (i.e., ability to return to sample station) are essential. Positioning for all surveys and sampling techniques will be achieved using a global position system (GPS) that is capable of locating stations to within an accuracy and repeatability of +/- 1 meter.

Responsibility

The Field Supervisor will be responsible for ensuring the navigation system is checked against known benchmarks and location control data is collected at the required times and frequencies as specified in this SOP.

Equipment

For water column sampling during baseline monitoring, navigation of the sampling vessels to the predetermined sampling locations and maintaining a final position will be accomplished using a handheld Trimble 2005 GEOXT Differential GPS (DGPS) navigation system; this unit is specified to provide sub-meter accuracy. This DGPS unit is capable of using either Coast Guard beacons or Wide Area Augmentation System (WAAS) to achieve the required accuracy. In Green Bay (OU 5), a charter boat will be leased for water column sampling; this boat will have GPS capabilities for the captain's use of his or her vessel to navigate and position. The sampling team will also verify position with the Trimble 2005 GEOXT DGPS. Water surface elevation or vertical accuracy is not required for these sampling activities.

Survey Datum

Location control for all sample stations will use the Wisconsin Transverse Mercator (WTM) coordinate system referenced to the 1997 adjustments to the north American Datum (NAD) 83 (97) Horizontal datum (i.e. WTM 83 (97)). The DGPS system will be referenced to the new Fox River monuments that were established by the Wisconsin Department of Natural Resources (WDNR) in 2003 (or an alternate monument that is tied to the same coordinate system and documented). These monuments were established using NAVD 88 vertical datum and the WTM 83 (97) horizontal coordinate system.

Procedures for Positioning Sample Vessel

- Prior to vessel departure at each transact, a calibration check shall be taken at the two known benchmarks nearest the transect(s) to be sampled. The acceptable tolerance for the benchmark check with the handheld DGPS unit shall be twice the instrument accuracy, or +/- 2 meters. These readings shall be recorded in a project field book by a project team

member and stored electronically for later download. Location readings shall be recorded and compared to published values.

- Sample locations for each transect are from Table 2-2, Water Sample Locations, *Lower Fox River Baseline Monitoring Plan.*
- The vessel navigation and sample station positioning shall be accomplished using the DGPS methodology and the handheld display. Actual coordinates of sample station starting position shall be recorded by a project team member and stored electronically for later download. Location readings and time shall be recorded.
- The position of the DGPS unit on the vessel shall be as close to the sampling team as possible during water quality monitoring activities without compromising field operations, worker safety, or sample integrity (i.e., potential for cross-contamination).
- At a minimum, DGPS locations shall be recorded at the beginning and end of each hydrocast during water column profiling, and at the beginning and end of each subsampling event at a particular location and depth along a sampling transect (i.e., each transect consists of six subsamples, per USGS quarter-point sampling procedures). For prolonged sampling activities, intermediate DGPS location readings shall also be taken at approximately two minute intervals (more frequently if possible). These readings shall be recorded in a project field book by a project team member and stored electronically for later download. Location readings and time shall be recorded.
- After each sampling transect event, a calibration check shall be taken at one of the pre-determined benchmarks. This reading shall be recorded and compared to published values.

Measurement Tolerance

The field checks of DGPS locations against know benchmarks will be evaluated using the following tolerance intervals:

- Less than or equal to 2 meters – Accuracy within project control limits;
- >2 to 5 meters – Acceptable accuracy, locations of associated water sampling locations will be qualified as estimated;
- >5 meters – Unacceptable accuracy, corrective action required (see below).

Corrective Action

In the event the DGPS unit fails to agree to *within 5 meters* of the known locations at the two benchmarks assigned to a particular water sampling station, the following corrective actions will be implemented:

- Check the DGPS unit against an alternate benchmark in case the original benchmark is compromised by interference, obstruction, or other signal deterioration;
- Wait for a stronger satellite signal and re-check the unit;
- Obtain and check a new DGPS unit.

STANDARD OPERATING PROCEDURE

Subject: Measuring Positions with Global Positioning System (GPS)

1. PURPOSE

This procedure covers hand-held Global Positioning System (GPS) units.

2. SCOPE

This procedure applies to operation and data collection using GPS units.

3. REFERENCES

- National Geodetic Survey http://www.ngs.noaa.gov
- Network of continuously operating reporting stations (CORS) http://www.ngs.noaa.gov/CORS
- Differential GPS Site Status http://www.navcen.uscg.gov/ADO/DgpsSelectStatus.asp
- Beacon Reference Stations http://www.trimble.com/findbeacon.asp
-

4. DEFINITIONS

See Section 10—Glossary of GIS Terms

5. TYPES OF GPS UNITS

Recreational GPS—these units are commonly found in outdoor stores and are intended for recreational use by hikers, campers, bicyclists, etc. These units work reasonably well with open sky, e.g. no tree canopy, no tall buildings, no close tall mountains, etc. These units typically do not provide for real-time differential data processing and post-collection processing is generally done manually. These units generally do not provide elevation data using GPS signals but may have a barometric altimeter for measuring elevations. Recreational units cost between $100 and $1000 with Garmin and Magellan common vendors...

Scientific/engineering GPS—these units are commonly used to collect location data for scientific or engineering evaluations. These units provide real-time differential processing and may have software that allows for easy post-collection data processing to improve positional data accuracy. These units use GPS signals to measure elevations and have much large memories for storing base maps and data points compared to the recreational units. The units commonly cost between $3000 and $7000 with software costing an additional $1000 to $2000. Trimble is the dominant vendor in this market.

Survey GPS—these units are used for construction, land surveying, commercial mapping, and civil engineering. These units have many internal and external features to provide more accurate results than the previous two categories. These units may have wireless communication to field computers, built-in theodolites, multiple base-station capabilities, etc. These units utilize all of the features built into the GPS to obtain accurate (cm scale) horizontal and vertical positional data. These units cost tens of thousands of dollars, specialized training to use, and are usually have several pieces of hardware to operate. Trimble and Topcon are common vendors.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

6. BASIC OPERATION OF GPS

Reference: http://www.garmin.com/aboutGPS/

6.1 Definition of GPS

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

6.2 How GPS works

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map.

A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more.

6.3 GPS Accuracy

Today's GPS receivers are extremely accurate, thanks to their parallel multi-channel design. Garmin's 12 parallel channel receivers are quick to lock onto satellites when first turned on and they maintain strong locks, even in dense foliage or urban settings with tall buildings. Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. Garmin® GPS receivers are accurate to within 15 meters on average.

Newer GPS receivers with WAAS (Wide Area Augmentation System) capability can improve accuracy to less than three meters on average. No additional equipment or fees are required to take advantage of WAAS. Users can also get better accuracy with Differential GPS (DGPS), which corrects GPS signals to within an average of three to five meters. The U.S. Coast Guard operates the most common DGPS correction service. This system consists of a network of towers that receive GPS signals and transmit a corrected signal by beacon transmitters. In order to get the corrected signal, users must have a differential beacon receiver and beacon antenna in addition to their GPS.

6.4 The GPS satellite system

The 24 satellites that make up the GPS space segment are orbiting the earth about 12,000 miles above us. They are constantly moving, making two complete orbits in less than 24 hours. These satellites are traveling at speeds of roughly 7,000 miles an hour.

GPS satellites are powered by solar energy. They have backup batteries onboard to keep them running in the event of a solar eclipse, when there's no solar power. Small rocket boosters on each satellite keep them flying in the correct path.

General facts about the GPS satellites (also called NAVSTAR, the official U.S. Department of Defense name for GPS):

- The first GPS satellite was launched in 1978.
- A full constellation of 24 satellites was achieved in 1994.
- Each satellite is built to last about 10 years. Replacements are constantly being built and launched into orbit.
- A GPS satellite weighs approximately 2,000 pounds and is about 17 feet across with the solar panels extended.
- Transmitter power is only 50 watts or less.

6.5 GPS signal

It is important to remember that for a GPS to work properly, it must be able to "see" at least three or four satellites. Tall buildings, trees, mountains, etc. can obstruct the satellite signals rendering the GPS unit non-functional because it will not be able to lock onto the required satellite signals. GPS units will not work underground for the same reason.

GPS satellites transmit two low power radio signals, designated L1 and L2. Civilian GPS uses the L1 frequency of 1575.42 MHz in the UHF band. The signals travel by line of sight, meaning they will pass through clouds, glass and plastic but will not go through most solid objects such as buildings and mountains.

A GPS signal contains three different bits of information — a pseudorandom code, ephemeris data and almanac data. The pseudorandom code is simply an I.D. code that identifies which satellite is transmitting information. You can view this number on your Garmin GPS unit's satellite page, as it identifies which satellites it's receiving.

Ephemeris data tells the GPS receiver where each GPS satellite should be at any time throughout the day. Each satellite transmits ephemeris data showing the orbital information for that satellite and for every other satellite in the system.

Almanac data, which is constantly transmitted by each satellite, contains important information about the status of the satellite (healthy or unhealthy), current date and time. This part of the signal is essential for determining a position.

6.6 Sources of GPS signal errors

Factors that can degrade the GPS signal and thus affect accuracy include the following:

- Ionosphere and troposphere delays—the satellite signal slows as it passes through the atmosphere. The GPS system uses a built-in model that calculates an average amount of delay to partially correct for this type of error.
- Signal multipath — this occurs when the GPS signal is reflected off objects such as tall buildings or large rock surfaces before it reaches the receiver. This increases the travel time of the signal, thereby causing errors.
- Receiver clock errors — a receiver's built-in clock is not as accurate as the atomic clocks onboard the GPS satellites. Therefore, it may have very slight timing errors.
- Orbital errors — also known as ephemeris errors, these are inaccuracies of the satellite's reported location.
- Number of satellites visible — the more satellites a GPS receiver can "see," the better the accuracy. Buildings, terrain, electronic interference, or sometimes even dense foliage can block

signal reception, causing position errors or possibly no position reading at all. GPS units typically will not work indoors, underwater or underground.

- Satellite geometry/shading — this refers to the relative position of the satellites at any given time. Ideal satellite geometry exists when the satellites are located at wide angles relative to each other. Poor geometry results when the satellites are located in a line or in a tight grouping.

- Intentional degradation of the satellite signal — Selective Availability (SA) is an intentional degradation of the signal once imposed by the U.S. Department of Defense. SA was intended to prevent military adversaries from using the highly accurate GPS signals. The government turned off SA in May 2000, which significantly improved the accuracy of civilian GPS receivers.

6.7 Accuracy of GPS Position Results

There are three parameters that are used in discussing GPS position results:

- **Accuracy**—accuracy is the difference between the "true" location of an object or feature and the location measured by the GPS unit. Accuracy can only be determined by comparing the locations from a GPS with locations measured using other methods such as traditional land survey techniques.

- **Precision**—precision is the repeatability of the location data collected by a GPS unit. Precision can be determined by repeatedly measuring the same location with the unit. Generally, the precision of GPS units is similar to the accuracy.

- **Significant figures**—the number of digits after the decimal point displayed by the GPS unit. Virtually all GPS units will display more significant figures than are warranted by either the precision or accuracy of the instrument. While the GPS unit may display location data with two or three digits after the decimal point, only the very expensive survey-quality units are capable of this accuracy or precision.

For recreational and scientific GPS units (without differential processing), the accuracy, with selective availability turned off, is generally less than 15 meters (45 feet) with 50% of them measurements on the order of 5 meters (15 feet, http://users.erols.com/dlwilson/gpsacc.htm). Precision of these units is variable depending on the unit being used but may be similar to the accuracy (http://users.erols.com/dlwilson/gpswaypt.htm). Elevation accuracy of these units is variable. The elevation data from units is generally less than 10 meters and can be close to zero depending on the unit (http://users.erols.com/dlwilson/gpsvert.htm).

Differential processing, either real-time or post data collection, the accuracy of the GPS measurements can be reduced to 1 to 3 meters using simple differential processing down to sub-meter and centimeter scale using multiple base stations or site-specific stationary GPS beacons. The latter is often done using the data from survey-grade GPS units to achieve desired accuracy.

7. RESPONSIBILITIES

7.1 GPS Survey Planner

The Survey Planner is responsible for determining the window of satellite configuration availability and scheduling the GPS sessions. Maximum data quality and collection efficiency can be obtained by arranging data collection periods to coincide with periods of good satellite visibility. The Trimble GeoXT unit has access to the satellite schedules in its internal software. Updated satellite configuration and orbit information can also be accessed via the Internet. The Planner should also consider factors such as weather conditions, season (leaf on or leaf off), travel distance among survey points, and GPS Operator availability.

7.2 GPS Operator

The field data collection is performed by the GPS Operator(s). The Operator should be trained in the proper use of the GPS equipment and be aware of the manufacturer's specifications. Procedures outlined in the next section should be followed during GPS field data collection.

8. PROCEDURE

8.1 Setup of GPS Unit

Before stating a GPS survey, the GPS unit needs to be set up according to the manufacturer's users manual. Key elements to be set up include:

- **Load appropriate base maps for field use.** Even inexpensive recreational units will support relatively detailed vector (points, lines, and polygons) base maps. Most expensive scientific/engineering and survey grade units will support air photo and satellite imagery base maps.

- **Select Position (Location) Formats.** Most GPS using support a variety of position formats with the two most common being geographic (longitude and latitude) and UTM. Most expensive GPS units with more memory will also support state plane coordinate systems. **Unless there is a project reason to collect data in a projected format (UTM, state plane, etc.) it is usually best to collect positional data in longitude and latitude using the decimal degree format. With this format, the position will have the format ddd.ddddd.** This format is easy to convert to other formats and use in GIS for developing location maps. It is recommended that the traditional degrees, minutes, seconds not be used to collect position data. That is because to use such data, it almost always will have to be converted to decimal degrees

- **Select Distance Units**. The distance units should be set to feet, miles, meters, or kilometers depending on what types of data are to be collected. These distance units are used on defining routes and tracks. The Position Format will usually define the numeric format for all location data collected.

- **Select Elevation Units.** Elevation units should be set to feet or meters depending on the coordinate system selected. For geographic (longitude and latitude) and UTM coordinates, elevation should be set to meters. For state plane coordinate system, the elevation units should be set to feet.

8.2 GPS Survey Control Points

A minimum of three control points should be identified for GPS field crews to use as accuracy benchmarks. The control points will allow for post field analysis to determine whether any of the field points collected should be questioned. If possible, control points should be actual survey points from a surveyor's traverse or a National Geodetic Survey (NGS) monument. Monitoring wells or other point locations can be used as control points, but caution should be taken to verify that previously recorded location information for the well is accurate.

The control points should be collected prior to collecting the unknown points, and then collected again at the end of the sampling to ensure that coordinates acquired are within are within acceptable accuracy. At least ten percent of the points surveyed should be located for estimation of precision.

8.3 Location Data Collection

For the collection of point data such as well locations, the GPS unit should be operated in streaming mode where the location is captured by the operator based on the unit obtaining a stable result. For higher accuracy, the position to be captured should be occupied for a longer duration. Control points should be occupied for 2 to 5 minutes, collecting at a 1 or 2 second interval. Sample points should be

occupied for at least 30 seconds, ideally collecting 35 – 40 readings. For high accuracy work, the receiving antenna should be leveled and centered exactly over the control point location.

In order to achieve acceptable location results, the following should be true:

- GPS receiver is utilizing a minimum of four GPS satellites
- There is good satellite visibility, with a PDOP of no more than eight
- For differentially corrected data using a beacon, the datalogger should be set to read satellites

9. ATTACHMENTS

None

Example End

10. FORMS

None

11. GLOSSARY OF GIS TERMS

The following definitions are applicable to the use of GPS. Users may find these terms in this SOP as well as the manuals for a specific GPS unit.

- **2D Operating Mode**—a two-dimensional GPS position fixes that includes only horizontal coordinates (no GPS elevation). It requires a minimum of three visible satellites. Most recreational GPS units operate in 2D mode.
- **3D Operating Mode**—a three-dimensional GPS position fixes that includes horizontal coordinates, plus elevation. It requires a minimum of four visible satellites.
- **Accuracy**—a measure of how close an estimate of a GPS position is to the true location.
- **Acquisition Time**—the time it takes a GPS receiver to acquire satellite signals and determine the initial position.
- **Almanac Data**—information transmitted by each satellite on the orbits and state (health) of every satellite in the GPS constellation. Almanac data allows the GPS receiver to rapidly acquire satellites shortly after it is turned on.
- **Altimeter**—an instrument for determining elevation, especially an aneroid barometer used in aircraft that senses pressure changes accompanying changes in altitude. The Garmin® eTrex® Vista and Summit models contain a basic GPS with a built-in barometric altimeter.
- **Beacon**—Stationary transmitter that emits signals in all directions (also called a non-directional beacon). In DGPS, the beacon transmitter also broadcasts pseudorange correction data to nearby GPS receivers for greater accuracy.
- ***C/A code***—*the standard (Course/Acquisition) GPS code. A sequence of 1023 pseudo-random,* binary, biphase modulations on the GPS carrier at a chip rate of 1.023 MHz. Also known as the "civilian code."
- **Control segment**—a world-wide network of GPS monitor and control stations that ensure the accuracy of satellite positions and their clocks.
- **Carrier frequency**—the frequency of the unmodulated fundamental output of a radio transmitter.

- **Coordinates**—a set of numbers that describes your location on or above the earth. Coordinates are typically based on latitude/longitude lines of reference or a global/regional grid projection (e.g., UTM, MGRS, Maidenhead). Coordinates can be in longitude and latitude degrees or geographic systems or northing and easting for projected systems like UTM or State Plane.

- **Coordinated Universal Time (UTC)**—replaced Greenwich Mean Time (GMT) as the world standard for time in 1986. UTC uses atomic clock measurements to add or omit leap seconds each year to compensate for changes in the rotation of the earth. Differential positioning—accurate measurement of the relative positions of two receivers tracking the same GPS signals.

- **Datum**—a math model which depicts a part of the surface of the earth. Latitude and longitude lines on a paper map are referenced to a specific map datum. The map datum selected on a GPS receiver needs to match the datum listed on the corresponding paper map in order for position readings to match.

- **Dilution of Precision (DOP)**—the multiplicative factor that modifies ranging error. It is caused solely by the geometry between the user and his set of satellites. Also known as DOP, PDOP, or GDOP depending on the reference.

- **Doppler shift**—the apparent change in the frequency of a signal caused by the relative motion of the transmitter and receiver.

- **Ephemeris**—the predictions of current satellite position that are transmitted to the user in the data message.

- **Geometric Dilution of Precision (GDOP)**—See Dilution of Precision.

- **Global Positioning System (GPS)**—a global navigation system based on 24 or more satellites orbiting the earth at an altitude of 12,000 statue miles and providing very precise, worldwide positioning and navigation information 24 hours a day, in any weather. Also called the NAVSTAR system.

- **Ionosphere**—the band of charged particles 80 to 120 miles above the Earth's surface. A region of the earth's atmosphere where ionization caused by incoming solar radiation affects the transmission of GPS radio waves. It extends from a height of 50 kilometers (30 miles) to 400 kilometers (250 miles) above the surface.

- **Ionospheric refraction**—the change in the propagation speed of a signal as it passes through the ionosphere.

- **L Band**—the radio frequencies that extend from 390 MHz to 1550 MHz. The GPS carrier frequencies are in the L band (1227.6 MHz and 1575.42 MHz).

- **L1 Frequency**—one of the two radio frequencies transmitted by the GPS satellites. This frequency carries the Coarse Acquisition Code (C/A code), P-Code, and the nav message, and is transmitted on a frequency of 1575.42 MHz.

- **L2 Frequency**—one of the two radio frequencies transmitted by the GPS satellites. This frequency carries only the P-Code, and is transmitted on a frequency of 1227.6 MHz.

- **Latitude**—a position's distance north or south of the equator, measured by degrees from zero to 90. One minute of latitude equals one nautical mile.

- **Longitude**—the distance east or west of the prime meridian (measured in degrees). The prime meridian runs from the North to South Pole through Greenwich, England.

- **LORAN**—Loran, which stands for LOng RAnge Navigation, is a grid of radio waves in many areas of the globe that allows accurate position plotting. Loran transmitting stations around the globe continually transmit 100 kHz radio signals. Special shipboard Loran receivers interpret these signals and provide readings that correspond to a grid overprinted on nautical charts. By

comparing signals from two different stations, the mariner uses the grid to determine the position of the vessel.

- **Magnetic North**—represents the direction of the North magnetic pole from the observer's position. The direction a compass points.
- **Map Display**—a graphic representation of a geographic area and its features.
- **Mean Sea Level**—the average level of the ocean's surface, as measured by the level halfway between mean high and low tide. Used as a standard in determining land elevation or sea depths.
- **Multipath Error**—an error caused when a satellite signal reaches the GPS receiver antenna by more than one path. Usually caused by one or more paths being bounced or reflected. The TV equivalent of multipath is "ghosting."
- **Multipath error**—errors caused by the interference of a signal that has reached the receiver antenna by two or more different paths. Usually caused by one path being bounced or reflected.
- **Multi-channel receiver**—a GPS receiver that can simultaneously track more than one satellite signal.
- **Multiplexing Receiver**—a GPS receiver that switches at a very rapid rate between satellites being tracked. Typically, multiplexing receivers require more time for satellite acquisition and are not as accurate as parallel channel receivers. Multiplexing receivers are also more prone to lose a satellite fix in dense woods than parallel channel GPS receivers.
- **Nautical Mile**—a unit of length used in sea and air navigation, based on the length of one minute of arc of a great circle, especially an international and U.S. unit equal to 1,852 meters (about 6,076 feet).
- **Navigation**—the act of determining the course or heading of movement. This movement could be for a plane, ship, automobile, person on foot, or any other similar means.
- **NAVSTAR**—the official U.S. Government name given to the GPS satellite system. NAVSTAR is an acronym for NAVigation Satellite Timing and Ranging.
- **P-code**—the Precise code. A very long sequence of pseudo random binary biphase modulations on the GPS carrier at a chip rate of 10.23 MHz which repeats about every 267 days. Each one week segment of this code is unique to one GPS satellite and is reset each week. The precise code of the GPS signal typically used only by the U.S. military. It is encrypted and reset every seven days to prevent use from unauthorized persons.
- **Precise Positioning Service (PPS)**—the most accurate dynamic positioning possible with standard GPS, based on the dual frequency P-code and no Selective Adjustment.
- **Pseudo random code**—a signal with random noise-like properties. It is a very complicated but repeating pattern of 1's and O's.
- **Prime Meridian**—the zero meridian, used as a reference line from which longitude east and west is measured. It passes through Greenwich, England.
- **Pseudo-Random Code**—the identifying signature signal transmitted by each GPS satellite and mirrored by the GPS receiver in order to separate and retrieve the signal from background noise.
- **Pseudorange**—the measured distance between the GPS receiver and the GPS satellite using uncorrected time comparisons from satellite-transmitted code and the local receiver's reference code.
- **Satellite constellation**—the arrangement in space of a set of satellites.

- **Selective Availability (SA)**—a policy adopted by the Department of Defense to introduce some intentional clock noise into the GPS satellite signals thereby degrading their accuracy for civilian users. This policy was discontinued as of May 1, 2000 and now SA is turned off
- **Space segment**—the part of the whole GPS system that is in space, i.e. the satellites.
- **Spread spectrum**—a system in which the transmitted signal is spread over a frequency band much wider than the minimum bandwidth needed to transmit the information being sent. This is done by modulating with a pseudo random code, for GPS.
- **Standard Positioning Service (SPS)**—the normal civilian positioning accuracy obtained by using the single frequency C/A code.
- **Statute Mile**—a unit of length equal to 5,280 feet or 1,760 yards (1,609 meters) used in the U.S. and some other English-speaking countries.
- **Triangulation**—a method of determining the location of an unknown point, as in GPS navigation, by using the laws of plane trigonometry.
- **Troposphere**—the lowest region of the atmosphere between the surface of the earth and the tropopause, characterized by decreasing temperature with increasing altitude. GPS signals travel through the troposphere (and other atmospheric layers).
- **True North**—the direction of the North Pole from your current position. Magnetic compasses indicate north differently due to the variation between true north and magnetic north. A GPS receiver can display headings referenced to true north or magnetic north.
- **User segment**—the part of the whole GPS system that includes the receivers of GPS signals.
- **Universal Transverse Mercator (UTM)**—a nearly worldwide coordinate projection system using north and east distance measurements from reference point(s). UTM is the primary coordinate system used on U.S. Geological Survey topographic maps. Northing and easting UTM coordinates are in meters.
- **Wide Area Augmentation System (WAAS)**—a system of satellites and ground stations that provide GPS signal corrections for better position accuracy. A WAAS-capable receiver can give you a position accuracy of better than three meters, 95 percent of the time. (At this time, the system is still in the development stage and is not fully operational.) WAAS consists of approximately 25 ground reference stations positioned across the United States that monitor GPS satellite data. Two master stations, located on either coast, collect data from the reference stations and create a GPS correction message.
- **WGS-84**—World Geodetic System, 1984. The primary map datum used by GPS. Secondary datums are computed as differences from the WGS 84 standard.

Return to SOP

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

STANDARD OPERATING PROCEDURE

Subject: Water Quality Meter Use

1. PURPOSE

This procedure is intended to provide general guidance and methods for using a field meter to measure water quality parameters from groundwater or surface water that is being purged, sampled, or monitored.

2. SCOPE

This procedure is applicable to all Shaw E & I projects where water quality monitoring is required using a water quality meter. The water quality meter may be a stand-alone meter or it may be a combined multi-probe unit used to measure temperature, pH, specific conductance, and/or other water quality parameters. The most common methods used for measuring water quality are instruments that measure in-situ parameters in one of the following two ways:

- Water is extracted from its source using a pump and measured in a flow-through cell or in some instances captured and then measured in individual aliquots. This method is preferred when monitoring wells are sampled for laboratory analysis of chemical parameters, and groundwater purging is required.
- The meter is submerged directly into the sample source, such as a monitoring well or surface water body, to collect in-situ monitoring parameters.

3. REFERENCES

- U.S. Army Corps of Engineers, 2001, *Requirements for the Preparation of Sampling and Analysis Plans*, Appendix C, EM-200-1-3, Washington, D.C.
- American Society of Testing and Materials, *Standard Guide for Selection of Purging and Sampling Devices for Ground-Water Monitoring Wells*, D6634-01, West Conshohocken, PA.
- American Society of Testing and Materials, *Standard Guide for Sampling Ground-Water Monitoring Wells*, D4448-01, West Conshohocken, PA.

4. DEFINITIONS

- **Water Quality Meter**—A device used to measure specific field parameters indicative of water quality, such as temperature, pH, specific conductance, and/or other parameters. The meter may be stand-alone or it may be a combined multi-probe unit.
- **Pump**—An electric, compressed air, or inert gas-driven device that raises liquids by means of pressure or suction. The types of pumps that should be used for water quality monitoring should be chosen based on the well size and depth, the type of contaminants, and the specific factors affecting the overall performance of the sampling or monitoring effort. The types of pumps that may be used include centrifugal, peristaltic, centrifugal submersible, gas displacement, and bladder pumps.
- **pH**—The negative log of the hydrogen ion concentration (-log10 [H+]); a measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The scale is 0 to 14.

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- **Turbidity**—A measure of overall water clarity determined by measurement of the degree to which light traveling through a water column is scattered by the suspended organic (including algae) and inorganic particles. Turbidity is commonly measured in Nephelometric Turbidity Units (NTU), but may also be measured in Jackson Turbidity Units (JTU).
- **Specific Conductance (SC)**—A measure of how well water can conduct an electrical current. Conductivity increases with increasing amount and mobility of ions such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, and iron, and can be used as an indicator of water pollution. The unit of conductance is expressed as microsiemens (1/1,000,000 siemen) per centimeter, or µS/cm.
- **Oxidation-Reduction (Redox) Potential**—A measure in volts of the affinity of a substance for electrons compared with hydrogen. Liquids that are more strongly electronegative than hydrogen (i.e. capable of oxidizing) have positive redox potentials. Liquids less electronegative than hydrogen (i.e. capable of reducing) have negative redox potentials.
- **Dissolved Oxygen (DO)**—Refers to the amount of oxygen expressed as mg/L that is contained in particular water. The amount of oxygen that can be held by the water depends on the water temperature, salinity, purity, and pressure.
- **Salinity**—The amount of dissolved salts in water, generally expressed in parts per thousand (ppt).

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be directed to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager or designee is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

6. PROCEDURE

6.1 Equipment

The following equipment is recommended for use in performing water quality measurements:

- Water Quality Meter(s)
- Spare parts such as alkaline batteries (if used) and sensor probes
- Pump and discharge hose/line for use with a flow-through cell
- Paper towels or lint-free wipes

- De-ionized water
- Sample gloves
- Calibration solutions for all parameters being measured; within expiration dates
- Plastic sheeting
- Logbook or log sheets

6.2 General Instructions

- Ensure that the measuring range of the instrument encompasses the expected sample concentration or units.
- Before going to the field, locate all necessary field supplies such as deionized water, calibration solutions, decontamination supplies, and spare parts.
- Consult the instrument's operation manual as well as the project-specific sampling plan to verify that you have prepared the proper equipment and supplies to successfully complete the work.

6.3 Calibration

*Calibration **must** be performed **at least once per day** during operation. Calibrate the meter according to the instrument's operating manual. If sampling and monitoring is being performed for long periods of time, periodically check the instrument calibration using the operating manual's recommended frequency.*

In order to avoid limiting the field personnel to one particular model, only general calibration instructions are presented in this procedure.

- Locate a clean, protected area in which to set up and calibrate the instrument. Ensure that sufficient supplies of de-ionized water, clean paper towels, buffer solutions, and standard solutions are available.
- Inspect the meter and probes for damage. Some of the probes are very delicate or have a thin membrane installed over the probe. Be careful when handling the meter/probes so as not to damage them. If damaged, replace probes in accordance with the instrument's operating manual or obtain a different meter.
- Turn on the meter and allow it to "warm-up" for the manufacturer-specified time (usually 15 to 30 minutes). Check the battery power to determine if the meter has sufficient power to operate for the monitoring period. Replace the batteries, if necessary.
- Calibrate the meter according to the instrument's operating manual. In general, calibration is performed by immersing the probe(s) in aliquots of calibration standard solution(s) and following certain meter keystrokes to set the calibration for each parameter. *Do not immerse the probe into the stock container of the solution. Always transfer a small amount of the solution into a separate container to calibrate the probe(s).* If calibrating for multiple parameters using more than one solution, be sure to wipe off and rinse the probe with de-ionized water between solutions.
- Recheck each parameter after calibration by immersing the probe into the calibration solution and reading it like a sample reading. If the agreement is not within 25% of the solution's known concentration, repeat the calibration process with a new solution aliquot.

- Discard the used calibration solution aliquots when finished into an appropriate waste container.
- Record the calibration data in the field logbook or log sheet.

6.4 Operation of the Instrument

- If using a flow-through cell system, attach the extraction pump and lines in accordance with the pump and meter manufacturer's instructions. Allow the lines to fill and the probes to become immersed before switching the instrument to its measurement mode.
- If using a down-hole system, allow a few minutes for the probe to stabilize before taking a reading.
- Operate the meter in accordance with the instrument's operating manual.
- Collect the field parameter reading(s) per the project requirements, and record them in a field logbook or on log sheets.
- Decontaminate the meter before collecting data from the next sample source. For a flow-through system, flush the lines with three line volumes of de-ionized water or replace with new ones between samples.

7. ATTACHMENTS

None.

8. FORMS

None.

APPENDIX

D

Appendix D –

Laboratory Standard Operating Procedures

Document List

1. Shaw SOP- Chain of Custody Documentation - Paper
2. En Chem (Pace Analytical)- Example Chain of Custody
3. En Chem (Pace Analytical)- Example Custody Seal
4. En Chem (Pace Analytical)- Example Labels
5. ~~Shaw SOP- Chain of Custody Documentation - Paper~~
6. Shaw- Example Analysis Request and Chain of Custody Record and Example Label
7. STL Knoxville SOP- Analysis of PCB Isomers by Isotope Dilution HRGC/HRMS
8. Pace Analytical SOP- The Determination of Lipids in Tissues, Fats, and Plants
9. En Chem (Pace Analytical) SOP- Total Organic Carbon Analysis on the Apollo 9000 Using EPA 600 4-79-020, Revised March 1983, Method 415.1 and EPA Manual SW846, 3rd Edition, Method 9060.
10. Pace Analytical SOP- The Determination of Mercury by Cold Vapor Atomic Absorption Spectrocopy
11. En Chem (Pace Analytical)- Total Suspended Solids Dried at 103-105 °C and Total Volatile Solids Dried at 550 °C.
12. Pace Analytical SOP- Analysis of PCBs by Gas Chromatography
13. STL Knoxville SOP- Record Retention and Document Storage
14. Pace Analytical Minneapolis SOP- Data Archiving
15. Pace Analytical SOP- Extraction of Biological Samples for Organochlorine Pesticides/PCBs
16. Pace Analytical SOP- Biological Tissue and Plant Tissue Preparation
17. Pace Analytical Minneapolis SOP- NT Server Backup
18. STL Lot Checking Sample Containers

STANDARD OPERATING PROCEDURE

Subject: Chain of Custody Documentation - Paper

1. PURPOSE

The purpose of this procedure is to provide the requirements for completion of written Chain of Custody (COC) documentation and to provide a suggested Chain of Custody Form for project use.

2. SCOPE

This procedure is applicable to all Shaw E & I efforts where samples are transferred among parties, including to off-site testing facilities. Adherence to this procedure is not required whenever the same individual/team is performing the sampling and testing within the same workday, and transfer to the testing process is being documented by other means, e.g. sampling and then field-screening in a mobile laboratory.

3. REFERENCES

- U.S. Environmental Protection Agency, 1986, *Test Methods for Evaluating Solid Waste; Physical/Chemical Methods, SW-846*, Third Edition.
- U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plans*, EM200-1-3.
- Shaw E & I, 2002, *Sampler's Training Course Handout.*

4. DEFINITIONS

- **Custody**—The legal term used to define the control and evidence traceability of an environmental sample. A sample is considered to be in an individual's custody when it is in actual physical possession of the person, is in view of the person, is locked in a container controlled by the person, or has been placed into a designated secure area by the person.
- **Chain of Custody Form**—A form used to document and track the custody and transfers of a sample from collection to analysis or placement in a designated secure area within the testing facility.
- **COC Continuation Page**—Additional page(s) that may be included with a Chain of Custody form. The continuation page(s) contain the information on additional samples contained within the *same* cooler/shipping container associated with the cooler/shipping container Chain of Custody form.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be directed to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw E & I employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

6. PROCEDURE

6.1 Documentation

All Chain of Custody documentation must be completed in indelible ink. All corrections must be performed using standard single-line cross-out methods, and the initials of the individual making the change must be included beside the corrected entry.

6.2 Continuation Pages

Continuation pages may be utilized for shipping containers/coolers with sufficient samples/sample containers that all of the lines of the Chain of Custody form are used before the documentation of the cooler/shipping container is complete. The number of pages in total must be filled out. *All samples entered onto a Continuation Page must be included in the same cooler/shipping container as those on the Chain of Custody form itself.*

6.3 Header Information

- Each Chain of Custody form must be assigned a unique Reference Document Number–use the Project/proposal number followed by a unique numeric sequence or current date (if only one cooler sent per day). Continuation Pages should contain the same Document Reference Number as the Chain of Custody form that they are associated with. The project team should maintain a log of Chain of Custody Reference Document Numbers.
- The page identifier and total page count section must be completed. Total pages include the Chain of Custody form and any attached Continuation Pages.
- Project number, name, and location information must be completed for all forms.
- If available, the laboratory Purchase Order Number should be included on the appropriate line.

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

- The name and phone number of the *Project Contact* should be included; the Project Contact should be a responsible individual that the laboratory may access to address analytical issues. This person is usually the analytical lead for the project
- The *Shipment Date* should be provided on the applicable lines.
- If shipping by carrier, the *Waybill/Airbill Number* must be included. Note: couriers will not sign custody documents. Therefore, inclusion of the waybill/airbill number on the Chain of Custody is the *only* means of documenting the transfer to the carrier.
- Laboratory Destination and Contact information should be provided.
- The Sampler(s) names should be provided on the appropriate line. This line should include all persons whose initials appear on any of the sample containers, to provide the laboratory a means of cross-referencing containers.
- The "Send Report To" information should be completed. If multiple reports/locations are needed, the information should be provided on a separate page included with the Chain of Custody documents.

6.4 Sample Information Section–Including on Continuation Page(s)

During actual sampling, each sample must be entered on the COC form at the time of collection in order to document possession. The sampler must not wait until sampling is completed before entering samples on the COC.

- Complete the *Sample ID Number* for each line. If there are multiple container types for a sample, use additional lines to indicate the needed information.
- Ensure that the *Sample Description* matches the description on the sample label–the laboratory will use this information for cross-referencing.
- Provide the *Collection Date* and *Time*. These must match those on the sample label and Field Logbook/Logsheets.
- Indicate whether the sample is a Grab or Composite sample.
- Indicate the *Matrix* of the sample. Use the Matrix Codes listed on the Chain of Custody form.
- Indicate the *Number of Containers* and the *Container Type*. If a sample has multiple container types, use multiple lines.
- Check the appropriate *Preservative* box for each line/container type.
- Write in and check the *Analyses Requested* boxes for each line/container type. The appropriate method number (e.g. EPA Method 8260C) must be written as well as the method name.
- Indicate the *Turn Around Time Requested* for each sample.
- Use the *Special Instructions* section to provide important information to the laboratory, e.g., samples that may require dilution or samples that will need to be composited by the laboratory. This section may also be used to inform the laboratory of additional information contained in attachments to the Chain of Custody package.
- Circle the appropriate *QC/Data Package Level* requested.

6.5 Custody Transfer Section

- The first *Relinquished By* space must be completed by the individual who will either transfer the samples or seal the shipping container.
- If the samples will be transferred to a courier, write the courier/carrier company in the *Received By* box and enter the Date and Time the shipping container was closed.
- All other transfers must be performed in person, and the Relinquisher must witness the signing by the Receiver.
- A copy of the Chain of Custody form and all associated Continuation Pages should be maintained in the project files.

7. ATTACHMENTS

None.

8. FORMS

- Shaw E & I Chain of Custody Form
- Shaw E & I COC Continuation Page

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

(Please p gibly)

Company Name: _____

Branch or Location: _____

Project Contact: _____

Telephone: _____

Project Number: _____

Project Name: _____

Project State: _____

Sampled By (Print) : _____

PO #: _____

Data Package Options - (please circle if requested)
Sample Results Only (no QC)
EPA Level II (Subject to Surcharge)
EPA Level III (Subject to Surcharge)
EPA Level IV (Subject to Surcharge)

Regulatory Program
UST
RCRA
SDWA
NPDES
CERCLA

Matrix Codes
W=Water
S=Soil
A=Air
C=Charcoal
B=Biota
Sl=Sludge

EN CHEM INC.

...chemistry for the environment

1241 Bellevue St., Suite 9
Green Bay, WI 54302
920-469-2436
Fax 920-469-8827

CHAIN OF CUSTODY Nº 120985

Page _____ of _____

Quote #: _____

Mail Report To: _____

Company: _____

Address: _____

_____

Invoice To: _____

Company: _____

Address: _____

_____

Mail Invoice To: _____

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=EnCore F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

FILTERED? (YES/NO)

PRESERVATION (CODE)*

ANALYSES REQUESTED

TOTAL # OF BOTTLES SENT

LABORATORY ID (Lab Use Only)	FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)

Rush Turnaround Time Requested (TAT) - Prelim
(Rush TAT subject to approval/surcharge)

Date Needed: _____

Transmit Prelim Rush Results by (circle):
Phone Fax E-Mail

Phone #: _____

Fax #: _____

E-Mail Address: _____

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:

En Chem Project No.

Sample Receipt Temp.

Sample Receipt pH (Wet/Metals)

Cooler Custody Seal

Present / Not Present

Intact / Not Intact

Version 4.0: 07/03

CUSTODY SEAL

DATE _____

SIGNATURE _____

QEC

Quality Environmental Containers

800-255-3950 • 304-255-3900

ENCHEM INC. TYPE (CHECK) FILTERED ☐ UNFILTERED ☐

SAMPLE TYPE _____

SAMPLE POINT _____

DATE/TIME _____

COLLECTOR/COMMENTS _____

PRESERVATIVE _____

ENCHEM INC. TYPE (CHECK) FILTERED ☐ UNFILTERED ☐

SAMPLE TYPE _____

SAMPLE POINT _____

DATE/TIME _____

COLLECTOR/COMMENTS _____

PRESERVATIVE _____

ENCHEM INC. TYPE (CHECK) FILTERED ☐ UNFILTERED ☐

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ENCHEM INC. TYPE (CHECK) FILTERED ☐ UNFILTERED ☐

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DATE/TIME _____

COLLECTOR/COMMENTS _____

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Collector/Comments _____
Preservative _____

Shaw™
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: EXAMPLE

Project Number: 108876
Project Name: Fox River
Sample Coordinator: BBLES
Turnaround Time:

Samples Shipment Date: 30 JUN 2004
Lab Destination: EnChem
Lab Contact: Tod Noltemeyer
Project Contact: George Hicks
Carrier/Waybill No.: Courier/

Bill To: Vicki Graves
312 Directors Drive
Knoxville TN 37923

Report To: Vicki Graves
312 Directors Drive
Knoxville TN 37923

Special Instructions:

Possible Hazard Indentification:
Non-hazard | Flammable | Skin Irritant | Poison B | Unknown

Sample Disposal:
Return to Client | Disposal by Lab | Archive (mos.)

1. Relinquished By (Signature/Affiliation) Date: Time:
2. Relinquished By (Signature/Affiliation) Date: Time:
3. Relinquished By (Signature/Affiliation) Date: Time:

1. Received By (Signature/Affiliation) Date: Time:
2. Received By (Signature/Affiliation) Date: Time:
3. Received By (Signature/Affiliation) Date: Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	Fil	CID	Condition On Receipt
EXAMPLE	2001-01-SD-EXAMPLE-REG	30 JUN 2004	16:14	0 None POLY BAG	1	None except cool to 4 C	PCB by Fox River Method, Percent Solids, Total Organic Carbon by Walkley Black	N		

Fox River

Shaw Environmental Project Number 108876

imple No: **EXAMPLE** Location: 2001-01

Lab: EnChem

Sample Date: 30 JUN 2004 Time: 16:14

Analysis: PCB by Fox River Method, Percent Solids, Total Organic Carbon by Walkley Black

Preservation: None except cool to 4 C

Require 4C: Y Filtered: N

Sampler:

Shaw™
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: EXAMPLE

Project Number: 108876
Project Name: Fox River
Sample Coordinator: BBLES
Turnaround Time:

Samples Shipment Date: 30 JUN 2004
Lab Destination: EnChem
Lab Contact: Tod Noltemeyer
Project Contact: George Hicks
Carrier/Waybill No.: Courier/

Bill To: Vicki Graves
312 Directors Drive
Knoxville TN 37923

Report To: Vicki Graves
312 Directors Drive
Knoxville TN 37923

Special Instructions:

Possible Hazard Indentification:
Non-hazard | Flammable | Skin Irritant | Poison B | Unknown

Sample Disposal:
Return to Client | Disposal by Lab | Archive (mos.)

1. Relinquished By (Signature/Affiliation) Date: Time:
2. Relinquished By (Signature/Affiliation) Date: Time:
3. Relinquished By (Signature/Affiliation) Date: Time:

1. Received By (Signature/Affiliation) Date: Time:
2. Received By (Signature/Affiliation) Date: Time:
3. Received By (Signature/Affiliation) Date: Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	Fil	CID	Condition On Receipt
EXAMPLE	2001-01-SD-EXAMPLE-REG	30 JUN 2004	16:14	0 None POLY BAG	1	None except cool to 4 C	PCB by Fox River Method, Percent Solids, Total Organic Carbon by Walkley Black	N		

Shaw E & I, Inc.

Sample Collection Log

108876 Fox River

Manager: George Hicks

RFA / COC Number: EXAMPLE

Location Code: **2001-01**
Sample Number: **EXAMPLE**
Sample Name: **2001-01-SD-EXAMPLE-REG**
Sampling Method: **CORE**
Sample Type: **SD** *Sample Purpose:* **REG**

Task:
Collection Date: **30-JUN-04**
Collection Time: **16:14**
Start Depth: **2**
End Depth: **2.5**
Sample Matrix: **SOIL**
Sample Team:

ERPIMS Values:
Sacode:
Lot Control#:

	Containers					
Analytical Suite	**Flt**	**Frtn**	**Qty**	**Size**	**Units**	**Type**
PCBS	N	A	1	0	None	POLY BAG
SOLIDS	N	A	1	0	None	POLY BAG
TOC	N	A	1	0	None	POLY BAG

Comments:

Sketch Location:

Logged BY / Date: _____ *Reviewed BY / Date:* _____

Fox River

Shaw Environmental Project Number 108876

ample No: **EXAMPLE** Location: 2001-01

Lab: EnChem

Sample Date: 30 JUN 2004 Time: 16:14

Analysis: PCB by Fox River Method, Percent Solids, Total Organic Carbon by Walkley Black

Preservation: None except cool to 4 C

Require 4C: Y Filtered: N

Sampler:

STL KNOXVILLE

DRAFT FINAL STANDARD OPERATING PROCEDURE

TITLE: Analysis of Polychlorinated Biphenyl (PCB) Isomers by Isotope Dilution HRGC/HRMS

(SUPERSEDES: KNOX-ID-0013, Revision 2)

Prepared By: _____

Reviewed By: _____
Technical Specialist

Approved By: _____
Quality Assurance Manager

Approved By: _____
Environmental, Health and Safety Coordinator

Approved By: _____
Laboratory Director

Proprietary Information Statement:

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1 Scope and Application

1.1 This procedure is designed to meet analytical program requirements where HRGC/HRMS analysis of polychlorinated biphenyl (PCB) isomers is specified. The procedure is used by STL Knoxville for the detection and quantitative measurement of all 209 PCB isomers in a variety of environmental matrices at part-per-trillion (ppt) to part-per-quadrillion (ppq) concentrations. This procedure is based on EPA method 1668A.

1.2 The compounds listed in Table 1 may be determined by this procedure. The detection limits and quantitation levels in this method are usually dependent on the level of interferences rather than instrumental limitations. The estimated minimum levels (EMLs) in Table 4 are the levels at which the PCBs can be determined with only common laboratory interferences present. The actual limits of detection and quantitation will vary depending on the complexity of the matrix.

1.3 The Low Calibration Level (LCL's) of the method are listed in Table 3 for individual isomers. Analysis of a one-tenth aliquot of the sample permits measurements of concentrations up to 10 times the upper calibration range. Samples containing concentrations of PCB's that are greater than ten times the upper calibration are analyzed by protocols designed for such concentration levels.

1.4 The GC/MS portions of this method are for use only by analysts experienced with HRGC/HRMS or under the close supervision of such qualified persons. Each laboratory that uses this method must demonstrate the ability to generate acceptable results using the procedure in section 9.1.

1.5 This procedure is based on "performance-based" methods. These reference methods allow modifications to overcome interferences or lower the cost of measurements, if all performance criteria in the methods are met and method equivalency is established. Deviations from the referenced methods have been incorporated into this procedure and are listed in section 17.1. Deviations to this procedure are only allowed as specified in section 11.1.

1.6 Because of the extreme toxicity of many of these compounds, the analyst must take the necessary precautions to prevent exposure to materials known or believed to contain PCBs. It is the responsibility of the laboratory personnel to ensure that safe handling procedures are employed. Section 5 of this procedure discusses safety procedures.

2 Summary of Method

2.1 Screening and protocol assignment.

2.1.1 All solid, semi-solid and fish tissue samples are screened by GC/ECD prior to extraction. Aqueous samples may be screened if the potential for congener levels above 40 ng/L exists. Variations to sample size, spiking levels and final volume are established based on the screening result.

2.2 Extraction

2.2.1 Aqueous samples (samples containing less than one percent solids): Stable isotopically labeled analogs of the toxic PCBs plus additional labeled PCB's are spiked into a 1-L sample, and the sample is extracted with methylene chloride using separatory funnel techniques.

2.2.2 Solid and semi-solid (but not tissue): A 1.0 g sub-sample is screened to determine the greatest concentration for individual congeners. Based on the screen, the sample is prepared by one of four protocols. Each protocol defines the sample amount to be extracted, the fraction of the extract to be used, and the final extract volume. Protocol 1 is for samples which can be processed without adjustments for contamination. In this protocol, the labeled compounds are spiked into a sample containing 10 g (dry weight) of solids. The sample is extracted for 16 hours with an appropriate solvent using a Soxhlet extractor. The extract is concentrated for cleanup. If other analyses are to be performed on the same extract, the extract is split and a separate analysis is performed on each extract fraction.

2.2.3 Multi-phase samples: Samples containing multiple phases are separated and the phases are extracted following the procedures for the appropriate matrix. The extracts may be combined for cleanup and analysis or processed separately. Specific handling of multi-phase samples should be discussed and documented with the project manager prior to extraction of samples.

2.2.4 Fish and other tissue: A 1.0 g sub-sample is screened to determine the greatest concentration for individual congeners. Based on the screen, the sample is prepared by one of four protocols. Each protocol defines the sample amount to be extracted, the fraction of the extract to be used, and the final extract volume. Protocol 1 is for samples which can be processed without adjustments for contamination. In this protocol, a 20-g aliquot of sample is homogenized, and a 10-g aliquot is spiked with the labeled compounds. The sample is blended with sodium sulfate, and extracted for 16 hours using methylene chloride:hexane (1:1) in a Soxhlet extractor. A portion of the extract is evaporated to dryness and used to determine the lipid content. The remaining extract is concentrated for cleanup.

2.2.5 Non-aqueous liquids such as oils and organic solvents are diluted or solvent exchanged in hexane.

2.3 After extraction, samples may be cleaned up using gel-permeation chromatography, back-extraction with sulfuric acid and Florisil column chromatography.

2.4 After cleanup, the extract is concentrated to either 100 µL or 20 µL. Recovery standards are added to each extract, and an aliquot of the extract is injected into the gas chromatograph. The analytes are separated by the GC and detected by a high-resolution (≥10,000) mass spectrometer. Two exact m/z's are monitored for each analyte.

2.5 An individual PCB congener is identified by comparing the GC retention time and ion-abundance ratio of two exact m/z's with the corresponding retention time of an authentic standard and the theoretical or acquired ion-abundance ratio of the two exact m/z's.

2.6 Quantitative analysis is performed using selected ion current profile (SICP) areas, in one of two ways:

2.6.1 For PCBs with labeled analogs (see Table 1), the GC/MS system is calibrated, and the concentration of each compound is determined using the isotope dilution technique.

2.6.2 For PCBs without labeled compounds, the GC/MS system is calibrated and the concentration of each compound is determined using the internal standard technique.

2.7 The quality of the analysis is assured through reproducible calibration and testing of the extraction, cleanup, and GC/MS systems.

3 Definitions

These definitions and purposes are specific to this method but conform to common usage as much as possible.

Note: Terminology differences existing in some isotope dilution reference methods regarding the functionality of the labeled analogs may lead to confusion. For example, EPA's Office of Solid Waste methods (8280, 8290) use the term "Internal Standards" to describe the labeled analogs which are added to the sample prior to extraction and used to quantitate the native targets. EPA's Office of Water methods (1613B, 1668 Draft) use the term "Labeled Analogs" to describe these same compounds while using the term "Internal Standards" to describe the labeled analogs which are added to the extract just prior to analysis and used to quantitate the recovery of the labeled analogs added before extraction. EPA's Office of Solid Waste methods (8280, 8290) uses the term "Recovery Standards" to describe these later labeled analogs.

The terminology conventions established by the EPA's Office of Solid Waste methods (8280, 8290) are used in the laboratory for all Standard Operating Procedures and internal communications as defined in this section.

3.1 Analyte - A PCB tested for by this method. The analytes are listed in Table 1.

3.2 Calibration standard (CAL) - A solution prepared from a secondary standard and/or stock solutions and used to calibrate the response of the instrument with respect to analyte concentration.

3.3 Calibration verification standard (VER) - The mid-point calibration standard (CS3) that is used to verify calibration. See Table 6.

3.4 CB - Chlorinated biphenyl congener. One of the 209 individual chlorinated biphenyl congeners determined using this Method. The 209 CBs are listed in Table 1.

3.5 Cleanup Standard - Isotopically labeled compound that is added to samples, blanks, quality control samples, and calibration solutions. It is added to the samples after extraction but prior to extract cleanup, and is used to judge the efficiency of the cleanup procedures.

3.6 Congener - Any member of a particular homologous series, for example, 2,2'-DiCB.

3.7 CS0.5, CS1, CS2, CS3, CS4, CS5 - See Calibration standards and **Table 6**.

3.8 Estimated Detection Limit (EDL): The sample specific estimated detection limit (EDL) is the concentration of a given analyte required to produce a signal with a peak height of at least 2.5 times the background signal level.

3.9 Estimated Maximum Possible Concentration (EMPC): The calculated concentration of a signal having the same retention time as a PCB congener but which does not meet the other qualitative identification criteria defined in the method.

3.10 Estimated Minimum Detection Limit (EMDL) – The lowest concentration at which an analyte can be detected with common laboratory interferences present.

3.11 Estimated Minimum Level (EML) – The lowest concentration at which an analyte can be measured reliably with common laboratory interferences present.

3.12 Field blank - An aliquot of reagent water or other reference matrix that is placed in a sample container in the laboratory or the field, and treated as a sample in all respects, including exposure to sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the field blank is to determine if the field or sample transporting procedures and environments have contaminated the sample.

3.13 GC - Gas chromatograph or gas chromatography.

3.14 Homologous Series - A series of compounds in which each member differs from the next member by a constant amount. The members of the series are called homologs.

3.15 HRGC - High resolution GC.

3.16 HRMS - High resolution MS.

3.17 ICV: Initial Calibration Verification Standard. A calibration standard from a second source, traceable to a national standard if possible. The ICV is analyzed after the Initial calibration to verify the concentration of the Initial Calibration Standards.

3.18 Internal Standards (IS): Isotopically labeled analogs of the target analytes that are added to every sample, blank, quality control spike sample, and calibration solution. They are added to the sample before extraction and are used to calculate the concentration of the target analytes or detection limits.

3.19 IPR - Initial precision and recovery; four aliquots of the diluted PAR standard analyzed to establish the ability to generate acceptable precision and accuracy. An IPR is performed prior to the first time this method is used and any time the method or instrumentation is modified.

3.20 Isomer - Chemical compounds that contain the same number of atoms of the same elements, but differ in structural arrangement and properties. For example, 4-DiCB and 9-DiCB are structural isomers.

3.21 K-D - Kuderna-Danish concentrator; a device used to concentrate the analytes in a

solvent.

3.22 Laboratory blank - See Method blank.

3.23 Laboratory control sample (LCS) - See Ongoing precision and recovery standard (OPR).

3.24 Laboratory reagent blank - See Method blank.

3.25 Method blank - An aliquot of a clean test matrix that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with samples. The method blank is used to determine if analytes or interferences are present in the laboratory environment, the reagents, or the apparatus.

3.26 Minimum Level (ML) - The level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that all Method-specified sample weights, volumes, and cleanup procedures have been employed.

3.27 MS - Mass spectrometer or mass spectrometry.

3.28 OPR - Ongoing precision and recovery standard (OPR); a laboratory blank spiked with known quantities of analytes. The OPR is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the limits specified in this method for precision and recovery.

3.29 PAR - Precision and recovery standard; secondary standard that is diluted and spiked to form the IPR and OPR.

3.30 PFK - Perfluorokerosene; the mixture of compounds used to calibrate the exact m/z scale in the HRMS.

3.31 Primary dilution standard - A solution containing the specified analytes that is purchased or prepared from stock solutions and diluted as needed to prepare calibration solutions and other solutions.

3.32 Quality control check sample (QCS) - A sample containing all or a subset of the analytes at known concentrations. The QCS is obtained from a source external to the laboratory or is prepared from a source of standards different from the source of calibration standards. It is used to check laboratory performance with test materials prepared external to the normal preparation process.

3.33 PCB - Polychlorinated biphenyl

3.34 Reagent water - Water demonstrated to be free from the analytes of interest and potentially interfering substances at the method minimum level for the analyte.

3.35 Recovery Standard (RS): Isotopically labeled compounds which are added to every sample, blank, and quality control spike sample extract prior to analysis. They are used to

measure the recovery of the internal standards and the cleanup standards.

3.36 Relative Percent Difference (RPD): A measure of the difference between two values normalized to one of the values. It is used to determine the accuracy of the concentration measurements of second source verification standards.

3.37 Relative standard deviation (RSD) - The standard deviation times 100 divided by the mean. Also termed "coefficient of variation."

3.38 RF - Response factor. See Section 10.2.5.

3.39 RRF - Relative response factor. See Section 10.2.5.

3.40 RSD - See Relative standard deviation.

3.41 SDS - Soxhlet/Dean-Stark extractor; an extraction device applied to the extraction of solid and semi-solid materials.

3.42 SICP - Selected ion current profile; the line described by the signal at an exact m/z.

3.43 SPE - Solid-phase extraction; an extraction technique in which an analyte is extracted from an aqueous sample by passage over or through a material capable of reversibly adsorbing the analyte. Also termed liquid-solid extraction.

3.44 Specificity - The ability to measure an analyte of interest in the presence of interferences and other analytes of interest encountered in a sample.

3.45 Stock solution - A solution containing an analyte that is prepared using a reference material traceable to EPA, the National Institute of Science and Technology (NIST), or a source that will attest to the purity and authenticity of the reference material.

3.46 Surrogate Standards (SS) - Isotopically labeled compounds that are added to XAD samples and calibration solution. They are added to XAD sampling tubes before sampling and are used to measure sampling and recovery efficiency.

3.47 VER - See Calibration verification standard.

3.48 Additional definitions can be found in the STL Knoxville LQM glossary and in the STL Quality Management Plan.

4 Interferences

4.1 Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and/or elevated baselines causing misinterpretation of chromatograms. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required. Where possible, reagents are cleaned by extraction or solvent rinse. The non-coplanar PCB congeners 105, 114, 118, 123, 156, 157, 167, and 180 have been shown to be very difficult to completely eliminate from the laboratory at the minimum levels in this method, and baking of glassware in a kiln or furnace at 450 - 500°C may be

necessary to remove these and other contaminants.

4.2 Proper cleaning of glassware is extremely important, because glassware may not only contaminate the samples but may also remove the analytes of interest by adsorption on the glass surface. For specific glassware cleaning procedures, see SOP KNOX-QA-0002, current revision, "Glassware Cleaning".

4.3 All materials used in the analysis shall be demonstrated to be free from interferences by running laboratory method blanks (section 9.3) initially and with each sample batch (samples started through the extraction process on a given 12-hour shift, to a maximum of 20 samples).

4.3.1 The method blank consists of reagent water for water samples, sand for solid samples, sodium sulfate for tissue samples, or reagent solvent for waste samples.

4.4 Interferences coextracted from samples will vary considerably from source to source, depending on the diversity of the site being sampled. Interfering compounds may be present at concentrations several orders of magnitude higher than the PCBs. The most frequently encountered interferences are chlorinated dioxins and dibenzofurans, methoxy biphenyls, hydroxy-diphenyl ethers, benzylphenyl ethers, polynuclear aromatics, and pesticides. Because very low levels of PCBs are measured by this method, the elimination of interferences is essential. The cleanup steps given in section 11.8 can be used to reduce or eliminate these interferences and thereby permit reliable determination of the PCBs at the levels shown in Table 3.

4.5 Each piece of reusable glassware is numbered to associate that glassware with the processing of a particular sample. This will assist the laboratory in tracking possible sources of contamination for individual samples, identifying glassware associated with highly contaminated samples that may require extra cleaning, and determining when glassware should be discarded.

4.6 Cleanup of tissue - The natural lipid content of tissue can interfere in the analysis of tissue samples for the PCBs. The lipid contents of different species and portions of tissue can vary widely. Lipids are soluble to varying degrees in various organic solvents and may be present in sufficient quantity to overwhelm the column chromatographic cleanup procedures used for cleanup of sample extracts. Lipids must be removed by the acid cleanup procedure in section 11.8.3, followed by Florisil (section 11.8.4).

5 Safety

5.1 Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

5.2 Eye protection that satisfies ANSI Z87.1 (as per the STL Corporate Safety Manual), laboratory coat and appropriate gloves must be worn while samples, standards, solvents and reagents are being handled. Disposable gloves that have become contaminated will be removed and discarded, other gloves will be cleaned immediately.

5.2.1 Latex and vinyl gloves provide no protection against most of the organic solvents used in this method. For the operations described herein, Nitrile clean room gloves are worn. For operations using solvents that splash, silver shield gloves are recommended. Silver shield gloves protect against breakthrough for most of the solvents used in this procedure

5.3 The effluents of sample splitters for the gas chromatograph and roughing pumps on the mass spectrometer must be vented to the laboratory hood exhaust system or must pass through an activated charcoal filter.

5.4 The gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them or use thermal protection when working on them while they are above room temperature.

5.5 The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source. Alternatively, the source may be removed from the vacuum manifold through a vacuum interlock.

5.6 There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power. If the work involved requires measurement of voltage supplies, the instrument may be left on.

5.7 Hearing protection must be worn when using mechanical systems to grind fish or tissue samples.

5.8 When using a scalpel, cut away from yourself. If you are holding something, cut away from your hand.

5.9 Primary Materials Used: The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Sulfuric Acid (1)	Corrosive, Oxidizer, Dehydradator	1 mg/m^3	This material will cause burns if comes into contact with the skin or eyes. Inhalation of vapors will cause irritation of the nasal and respiratory system.

Methylene Chloride	Carcinogen, Irritant	25 ppm-TWA, 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
Hexane	Flammable, Irritant	500 ppm-TWA	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.
Methanol	Flammable, Poison, Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Toluene	Flammable, Poison, Irritant	200 ppm-TWA 300 ppm-Ceiling	Inhalation may cause irritation of the upper respiratory tract. Symptoms of overexposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e. g. pins and needles) or numbness may be produced. Causes severe eye and skin irritation with redness and pain. May be absorbed through the skin.
Acetone	Flammable	1000 ppm-TWA	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
Nonane	Flammable	None established	Harmful if inhaled/swallowed. Vapor/mist is irritating to eyes, mucous memebranes and upper respiratory tract. Causes skin irritiation.
2-Propanol	Flammable	400 ppm -TWA	Flammable liquid and vapor. Harmful if swallowed or inhaled. Causes irritation to eyes and respiratory tract. Affects central nervous system. May be harmful if absorbed through the skin. May cause irritation to the skin.
Ethyl Ether	Flammable, Irritant, Peroxide Former	400 ppm-TWA	General anesthesia by inhalation can occur. Continued exposure may lead to respiratory failure or death. Early symptoms include irritation of nose and throat, vomiting, and irregular respiration, followed by dizziness, drowsiness, and unconsciousness. May cause irritation, redness and pain to the eyes. Irritating to the skin and mucous membranes by drying effect. Can cause dermatitis on prolonged exposure. May be absorbed through skin. **May form explosive peroxides on long standing or after exposure to air or light. This material must be disposed of with six months.**

Benzene	Flammable, Toxic, Carcinogen	PEL: 1 ppm TWA ; 5 ppm, 15 min. STEL	Causes skin irritation. Toxic if absorbed through skin. Causes severe eye irritation. Toxic if inhaled. Vapor or mist causes irritation to mucous membranes and upper respiratory tract. Exposure can cause narcotic effect. Inhalation at high concentrations may have an initial stimulatory effect on the central nervous system characterized by exhileration, nervous excitation and/or giddiness, depression, drowsiness or fatigue. Victim may experience tightness in the chest, breathlessness, and loss of consciousness.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

5.10 Chemicals that have been classified as **carcinogens**, **potential carcinogens**, or **mutagens include**: benzene, methylene chloride, polychlorinated biphenyls, and toluene. The toxicity or carcinogenicity of each reagent used in this method is not precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be kept to a minimum.)

5.11 Chemicals known to be **flammable** are: acetone, benzene, hexane, nonane, tetradecane, and toluene.

5.12 The following materials are known to be **corrosive**: sulfuric acid.

5.13 Exposure to chemicals will be maintained as low as reasonably achievable; therefore, unless they are known to be non-hazardous, all samples will be opened, transferred and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

5.14 The preparation of all standards, reagents, and glassware cleaning procedures that involve solvents will be conducted in a fume hood with the sash closed as far as the operations will permit.

5.15 Equipment goggles or a face shield **must** be used when employees are using solvents to rinse or clean glassware

5.16 The effluents of sample splitters for the gas chromatograph and roughing pumps on the mass spectrometer must be vented to the laboratory hood exhaust system or must pass through an activated charcoal filter.

5.17 Personal Hygiene: Thorough washing of hands and forearms is recommended after each manipulation and before breaks (coffee, lunch, and shifts).

5.18 Confinement: Work areas should be isolated and posted with signs. Glassware and tools should be segregated. Benchtops should be covered with plastic backed absorbent paper.

5.19 Waste: Good technique includes minimizing contaminated waste. Plastic bag liners should be used in waste cans.

5.20 Accidents: Remove contaminated clothing immediately, taking precautions not to contaminate skin or other articles. Wash exposed skin vigorously and repeatedly until medical attention is obtained.

5.21 All work must be stopped in the event of a known or potential compromise to the health or safety of laboratory personnel. The situation must be reported immediately to a laboratory supervisor.

6 Equipment and Supplies

Note: All glassware used in extraction and cleanup procedures is solvent rinsed 2 times before use with acetone, methylene chloride and hexane in that order. Pre-extract Soxhlet apparatus with toluene for at least 4 hours. Rerinse the glassware with all 4 solvents once. See SOP KNOX-QA-0002, current revision, "Glassware Cleaning", for details.

6.1 Equipment for sample preparation.

6.1.1 Laboratory fume hood of sufficient size to contain the sample preparation equipment listed below.

6.1.2 Tissue homogenizer - Laboratory blender with glass body and stainless steel blades.

6.1.3 Equipment for determining percent moisture.

6.1.3.1 Oven - Capable of maintaining a temperature of 105 ±5°C.

6.1.3.2 Desiccator.

6.1.4 Balances.

6.1.4.1 Top loading - Capable of weighing 10 mg.

6.2 Extraction apparatus.

6.2.1 Liquid/liquid extraction for water samples.

6.2.1.1 Graduated cylinder, 1-L capacity.

6.2.1.2 Separatory funnels, 250-, 500-, and 2000 mL, with fluoropolymer stopcocks.

6.2.2 Soxhlet/Dean-Stark (SDS) extractor for filters and solid/sludge samples.

6.2.2.1 Soxhlet - 50-mm ID, 200-mL capacity with 500-mL round bottom flask.

6.2.2.2 Soxhlet - 64 mm ID, 500-mL capacity with 1000-mL round bottom flask.

6.2.2.3 Glass condenser, capable of fitting top of Soxhlet or Dean Stark apparatus.

6.2.2.4 Thimble - Whatman high purity glass fiber thimbles

6.2.2.5 Dean Stark moisture trap, with fluoropolymer stopcock, to fit Soxhlet.

6.2.2.6 Heating mantles with temperature controls

6.3 Flasks, Erlenmeyer, 500 mL

6.4 Beakers, 500-mL.

6.5 Spatulas - Stainless steel.

6.6 Fluoropolymer squirt bottles, 500 mL

6.7 Filtration apparatus.

6.7.1 Pyrex glass wool – Solvent rinsed.

6.7.2 Glass funnel – 100 mm with short stem.

6.7.3 Buchner funnel – 15-cm.

6.7.4 Glass-fiber filter paper for Buchner funnel above.

6.7.5 Filtration flasks - 1.5- to 2.0-L, with side arm.

6.8 Cleanup apparatus.

6.8.1 Pipettes.

6.8.1.1 Glass, 1 mL, Class A.

6.8.1.2 Borosilicate glass, disposable, Pasteur, 150-mm long x 5-mm ID.

6.8.1.3 Borosilicate glass, disposable, Pasteur, 230-mm long x 5-mm ID.

6.8.1.4 Pipette Bulbs, rubber, disposable.

6.8.1.5 Gel permeation chromatography system (J2 Scientific Accu Prep or equivalent).

6.8.1.6 Bio Beads: (S-X3) -200-400 mesh, 70 gm (Bio-Rad Laboratories, Richmond, CA, Catalog 152-2750 or equivalent).

6.8.1.7 Chromatographic column: 700 mm x 25 mm ID glass column.

6.8.1.8 Ultraviolet detector: Fixed wavelength (254 nm) and a semi-prep flow-through cell.

6.8.2 Glass chromatographic columns.

6.8.2.1 All disposable columns are solvent rinsed before use. The solvents used are acetone, toluene, methylene chloride and hexane (in this order). Allow to air dry in a hood.

6.8.3 Oven-For baking and storage of absorbents, capable of maintaining a constant temperature (±5°C) in the range of 105-250°C.

6.9 Concentration apparatus.

6.9.1 Kuderna-Danish (K-D) concentrator.

6.9.1.1 Concentrator tube - 10 mL graduated.

6.9.1.2 Evaporation flask - 500 mL, attached to concentrator tube with springs.

6.9.1.3 Snyder column - Three-ball macro.

6.9.1.4 Boiling beads, 6 mm glass

6.9.1.5 Boiling chips. - PFTE - Extracted with methylene chloride.

6.9.1.6 Water bath - Heated, installed in a fume hood.

6.9.2 Nitrogen blowdown apparatus - Rapidvap (Labconco) and/or N-Evap (Organomation Associates, inc., South Berlin, MA), installed in a fume hood.

6.9.3 Sample vials

6.9.3.1 Borosilicate glass, 40 mL disposable with fluoropolymer cap

6.9.3.2 Mini vials, 1.1 mL capacity with a tapered bottom; with Teflon™-faced, rubber septa and screw caps.

6.10 Gas chromatograph - Shall have splitless or on-column injection port for capillary column, temperature program with isothermal hold, and shall meet all of the performance specifications in Section 10.

6.10.1 Column #1 - 30 ±5-m long x 0.25±0.02-mm ID; 0.25-µm film SPB-Octyl (Supelco 2-4218, or equivalent).

6.10.2 Column #2 - 60m x 0.32mm ID x 0.25µm film thickness DB-5 or RTX-5 fused silica capillary column (J&W No. 123-5062 or Restek No.10227) or equivalent.

6.10.3 Column #3 – GC/ECD Screening – 30m X 0.32mm ID X 0.25µm film thickness DB-5 or RTX-5 or equivalent

6.11 Mass spectrometer - Electron impact ionization, shall be capable of repetitively selectively monitoring 20 exact m/z's minimum at high resolution (≥10,000) during a period less than 1.0 second, and shall meet all of the performance specifications in Section 10.

6.12 GC/MS interface - The mass spectrometer (MS) shall be interfaced to the GC such that the end of the capillary column terminates within 1 cm of the ion source but does not intercept the electron or ion beams.

6.13 Data system - Capable of collecting, recording, and storing MS data.

6.14 GC-ECD system for Sample Screening – Agilent 5890, 6890 or equivalent.

7 Reagents and Standards

CAUTION: Refer to Material Safety Data Sheets (MSDS) for specific safety information on chemicals and reagents prior to use or as needed.

CAUTION: During preparation of reagents, associates shall wear lab coat, gloves, safety glasses with side shields, face shield (when using concentrated acid) and laboratory approved shoes as a minimum. Reagents shall be prepared in a fume hood.

7.1 Sulfuric acid - Reagent grade (specific gravity 1.84).

7.2 Sodium chloride - Reagent grade, prepare at 5% (w/v) solution in reagent water.

7.3 Sodium sulfate, reagent grade, granular, anhydrous (Baker 3375, or equivalent), rinsed with methylene chloride, stored in a desiccator, and stored in a pre-cleaned glass bottle with fluoropolymer lined screw-cap that prevents moisture from entering. If, after heating, the sodium sulfate develops a noticeable grayish cast (due to the presence of carbon in the crystal matrix), that batch of reagent is not suitable for use and should be discarded. Pre-cleaning of sodium sulfate by extraction with methylene chloride is required if contamination is indicated by reagent tests or method blanks that do not meet quality requirements.

7.4 Purified nitrogen.

7.5 Solvents - Acetone, toluene, n-hexane, 2-propanol, methanol, methylene chloride, ethyl ether and nonane; pesticide quality, from lots that have been approved for use by the Specialty Organics lab.

7.6 Reagent water - Water prepared by passing through carbon bed and ion exchange filters.

7.7 White quartz sand, 60/70 mesh - For Soxhlet/Dean-Stark extraction (Aldrich Chemical, Cat. No. 27-437-9, or equivalent). Placed in kiln at a temperature setting of approximately 450c for a minimum of 4 hours.

7.8 Florisil®, Pesticide residue (PR) grade (60/100) mesh; purchased activated at 1250°C (677°F), stored in glass container with fluoropolymer lined top. Fill a clean 1- to 2-L bottle 1/2 to 2/3 full with Florisil® and place in an oven at 125-135 °C for a minimum of 6 hours.

7.9 Perfluorokerosene (PFK) high boiling mass spectroscopy grade; bp 210-260°C; d^{20}_4 1.94; n^{20}_D 1.330; Fluka (Catalog No. - 77275).

7.10 Tetrabutylammonium hydrogen sulfate.

7.10.1 Tetrabutylammonium (TBA) sulfite reagent - Prepare the reagent by dissolving 3.39 g of tetrabutylammonium hydrogen sulfate in 100 ml of reagent water. To remove impurities extract this solution three times with 20 ml portions of hexane. After discarding the last hexane wash slowly add 25 g of sodium sulfite to the solution and shake bottle until the sodium sulfite dissolves. Record the date prepared, initials of the

preparer and expiration date on the bottle label. This solution can be stored for 1 month at room temperature in an amber bottle with a Teflon-lined lid.

NOTE: To prepare 50 ml of this reagent, halve the recipe listed above.

7.11 Sodium sulfite.

7.12 Standards and Calibration Solutions: Obtained as prepared solutions from Accustandard (New Haven, CT.), Cambridge Isotope Laboratories (CIL, Andover Massachusetts), and Wellington Laboratories (Guelph, Ontario, Canada). If the chemical purity is 98% or greater, the weight may be used without correction to compute the concentration of the standard. When not being used, standards are stored in the dark at room temperature in screw-capped vials with fluoropolymer-lined caps.

7.12.1 Native PCB Calibration Stock – Custom PCB Standard containing all 209 congeners used as Certified Reference Standard (Accustandard Product No S-9994-4x). Stock solution purchased at 4 µg/mL in isooctane. Once the ampoule has been sonicated and opened, the solution is transferred to an amber glass vial with fluoropolymer-lined cap and is used as received.

7.12.2 PCB Congener Mix 1 through 5 standard solutions containing all 209 isomers are Certified Reference Standards (Accustandard Product No's. M-1668A-1, M-1668A-2, M-1668A-3, M-1668A-4, M-1668A-5,). Stock solutions are purchased at 250-750 µg/mL in isooctane. Once the ampoule has been sonicated and opened, the solution is transferred to an amber glass vial with fluoropolymer-lined cap and is used as received. Initially (while setting up for this method) these five mixes are run in triplicate to determine the retention times for each of the congeners and which congeners will co-elute. The retention times and elution orders listed in Table 11 were confirmed by the analysis of individual congener standards procured from Accustandard.

7.12.3 Labeled PCB congener solutions used are Certified Reference Standards purchased from Cambridge Isotope Laboratories (CIL, Andover Massachusetts) and Wellington Laboratories (Guelph, Ontario, Canada) (see

7.12.4 Table 5). Stock solutions are purchased at 40µg/mL or 50µg/mL in nonane. Once the ampoule has been sonicated and opened, the solution is transferred to an amber glass vial with fluoropolymer-lined cap and is used as received.

7.12.5 Mixed stock standard solutions are prepared by diluting the stock solutions into nonane. The following mixed stock standard solutions are prepared;

7.12.5.1 Native PCB Secondary Stock solution: Prepared by combining the Native PCB Stock solutions referred to in section 7.12.1 and taking to a concentration of 3.0 ug/mL with nonane.

7.12.5.2 $^{13}C_{12}$ Labeled Internal Standard stock solution: Prepared by diluting the individual stock solutions of the $^{13}C_{12}$ labeled internal standards listed in section 7.12.3 and

7.12.5.3 Table 5 to a concentration of 1000 ng/mL in nonane.

7.12.5.4 $^{13}C_{12}$ Labeled Recovery Standard stock solution: Prepared by mixing the individual stock solutions of the $^{13}C_{12}$ labeled recovery standards listed in section 7.12.3 and

7.12.5.5 Table 5, resulting in a concentration of 1000 ng/mL.

7.12.5.6 $^{13}C_{12}$ Labeled Cleanup Standard Primary Stock solution: Prepared by diluting the individual stock solutions of the $^{13}C_{12}$ labeled cleanup standards listed in section 7.12.3 and

7.12.5.7 Table 5 to a concentration of 5000 ng/mL in nonane.

7.12.5.8 $^{13}C_{12}$ Labeled Surrogate Standard Primary Stock solution: Prepared by diluting the individual stock solutions of the $^{13}C_{12}$ labeled surrogate standards listed in section 7.12.3 and

7.12.5.9 Table 5 to a concentration of 5000 ng/mL in nonane.

7.12.6 Calibration Standard solutions (CS0.5 through CS5) are prepared by dilution of the stock standard solution prepared described section 7.12.1 in nonane and labeled stocks listed in section 7.12.5 . Table 6 shows the calibration solutions components and final concentrations. This series of solutions is used to establish linearity and relative response factors for all compounds in the initial calibration solutions. These RRFs are used to quantify PCB congeners in the calibration verification (VER) and all samples. The CS3 standard is used for calibration verification (VER). The VER solution is used to verify chromatographic performance, and to update retention times and relative retention times.

7.12.7 PAR PCB Spiking Solutions: Prepared by dilution of the stock standard solution prepared described section 7.12.1 to the concentrations specified in

7.12.8 Table 5 with acetone in a volumetric flask. 1.0 mL of this solution is added to each IPR or OPR sample prior to extraction. The concentration of this solution is verified by GC/MS before use.

Note: A low concentration PAR PCB spiking solution is prepared at 1 ng/mL for samples to be taken to a final volume of 20 µL (water samples). A high concentration PAR PCB spiking solution is prepared at 5 ng/mL for samples to be taken to 100 µL final volume (other matrices). The analyst must choose the correct solution to use for each sample.

7.12.9 $^{13}C_{12}$ Labeled Internal Standard Spiking Solutions: Prepared by diluting the $^{13}C_{12}$ labeled internal standard stock solution prepared in section 7.12.5.2 to the concentrations specified in

7.12.10 Table 5 with acetone in a volumetric flask. 1.0 mL of this solution is added to each sample prior to extraction. The concentration of this solution is verified by GC/MS before use.

Note: A low concentration $^{13}C_{12}$ labeled internal standard spiking solution is prepared at 2 ng/mL for samples to be taken to a final volume of 20 µL (water samples). A high concentration $^{13}C_{12}$ labeled internal standard spiking solution is prepared at 10 ng/mL for samples to be taken to 100 µL final volume (other matrices). The analyst must choose the correct solution to use for each sample.

7.12.11 $^{13}C_{12}$ Labeled Cleanup Standard Spiking solutions: Prepared by diluting the $^{13}C_{12}$ Labeled Cleanup Standard Primary Stock solution prepared in section 7.12.5.6 to the concentrations specified in

7.12.12 Table 5 with hexane in a volumetric flask. 1.0 mL of this solution is added to each sample prior to extraction. The concentration of this solution is verified by GC/MS before use.

Note: A low concentration $^{13}C_{12}$ labeled cleanup standard spiking solution is prepared at 2 ng/mL for samples to be taken to a final volume of 20 µL (water samples). A high concentration $^{13}C_{12}$ labeled cleanup standard spiking solution is prepared at 10 ng/mL for samples to be taken to 100 µL final volume (other matrices). The analyst must choose the correct solution to use for each sample.

7.12.13 $^{13}C_{12}$ Labeled Surrogate Standard Spiking solution: Prepared by diluting the $^{13}C_{12}$ Labeled Surrogate Standard Primary Stock solution prepared in section 7.12.5.8 to the concentration specified in

7.12.14 Table 5 with nonane in a volumetric flask. 100 uL of this solution is added to each XAD tube or PUF cartridge prior to sampling. The concentration of this solution is verified by GC/MS before use.

7.12.15 $^{13}C_{12}$ Labeled Recovery Standard Spiking solution: Prepared by diluting the $^{13}C_{12}$ Labeled Recovery Standard Stock solution prepared in section 7.12.5.4 to the concentration specified in

7.12.16 Table 5 with nonane in a volumetric flask. Depending upon the required final extract volume, 20uL or 100uL of this solution is added to each sample extract prior to analysis. The concentration of this solution is verified by GC/MS before use.

7.12.17 QC Check Sample - A QC Check Sample should be obtained from a source independent of the calibration standards. This check sample is a certified standard reference material (SRM) containing the PCBs in known concentrations in a sample matrix similar to the matrix under test. The National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland has an SRM 1944 – New York/New Jersey Waterway Sediment that the NYSDEC recommends for use.

7.12.18 Initial Calibration Verification Standard - A second source standard traceable to a national standard, if available.

8 Sample Collection, Preservation and Storage

8.1 Sampling is not performed for this method by STL Knoxville. For information regarding sample shipping, refer to SOP KNOX-SC-0003, Receipt and Log In of Commercial Samples, current revision

8.2 Collect samples in amber glass containers following conventional sampling practices.

Note: Sample preservation, if required, must be performed at the time of collection and is the responsibility of the sample collector in accordance with the clients Quality Assurance Project Plan. The methods referenced in section 15 provide sample collection and preservation guidance which may be used in the absence of a specific Quality Assurance Project Plan.

8.3 Sample Storage

8.3.1 Maintain aqueous samples at 0-4°C from the time of collection until receipt at the laboratory. Store aqueous samples in the dark at 0-4°C.

8.3.2 Maintain solid, semi-solid, oily, and mixed-phase, fish, and adipose tissue samples at <4°C from the time of collection until receipt at the laboratory. Fish and adipose tissue should be shipped with dry ice if at all possible. Store solid, semi-solid, oily, and mixed-phase in the dark at <-10°C, store fish, and adipose tissue samples in the dark at <-10°C.

8.4 Holding Times

8.4.1 If stored according to the conditions specified in 8.3, samples may be stored for up to one year.

8.4.2 Store sample extracts in the dark at room temperature until analyzed. If stored in the dark at room temperature, sample extracts may be stored for up to one year.

9 Quality Control

9.1 Initial precision and recovery (IPR) samples are analyzed to demonstrate the ability to generate acceptable precision and accuracy.

9.1.1 For aqueous samples, extract, concentrate, and analyze four 1-L aliquots of reagent water spiked with labeled internal standards and the precision and recovery standard according to the procedures in section 11. For non-aqueous samples, extract, concentrate, and analyze four aliquots of sand spiked with labeled internal standards and the precision and recovery standard according to the procedures in sections 11. All sample processing steps that are to be used for processing samples, including preparation, extraction, and cleanup shall be included in this test.

9.1.2 Using the results of the set of four analyses, compute the average concentration (X) of the extracts in ng/mL and the relative standard deviation (RSD) of the concentration in

ng/mL for each compound.

9.1.3 For each PCB and labeled compound, compare RSD and X with the corresponding limits for initial precision and recovery in Table 10. If RSD and X for all compounds meet the acceptance criteria, system performance is acceptable and analysis of blanks and samples may begin. If, however, any individual RSD exceeds the precision limit or any individual X falls outside the range for accuracy, system performance is unacceptable for that compound. Correct the problem and repeat the test.

9.2 Internal Standards

9.2.1 Every sample, blank, and QC sample is spiked with internal standards. Internal standard recoveries in samples, blanks, and QC samples must be assessed to ensure that recoveries are within established limits. When properly applied, results from isotope dilution techniques are independent of recovery. The recovery of each internal standard should be within the limits in Table 10. If the recovery is outside these limits the following corrective action should be taken:

- Check all calculations for error.
- Ensure that instrument performance is acceptable.
- Recalculate the data and/or reanalyze if either of the above checks reveal a problem.
- If the recovery of any internal standard is less than 25 percent, calculate the S/N ratio of the internal standard. If the S/N is > 10 and the estimated detection limits (EDL's) are less than the estimated minimum levels (EML's), report the data as is with qualifiers in the report and a discussion in the case narrative. If the S/N is < 10 or the estimated detection limits (EDL's) are greater than the estimated minimum levels (EML's), re-extract and re-analyze the sample. If the ion chromatogram of the PFK lock mass m/z indicates ion suppression in the region where the internal standard elutes, reanalyzing the extract at up to a 1/10 dilution may improve the internal standard recovery. If the poor internal standard recovery is judged to be a result of sample matrix, a reduced portion of the sample may be re-extracted or additional clean-ups may be employed. The decision to reanalyze or flag the data should be made in consultation with the client.

9.2.2 Refer to the QC Program document (QA-003) for further details of the corrective actions.

9.3 Method Blanks

9.4 A laboratory method blank must be run along with each analytical batch of 20 or fewer samples. The method blank consists of reagent water for aqueous samples, and a clean solid matrix (sand or sodium sulfate) for solid samples. Analyze the blank immediately after analysis of the OPR to demonstrate freedom from contamination. The method blank should not contain any of the compounds of interest at a concentration above the estimated minimum level (EML) shown in **Table 4**.

9.4.1 Corrective action is required when compounds of interest are detected in the method blank above the EML. Corrective action may include reanalysis of the method blank. Contact the Project Manager to determine further corrective action. At a minimum, all associated results are qualified with a B flag. Re-extraction and reanalysis of all samples associated with a contaminated method blank is required if requested by the client or Project Manager. Investigation of the source of the method blank contamination will be initiated before further samples are extracted.

9.4.2 The method blank must have acceptable internal standard recoveries. If internal standard recoveries are not acceptable, the data must be evaluated to determine if the method blank has served the purpose of demonstrating that the analysis is free of contamination. If internal standard recoveries are low and there are reportable analytes in the associated samples re-extraction of the blank and affected samples will normally be required. Consultation with the client should take place.

9.4.3 Refer to the QC Program document (QA-003) for further details of the corrective actions.

9.5 Instrument Blank

9.5.1 Instruments must be evaluated for contamination during each 12-hour analytical run. This may be accomplished by analysis of a method blank. If a method blank is not available, an instrument blank must be analyzed. An instrument blank consists of solvent with the internal standards and recovery standards added. It is evaluated in the same way as the method blank.

9.6 Ongoing Precision and Recovery (OPR) Sample

9.6.1 An ongoing precision and recovery (OPR) is prepared and analyzed with every batch of 20 samples. All analytes must be within established control limits specified in Table 10. The OPR is spiked with the compounds listed in

9.6.2 Table 5.

9.6.3 If any analyte in the OPR is outside the control limits, corrective action must occur. Corrective action may include re-extraction and reanalysis of the batch.

- If the batch is not re-extracted and reanalyzed, the reasons for accepting the batch must be clearly presented in the project records and the report.
- If re-extraction and reanalysis of the batch is not possible due to limited sample volume or other constraints the OPR is reported and the failure is documented in the project narrative.

9.7 QC Check Sample - Analyze the QC Check Sample (section 7.12.17) periodically to assure the accuracy of calibration standards and the overall reliability of the analytical process. It is suggested that the QC Check Sample be analyzed at least annually.

10 Calibration and Standardization

10.1 Two types of calibration procedures are required. One type, initial calibration, is required before any samples are analyzed and may be required intermittently throughout sample analyses as dictated by the results of continuing calibration procedures described below. The other type, continuing calibration, consists of analyzing the continuing calibration verification solution (VER). No samples are to be analyzed until acceptable calibration as described in sections 10.2 and 10.2.8 is demonstrated and documented.

10.2 Initial Calibration

Initial calibration is required before any samples are analyzed for PCBs. Initial calibration is also required if any continuing calibration (section 10.2.8) does not meet the required criteria in section 10.2.7.

10.2.1 Prepare multi-level calibration standards containing the compounds and concentrations as specified in Table 6. Calibration standards should be stored at room temperature and preferably in amber vials. Calibration standard solutions have an expiration date of ten (10) years from date of receipt unless otherwise specified by the manufacturer/supplier.

10.2.2 Establish operating parameters for the GC/MS system (suggested operating conditions are displayed in Figure 1 and Figure 2). By using a PFK molecular leak, tune the instrument (see the appropriate instrument manufacturer's operating manual for tuning instructions) to meet the minimum resolving power of 10,000 (10 percent valley) at m/z 192.98882 (PFK). By using peak matching conditions and the aforementioned PFK reference peak, verify that the exact masses of m/z 230.98563 (PFK) and 268.98243 (PFK) are within 5 ppm of the required value. Document that the resolving power at reduced accelerating voltages of m/z 230.98563 (PFK) and 268.98243 (PFK) are greater than 10,000 (10 percent valley).

10.2.2.1 Check the resolution and mass accuracy as described above for the following ion sets: m/z 268.98243, 292.98243, 342.97924; 372.97924, 380.97605, 430.97285; 404.97604, 442.97285, 504.96966 (PFK). Iteratively adjust operating parameters and tuning values until the resolution and mass accuracy criteria are met. Document the resolution and mass accuracy for each of the ion sets.

10.2.3 Analyze 2µL of each of the five individual PCB mixtures (section 7.12.1). Repeat the series twice more in succession to provide 3 runs of each mix. It is not necessary to interrupt this analytical sequence to perform a 12-hour resolution check. Set the switch-points for the MID descriptors. The switch-points must be set to insure that the first and last eluting isomer of each homolog group and the labeled internal standards are acquired properly. Determine the average retention time of each PCB congener using the elution order information in Table 11.

Note 1: PCB Mixture 5 (M-1668A-5) contains the first and last eluting isomer in each homolog group for the SPB-Octyl column (see Table 7 and Table 11).

Note 2: Laboratory data has indicated that the SPB-Octyl column can exhibit significant differences in performance from column to column. It has also been indicated that the column's performance can change significantly due to oxidation with subsequent changes in congener retention times and elution order. The individual PCB mixtures should be analyzed whenever the column's performance or specific congeners retention times are in doubt.

10.2.4 Calculate the relative retention time for all native and labeled congeners, using their retention time references from Table 2. Calculate the relative retention time window using the absolute retention time windows from Table 2.

$$\text{RRT Limit Low} = \frac{RT_A - (RT_{WIN}/2)}{RT_{IS}}$$

$$\text{RRT Limit High} = \frac{RT_A + (RT_{WIN}/2)}{RT_{IS}}$$

Where

RT_A = Average retention time of analyte

RT_{IS} = Average retention time of RT reference.

RT_{WIN} = Absolute RT window in seconds from Table 2

10.2.5 Inject a 2 µL aliquot of the CS0.5 calibration solution.

10.2.5.1 Retention Times and Relative Retention Times.

10.2.5.1.1 Adjust the chromatographic conditions and scan descriptors until the RT and RRT for all congeners are within the windows in Table 2. If the GC is utilizing Electronic Pressure Control (EPC) it is not necessary to match the RT and RRT's in Table 2. Instead the actual RT's and RRT's must be documented and used for sample qualitative determinations.

10.2.5.1.2 The absolute retention time of CB 209 must exceed 55 minutes. Otherwise the GC temperature program must be adjusted and the test repeated until the requirement is met. If the GC is equipped with Electronic Pressure Control (EPC) the absolute RT criteria of CB 209 may be rendered obsolete.

10.2.5.2 Ion abundance ratios, minimum levels, and signal-to-noise ratios.

10.2.5.2.1 Measure the SICP areas for each congener or congener group, and compute the ion abundance ratios at the exact m/z's specified in Table 8. Compare the computed ratio to the theoretical ratio given in Table 9.

10.2.5.2.2 All CBs and labeled compounds in the CS0.5 standard must be within the QC limits in Table 9 for their respective ion abundance ratios; otherwise, the mass spectrometer must be adjusted and this test repeated until the m/z ratios fall within the limits specified. If the adjustment alters the resolution of the mass spectrometer, resolution must be verified (Section 10.2.2) prior to repeat of the test.

10.2.5.2.3 Verify that the HRGC/HRMS instrument meets the estimated minimum levels (EMLs) in Table 4. The peaks representing the CBs and labeled compounds in the CS0.5 calibration standard must have signal-to-noise ratios (S/N) $\geq$ 10; otherwise, the mass spectrometer must be adjusted and this test repeated until the minimum levels in Table 4 are met.

10.2.5.2.4 An exception to the ion abundance ratio and signal to noise ratio requirements is the secondary ion for dichlorinated biphenyls (m/z 223.9974). High background from PFK fragments at 223.9974 results in noise levels which exceed 10% of the signal height at levels that are reliably quantifiable.

10.2.6 Analyze 2µL of each of the other calibration standards.

10.2.6.1 Isomer specificity.

10.2.6.1.1 Use the CS-3 calibration standard to evaluate column performance. The toxic isomers must be uniquely resolved from all other congeners. Isomers may be unresolved so long as they have the same TEF and response factor and so long as these unresolved isomers are uniquely resolved from all other congeners. For example, the SPB-Octyl column achieves unique GC resolution of all Toxics except congeners with IUPAC numbers 156 and 157. This isomeric pair is uniquely resolved from all other congeners and these congeners have the same TEF and response factor.

10.2.6.1.2 Evaluate and document the percent valley between PCBs 34 and 23. The valley height must be less than 40 percent of the height of the shorter of the two peaks.

10.2.6.1.3 Evaluate and document the percent valley between PCBs 187 and 182. The valley height must be less than 40 percent of the height of the shorter of the two peaks.

10.2.6.1.4 Column to column variations in the SPB-Octyl phase significantly affects the resolution of isomers 156 and 157. Document the percent valley between the isomers. If the %valley is < 40% then calculate the isomers as non-coeluting peaks. If the %valley is > 40% then calculate the isomers as co-eluting peaks.

10.2.6.2 Calculate the RRF of each compound of interest (target analytes, internal standards, cleanup standards, and surrogate standards) vs. the appropriate reference standard (as specified in Table 2) using the following equation;

$$RRF = \frac{As \times Cis}{Ais \times Cs}$$

where:

As = sum of the areas of the quantitation ions of the compound of interest
Ais = sum of the areas of the quantitation ions of the appropriate reference standard
Cis = concentration of the appropriate reference standard
Cs = concentration of the compound of interest

10.2.6.3 Calculate the mean relative response factor (mean RRF) and the percent relative standard deviation (RSD) of the relative response factors for each compound of interest in the six calibration standard solutions using the following equations;

$$\overline{RRF}_{n=6} = \frac{1}{n} \times \sum_{i=1}^{n} RF_i$$

$$RSD_{n=6} = \sqrt{\frac{\sum_{i=1}^{n} \left(RF_i - \overline{RF}\right)^2}{n-1}} \times \frac{100}{\overline{RRF}}$$

10.2.6.4 Assign the retention time for all native and labeled congeners using the average of triplicate analyses (section 10.2.3) of the 5 congener mixes described in section 7.12.2.

10.2.7 Criteria for Acceptable Calibration - The criteria listed below for acceptable calibration must be met before sample analyses are performed. If acceptable initial calibration is not achieved, identify the root cause, perform corrective action, and repeat the initial calibration. If the root cause can be traced to problems with an individual analysis within the calibration series, repeat the individual analysis and recalculate the percent relative standard deviation. If the calibration is acceptable, document the problem and proceed, otherwise repeat the initial calibration.

10.2.7.1 The percent relative standard deviation (RSD) for the mean relative response factors for the unlabeled native analytes calculated by isotope dilution must not exceed ± 20 percent. The percent RSD for the mean relative response factors for the unlabeled native analytes calculated by internal standard must not exceed ± 35 percent. The percent RSD for the mean relative response factors for the labeled standards must not exceed ± 35 percent.

10.2.8 Analyze 2µL of the Initial Calibration Verification (ICV) Standard in section 7.12.18.

Calculate the concentration of the ICV using the RRF's from the CS3 standard analyzed in section 10.2.5. Calculate the percent difference (%D) between the expected and the calculated ICV concentration using the following formula.

$$\%D = \frac{(C_{Exp} - C_{Calc})}{C_{Exp}} \times 100$$

Where:

C_{Exp} = The expected concentration of the ICV Standard.
C_{Calc} = The calculated concentration of the ICV Standard.

10.2.8.1 The general criteria for percent difference acceptance limits is less than or equal to ±35% for all native and labeled compounds. The warning limits for percent difference is ±35 - 55%.

10.2.8.2 All data associated with compounds with percent differences in the warning limits must be reviewed before acceptance.

10.2.8.3 All data associated with compounds with percent differences outside the warning limits shall be documented as an NCM. Corrective action must be taken and may include the following

- Reanalyze the ICV Standard
- Replace and reanalyze the ICV Standard
- Evaluate the instrument performance
- Evaluate the Initial Calibration Standards

10.3 Continuing Calibration

10.3.1 Continuing calibration is performed at the beginning of a 12-hour period after successful mass resolution check.

10.3.2 Document the mass resolution performance as specified in section 10.2.2 at both the beginning and end of the 12-hour period.

10.3.3 Analyze 2µL of the Continuing Calibration Verification Standard (VER). Calculate the concentration (C) of the compounds of interest (target analytes, internal standards, cleanup standards, and surrogate standards) vs. the appropriate reference standard (as specified in Table 2) using the following equation:

$$C = \frac{As \times Cis}{Ais \times RRF}$$

where:

As = sum of the areas of the quantitation ions of the compound of interest
Ais = sum of the areas of the quantitation ions of the appropriate reference standard

Cis = concentration of the appropriate reference standard
RRF= mean relative response factor from section 10.2.6.3

10.3.4 Calculate the percent of the calculated concentration relative to the test concentration and compare it to the limits specified in Table 10 using the following equation:

$$C_{ver}\% = \frac{C_{ver}}{C_{test}} \times 100$$

where:

C_{ver} = the concentration of the VER standard calculated in section 10.3.3
C_{test} = the test concentration of the VER standard listed in Table 10.

10.3.5 Criteria for Acceptable Calibration - The criteria listed below for acceptable calibration must be met before sample analyses are performed. If the acceptance criteria is met the calibration is deemed to be in control and the RRF's generated from the initial calibration are used to quantify samples. If acceptable calibration is not achieved, identify the root cause, perform corrective action, and repeat the continuing calibration. If a second consecutive attempt at a continuing calibration fails, two consecutive calibrations must meet the criteria, or an initial calibration must be run before proceeding with client samples.

10.3.5.1 The ion abundance ratios of the peaks representing the Toxics/LOCs and labeled standards must be within the specified control limits specified in Table 9.

10.3.5.2 The S/N for the GC signals present in every SICP (including the ones for the labeled standards) must be ≥ 10.

10.3.5.3 The percent of the calculated concentration relative to the test concentration (target analytes, internal standards, cleanup standards, and surrogate standards) must be within the limits in Table 10.

10.3.5.4 For Toxic and LOC congeners, as listed in the first section of Table 10, the percent of the calculated concentration relative to the test concentration is within 70-130%.

10.3.5.5 For non-Toxics/LOCs if the percent of the calculated concentration relative to the test concentration is within 70-130% then the ICAL RF for that congener is used. If the calculated concentration relative to the test concentration is not within 70-130% but is within 40-160% then calculate the RF from the VER standard for that congener and use it to calculate any associated samples run during that 12 hour shift.

10.3.5.6 The absolute retention times (RT) of the labeled internal standards must be within ±15 seconds of the retention times obtained during initial calibration.

10.3.5.7 The relative retention times (RRT) of the Toxics/LOC congeners must be within their respective RRT limits in Table 2. If the GC is utilizing Electronic Pressure

Control (EPC) it is not necessary to match the RT and RRT's in Table 2. Instead the actual RT's and RRT's must be documented and used for sample qualitative determinations.

10.3.5.7.1 If the RRT's or RT's are not within the limits above, the GC may not be performing properly. However, routine column maintenance may include removing short amounts of the beginning of the column when active sites or non-volatile compounds in sample extracts cause poor chromatography and loss of specificity. Shortening of the column can cause the RRT's or RT's to fall outside the above limits.

10.3.5.7.2 When the RRT of any compound or the RT of any internal standard is not within the above limits corrective action must be taken. If the GC is not performing properly, correct the problem and repeat the test. If the GC is performing properly but the RRT's or RT's have changed due to routine column maintenance, update the RT's and the RRT's from the VER to identify the target analytes. Alternatively, adjust the GC and repeat the test or recalibrate, or replace the GC column and either verify calibration or recalibrate.

10.3.5.8 Evaluate and document the percent valley between PCBs 34 and 23. The valley height must be less than 40 percent of the height of the shorter of the two peaks.

10.3.5.9 Evaluate and document the percent valley between PCBs 187 and 182. The valley height must be less than 40 percent of the height of the shorter of the two peaks.

10.3.5.10 If PCBs 156 and 157 have been classified as uniquely resolved at the most recent initial calibration, the valley between the two must be less than or equal to 50% the lower of the two peaks. If this cannot be demonstrated, the resolution must be reestablished, or a new initial calibration must be analyzed.

10.3.6 Daily calibration must be performed every 12 hours of instrument operation. The 12-hour shift begins with the documentation of the mass resolution followed by the injection of the Continuing Calibration Standard (VER).

11 Procedure

11.1 One time procedural variations are allowed only if deemed necessary in the professional judgement of supervision to accommodate variations in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variations in the procedure, except those specified by project specific instructions, shall be completely documented using a Nonconformance Memo and approved by a Technical Specialist, Project Manager, and QA Manager. If contractually required, the client shall be notified.

Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

11.2 Samples are extracted by the following procedures depending upon sample matrix. Water

samples are prepared by separatory funnel liquid/liquid extraction. Solid samples including soils, sediments, tissues, XAD tubes, PUF cartridges, and solid waste materials are prepared by Soxhlet extraction. Non-aqueous liquid wastes and organic solvents are prepared by waste dilution techniques.

NOTE: Samples should be removed from the refrigerator several hours before extraction and allowed to come to room temperature before measuring the volume or performing the extraction.

11.3 Aqueous Samples (samples containing 1% solids or less.)

11.3.1 Refer to Knoxville SOP, KNOX-QA-0002, current revision, for information on glassware cleaning procedures for extraction glassware.

11.3.2 Place separatory funnels, one for each sample, in the rings attached to the latticework set up in the hood.

11.3.3 Place the 600 mL Rapid-Vap concentrator tube directly beneath the separatory funnel.

11.3.4 Plug the glass funnel with glass wool and pour in some sodium sulfate (about 1 to 2 inches from the top). Rinse the sodium sulfate with methylene chloride. After the funnel stops dripping, place the funnel on top of the flask that is fitted with a paper clip to aid in filtering.

11.3.5 Inspect the sample for solids or biphasic sample characteristics. If either condition exists, consult the project manager for further instructions. Mark the level of the sample on the sample bottle in order to measure the volume later and carefully add the sample to the separatory funnel, taking care not to spill any sample. For the method blank and the OPR, use a 1000 mL graduated cylinder to measure 1000 mL of reagent water.

11.3.6 Verify the specified final volume of the extract. If the standard 20 µL is specified, use low-level spiking solutions. Add 1 mL of the low-level ^{13}C labeled internal standard spiking solution, specified in section 7.12.9, to the sample. For the IPR or OPR, add 1 mL of the low-level PAR PCB Spiking Solution as specified in section 7.12.7. Record the amount of spike used and the spike standard number in the standards logbook and on the benchsheet.

11.3.7 Add 60 mL of methylene chloride to the sample bottle and shake. Then add the methylene chloride to the separatory funnel.

11.3.8 Extract the sample by shaking the separatory funnel for 2 minutes.

CAUTION: Care should be used while performing this operation. Vent the separatory funnel frequently. Goggles should be worn when performing this procedure.

11.3.9 Allow the water and the methylene chloride to separate for 10 minutes. If it is not separated after 10 minutes, try to break up the emulsion by gently swirling the sample or tilting the separatory funnel on its side.

11.3.10 Drain the methylene chloride from the separatory funnel into the glass funnel that is filled with sodium sulfate, allowing the extract to drip into the KD flask or round bottom flask. Be careful not to allow water to escape the separatory funnel or the sodium sulfate will harden and block the flow of the extract. When an emulsion is present, do not drain the emulsion until the third methylene chloride shake has been completed (see section 11.3.12).

11.3.11 Repeat steps 11.3.7 through 11.3.10 two more times.

11.3.12 After the third methylene chloride portion has filtered through the sodium sulfate, rinse the funnel with approximately 40 mL of methylene chloride.

11.3.13 Remove the separatory funnel from the hood and pour the extracted water into the extracted waters waste carboy.

11.3.14 Fill the empty sample bottle to the marked level with tap water. Pour the tap water into a 1000 mL graduated cylinder. Record the volume of sample used on the benchsheet.

11.3.15 Remove the glass funnel from the top of the KD flask or the round bottom flask, attach a Snyder column to the KD flask or round bottom flask and place in a steam bath or heating mantle. Prewet the Snyder column by adding approximately 1 mL of solvent through the top. Adjust the water temperature or heating mantle as required to achieve the proper rate of distillation. At the proper rate, the balls of the column will actively chatter but the chambers will not flood.

11.3.16 Once the sample is concentrated down to 10 mL, add 50 mL of hexane and concentrate to approximately 10 mL again. Do not allow the sample to go to dryness at any time!

11.3.17 If a KD flask is used, remove the Snyder column, then rinse the KD flask with 2 mL of hexane; that is allowed to drain into the concentrator tube. The concentrator tube is then taken off the KD flask and the ground glass joint of the KD flask is rinsed with a small amount of hexane into the concentrator tube. The sample is then either transferred to a 40 mL vial for acid wash or the concentrator tube is placed on the nitrogen blowdown apparatus and the volume is reduced to 2 mL in preparation for running the sample through Florisil column clean-up. Do not allow the sample to go to dryness at any time!

11.3.18 If a round bottom flask is used, remove the Snyder column, then transfer the extract into a 40 ml vial and then rinse three times with 3 ml (each time) of hexane. The sample is then either ready for acid wash or the 40mL vial is placed on the nitrogen blowdown apparatus and the volume is reduced to 2 mL in preparation for running the sample through florisil column clean-up. Adjust the final volume of the extract with hexane to 15 mL for acid cleanup or 2 mL for column cleanup. Do not allow the sample to go to dryness at any time!

11.3.19 Proceed to section 11.8.

11.4 Solid Sample Screening and Assignment of Sample Preparation Protocols

11.4.1 Tare a 40 mL voa vial

11.4.2 Add a 1 +/- 0.1 g sub-sample in accordance with the Knox-QA-0006.

11.4.3 Add 1.0 mL of 8082 surrogate mix.

11.4.4 Add 9 mL of hexane.

11.4.5 Cap tightly, and secure on a platform shaker table.

11.4.6 Shake for 1 hour, minimum.

11.4.7 Filter, using a small funnel fitted with a GF filter paper and a small amount of Sodium Sulfate into a 12ml vial marked at 10.0 ml.

11.4.8 If extract is colored in any way, transfer approximately 4ml into a fresh 12ml vial, add approximately 4ml of Sulfuric Acid, cap tightly, and shake the vial for 30 seconds.

11.4.9 Mark the vial with the work-order ID followed by "AW" and deliver both extracts to the GC analyst.

11.4.10 Perform a calibration check on the screening instrument. If the %D for both Aroclors and Surrogates is within +/-30 percent from the initial calibration, analyze the sample extracts within 12 hours of the calibration check.

11.4.11 If no pattern and no prominent peaks are present at the 1.0 ppb reporting limit, process the sample using Protocol 1.

11.4.12 If an Aroclor-like pattern is observed, calculate the estimated concentration of the largest peak expected in the determinative analysis, and assign a protocol. Use the spreadsheet named "PCB Protocol Selection" found at knxsvr1\msoffice\templates, to perform the following steps:

11.4.12.1 Calculate the concentration of the most prominent technical mixture, by comparison to Aroclor standards. (Enter the Aroclor concentration on the spreadsheet, in ppb). Circle the amount entered on the gc hardcopy result.

11.4.12.2 Correct the concentration for surrogate recovery. (Enter the average, or selected recovery in the spreadsheet.)

11.4.12.3 Multiply the concentration by 0.1 (the spreadsheet default) to correct for the weight percent of the largest single congener in an Aroclor mix. (This is done by the spreadsheet.) This value may be changed to represent special cases, such as altered patterns, or unusual technical mixtures, but documentation of the rationale must accompany the spreadsheet.

11.4.12.4 Multiply the concentration by 4 to account for single-peak coelutions. (This is done by the spreadsheet).

11.4.12.5 The resulting concentration is used as the estimate for the largest peak expected in the determinative analysis. Assign the protocol for each sample according to Table 12.

11.4.12.6 Have an independent analyst review the data entry, and protocol assignments, initial and date the spreadsheet. Attach the spreadsheet and supporting GC data to the bench worksheets.

11.4.12.7 Adjust the sample volume, spiking volume, split ratio, final volume value, and bench dilution to reflect the selected protocol.

11.5 Solid Sample Extraction (samples containing more than 1% solids.)

11.5.1 Sample Pretreatment

11.5.1.1 Tissue Samples – This section uses protocol 1 as an example. If another protocol has been assigned, the sample amount extracted, spike volumes and percent of extract used is modified based on section 11.4.12

11.5.1.1.1 If the sample matrix is tissue and has not been homogenized prior to sample receipt, the entire sample is blended to provide a homogeneous sample.

11.5.1.1.2 Cut tissue into pieces of a uniform size (approximately 1 inch square). Homogenize the tissue sample in a laboratory blender.

11.5.1.1.3 Weigh out 10 grams of the homogenized tissue sample. Add the 10 g sample along with 20 g of sodium sulfate to a laboratory blender. Blend the tissue/sodium sulfate mixture, while adding dry ice as necessary, to achieve a powder like consistency.

11.5.1.1.4 Record the sample and weight on the sample prep sheet.

11.6 Soxhlet Extraction This section uses protocol 1 as an example. If another protocol has been assigned, the sample amount extracted, spike volumes and percent of extract used is modified based on section 11.4.12

11.6.1.1 Prepare and label the required number of Soxhlet systems.

11.6.1.1.1 The Soxhlet is prepared by cleaning and rinsing per section 5, adding an extraction thimble and glass wool plug to the Soxhlet body, charging the boiling flask with solvent, assembling the components, and precleaning by reflux for 4 hours before use.

11.6.1.2 Transfer a well-mixed 10 g aliquot of the solid sample, or the pretreated sample into a glass microfiber extraction thimble (+/- 0.05 grams). Record the sample and weight on the sample prep sheet. If the entire sample is to be analyzed (XAD, filters, etc.), transfer the entire sample to the Soxhlet extractor. If an extraction

thimble is not being used, sandwich the sample between glass wool plugs in the extractor. Small portions of acetone may be used to aid in the transfer of XAD. If necessary, weigh the XAD sampling tube both before and after the XAD is removed and record the weights.

11.6.1.3 Sand, baked at 450° C, is used for the blank and OPR. Transfer 10g of sand into an extraction thimble. Record the sample weight on the sample prep sheet.

11.6.1.3.1 If the matrix is tissue samples, sodium sulfate is used for the blank and OPR. Transfer 20 grams of the sodium sulfate and several small chips of dry ice into an extraction thimble. Record the sample weight on the sample prep sheet.

11.6.1.4 Spike each sample with 1 mL of the internal standard solution (see section 7.12.9) and add a small amount of glass wool to the top of the extraction thimble.

11.6.1.4.1 Spike the OPR with 1 mL of the native spiking solutions (see section 7.12.7) prior to adding the glass wool.

11.6.1.5 Pour approximately 350 mL of the extraction solvent into a 500 mL round bottom flask. Place the flask in the heating mantle. Add about 10-15 boiling beads and several Teflon™ boiling chips.

Note: Hexane/Acetone is the preferred solvent to be used for extraction but in certain cases (i.e. XAD extraction) MeCl2/Acetone may be a better choice.

11.6.1.6 Place the extraction thimble in the glass Soxhlet extractor.

11.6.1.7 Assemble the Soxhlet system and secure to the lab supports.

11.6.1.8 Adjust the temperature of the heating mantle to bring the solvent in the round bottom flask to a rolling boil. There should be a steady drip from the condensers so that the solvent should completely cycle at least 5 times an hour.

11.6.1.9 Soxhlet extract the sample in the above manner for 16 hours.

11.6.1.10 Turn off the heating mantle and allow the Soxhlet apparatus to cool.

11.6.1.11 Remove the condensers and allow the Soxhlet extractor chamber to empty, then remove the Soxhlet extractor from the 500 mL round bottom flask. Add a few Teflon™ boiling chips to allow smooth boiling.

11.6.1.12 Insert a three-ball macro Snyder column into the top of the 500 mL round flask. Prewet the Snyder column by adding approximately 1 mL of solvent through the top.

11.6.1.13 Place the 500 mL flask back into the heating mantle and reduce the extract volume to approximately 5 mL. Alternatively, transfer the extract to the Rapidvap concentrator tube rinsing the 500 mL flask 3 times with small amounts of

MeCl2/Acetone or Hexane/Acetone. Add the rinsings to the concentrator tube and evaporate the extract to 1 mL using the Rapidvap vortex concentrator. Do not allow the sample to go to dryness at any time!

11.6.1.14 Transfer the extract into a 40 mL vial, rinsing the 500 mL flask or concentrator tube 3 times with 3 mL of MeCl2/Acetone or Hexane/Acetone. Add the rinsings to the 40 mL vial.

11.6.1.15 Place the 40 mL vials into the N-EVAP concentration device and reduce the volume to approximately 0.5 mL. Do not allow the sample to go to dryness at any time. Add 5 mL of hexane and swirl the vial. Reduce the volume of hexane to approximately 0.5 mL again to complete the solvent exchange. Adjust the final volume of the extract with hexane to 15 mL for acid cleanup or 2 mL for column cleanup. If the sample exhibits poor solubility in hexane, add approximately 1 mL of benzene with a pipette to the vial to aid in dissolving the sample. Proceed to section 11.8.

11.7 Waste Sample Extraction

11.7.1 Organic wastes, oil, solids that will dissolve in solvent, and non-aqueous sludge samples may be prepared by the waste dilution technique.

11.7.2 Add an appropriate amount of sample (e.g. 1.0g) to a 40 mL VOA vial. Spike the sample with 1 mL of the internal standard spiking solution (see section 7.12.9). Record the spike solution number and the volume spiked. Add hexane to bring the volume to 15 mL. If the sample exhibits poor solubility in hexane, add approximately 1 mL of benzene with a pipette to the vial to aid in dissolving the sample. Proceed to section 11.8.

11.7.3 Record the weights and volumes used on the laboratory bench sheets.

11.8 Extract Cleanup

11.8.1 If the sample is to be analyzed for PCB's only, use the entire extract for the cleanup procedures. If additional analyses (example: Dioxins, Pesticides, PAH's, or Semi-volatiles) are to be performed on the extract, split the extract in equal portions for each analysis. Label each split portion with the sample ID and the analysis. Proceed with cleanup on the portion labeled for PCB analysis.

11.8.2 Spike each sample extract with 1 mL of the cleanup standard solution (see section 7.12.11).

11.8.3 Acid Cleanup

11.8.3.1 The acid cleanup is employed when sample extracts are colored and/or oily in appearance.

11.8.3.2 Slowly add 15 mL of concentrated sulfuric acid to the 15 mL extract in the 40 mL vial and shake for 2 minutes. If an emulsion forms, discontinue shaking. Vent the

vial frequently while shaking. Let the vial stand for a minimum of 10 minutes and remove the aqueous layer with a glass pipette. Repeat the acid washing until no color is visible in the acid layer (perform a maximum of four acid washings).

11.8.3.3 Add 15 mL 5% (w/v) aqueous sodium chloride to the vial and gently shake for 2 minutes. Vent the vial frequently while shaking. Let the vial stand for 10 minutes and remove the aqueous layer with a glass pipet. Dry the hexane extract by adding 1 to 2 grams of sodium sulfate and swirling the vial.

11.8.3.4 Reduce the extract volume to approximately 2 ml.

11.8.3.5 Proceed to Florisil® cleanup.

11.8.4 Florisil® Column Cleanup

11.8.4.1 Place a small ball of glass wool in the bottom of a glass chromatography column.

11.8.4.2 Attach the column to the lab support in the hood.

11.8.4.3 Pack the Florisil® column with the following layers. Add the column packing while tapping the column to settle the contents to prevent channeling. The order of the layers is from bottom to top.

11.8.4.3.1 Layer 1 - 8 cm (15 g) of Florisil®.

11.8.4.3.2 Layer 2 - 2 cm (2 g) of sodium sulfate.

11.8.4.4 Place a 500 mL KD or 500 mL round bottom flask under each column to catch the solvents as they filter through the column.

11.8.4.5 Pour 200 mL of 6% diethyl ether in hexane (v/v) into a graduate cylinder and save for later use in the procedure (one graduate cylinder for each column).

11.8.4.6 Wet the column with hexane to remove any air bubbles and discard this hexane into the solvent waste. Take care not to let the column drip dry at any time during this procedure.

11.8.4.7 Just before the level of hexane reaches the top of the sodium sulfate layer, transfer the sample extract into the top of the column. Rinse the vial 3 times with 2 mL portions of hexane and add these rinsings to the column.

11.8.4.8 Just before the sample volume reaches the top of the sodium sulfate, pour the 200 mL of 6% diethyl ether in hexane (v/v) into the top of the column and allow this to drip through the column and into the 500 mL KD flask.

11.8.4.9 Insert a three-ball macro Snyder column into the top of the 500 mL flask. Prewet the Snyder column by adding approximately 1 mL of solvent through the top.

11.8.4.10 Place the 500 mL flask into the steam bath or heating mantle and reduce the extract

volume to approximately 5 mL.

11.8.4.11 If a KD flask is used, remove the Snyder column, then rinse the KD flask with 2 mL of hexane that is allowed to drain into the concentrator tube. The concentrator tube is then taken off the KD flask and the ground glass joint of the KD flask is also rinsed with a small amount of hexane into the concentrator tube.

11.8.4.12 If a round bottom flask is used, remove the Snyder column, then transfer the extract into a 40 ml vial and then rinse three times with 3 ml (each time) of hexane. Place the concentrator tube or 40 mL vial containing the extract in the N-EVAP concentration apparatus and reduce the solvent volume to approximately 0.3 ml.

11.8.4.13 Transfer the concentrated extract into a 1.1 mL tapered mini-vial, rinsing 2 times with small amounts of hexane. Label the mini vial with the sample ID.

11.8.4.14 For aqueous samples, add 20 µL of the recovery standard solution (see section 7.12.15) to the mini-vial before transferring the extract into the minivial. Then reduce the extract volume back down to 20 µL. Take the mini-vial to the GC/MS lab for analysis.

11.8.4.15 For all other samples, add 100 µL of the recovery standard solution (see section 7.12.15) to the mini-vial before transferring the extract into the minivial. Then reduce the extract volume back down to 100 µL. If the extract has been split for other analyses, adjust the final volumes and recovery standard amounts by the split factor to achieve a comparable analysis sensitivity (example: Extract split in half for PCB and Dioxin analysis, use 50 µL of recovery standard solution and concentrate to a final volume of 50 µL).

11.8.4.15.1 If the sample has had a protocol other than protocol 1 assigned, dilute the extract with nonane to achieve the dilution factor shown in Table 12. Take the mini-vial to the GC/MS lab for analysis.

11.8.5 Sulfur clean-up by Tetrabutylammonium (TBA)

11.8.5.1 Bring the sample extract to between 5 ml and 10 ml in a 40 ml vial. Caution: Do not let the extract volume drop below 1 ml, as loss of analytes may occur.

11.8.5.2 Add 1.0 ml of TBA sulfite reagent and 2.0 ml of 2-propanol to the vial containing the extract. Shake the vial vigorously for 1 minute.

11.8.5.3 If the extract is colorless or the initial color is unchanged and if clear crystals (precipitated sodium sulfite) are observed, sufficient sodium sulfite is present. If the precipitated sodium sulfite disappears, add more sodium sulfite in approximately 0.10 g portions until a solid residue remains after repeated shaking.

11.8.5.4 Add 5ml of reagent water and shake the vial for 1 minute. Allow the layers to separate (at least 5 minutes). Filter the hexane layer (the top layer) through a small funnel filled with sodium sulfate that has been pre-wetted with hexane and into a

clean 40 ml vial.

11.8.5.5 Add 2 ml of fresh hexane to the clean-up vial. Shake for 30 seconds and allow the layers to separate again. Filter the hexane portion through the sodium sulfate funnel and into the clean 40ml vial.

11.8.5.6 Repeat step 11.8.5.5 once.

11.8.5.7 Rinse the sodium sulfate funnel with 2ml of hexane.

11.8.5.8 Proceed to section 11.8.4.13 for final concentration and transfer to a mini-vial

11.9 Sample Analysis

11.9.1 Analyze the sample extracts under the same instrument operating conditions used to perform the instrument calibrations. Inject 2 µL into the GC/MS and acquire data beginning at 8 minutes and ending after decachlorobiphenyl has eluted from the column.

11.9.2 Record analysis information in the instrument logbook. The following information is required:

Date of analysis
Time of analysis
Instrument data system filename
Analyst
Lab sample identification

Additional information may be recorded in the logbook if necessary.

11.9.3 Generate integrated ion chromatograms for the masses listed in Table 8 that encompass the expected retention windows of the PCB homologous series.

12 Data Analysis and Calculations

12.1 Qualitative identification criteria for PCBs.

For a gas chromatographic peak to be identified as a PCB, it must meet all of the following criteria:

12.1.1 The signals for the two exact m/z's in Table 8 must be present and must maximize within ±2 seconds.

12.1.2 The signal to noise ratio (S/N) for each GC peak at each exact m/z must be greater than or equal to (≥) 2.5. (This requirement does not apply to the secondary ion for dichlorinated biphenyls [m/z 223.9974]. High background from PFK fragments at 223.9974 results in noise levels which exceed 10% of the signal height at levels that are reliably quantifiable.)

12.1.3 The ratio of the integrated areas of the two exact m/z's specified in Table 8 must be

within the limits in Table 9. Alternately, the ratios may be within ±15% of the ratio in the midpoint (CS3) calibration or calibration verification (VER), whichever is most recent.

12.1.4 The relative retention time of the peak for a CB must be within the RRT QC limits calculated in section 10.2.6.4.

Note: For native CBs determined by internal standard quantitation, a given CB congener may fall within more than one RT window and be misidentified unless the RRT windows are made very narrow, as in Table 2. Therefore, consistency of the RT and RRT with other congeners and the labeled compounds may be required for rigorous congener identification. Retention time regression analysis may be employed for this purpose.

12.1.5 If identification is ambiguous, (i.e. some, but not all of the identification criteria are met for a congener) an experienced analyst must determine the presence or absence of the congener.

12.2 Quantitation for PCB's.

12.2.1 Calculate the Internal Standard Recoveries (Ris) relative to the Recovery Standard according to the following equation:

$$Ris = \frac{Ais \times Qrs}{Ars \times RRFis \times Qis} \times 100\%$$

where:

Ais = sum of the areas of the quantitation ions of the appropriate internal standard
Ars = sum of the areas of the quantitation ions of the recovery standard
Qrs = ng of recovery standard added to extract
Qis = ng of internal standard added to sample
RRFis = mean relative response factor of internal standard obtained during initial calibration

Note: In some situations, such as source testing, the extract is split for multiple analyses. In this case, Qrs must be correctly calculated to account for the splitting of extracts before the recovery standard was added.

$$Qrs = Qrss \times Split$$

where:

Qrs = ng of recovery standard added to extract
Qrss = ng of recovery standard added to the split portion of the extract
Split = split ratio of the extract

12.2.2 Calculate the concentration of individual PCBs according to the following equation:

$$\text{Concentration} = \frac{As \times Qis}{Ais \times RRF \times W \times S}$$

where:

As = sum of the areas of the quantitation ions of the compound of interest
Ais = sum of the areas of the quantitation ions of the appropriate internal standard
Qis = ng of internal standard added to sample
RRF = mean relative response factor of compound obtained during initial calibration
W = amount of sample extracted (grams or liters)
S = decimal expression of solids (optional, if results are requested to be reported on dry weight basis)

12.2.3 If reporting results for Total Homolog Groups, calculate the total concentration of all isomers within each homolog group by summing the concentrations of the individual PCB isomers within that homolog group.

12.2.4 If no peaks are present in the region of the ion chromatogram where the compounds of interest are expected to elute, calculate the estimated detection limit (EDL) for that compound according to the following equation:

$$EDL = \frac{N \times 2.5 \times Qis}{His \times RRF \times W \times S}$$

where:

N = sum of peak to peak noise of quantitation ion signals in the region of the ion chromatogram where the compound of interest is expected to elute
His = sum of peak heights of quantitation ions for appropriate internal standard
Qis = ng of internal standard added to sample
RRF = mean relative response factor of compound obtained during initial calibration
W = amount of sample extracted (grams or liters)
S = decimal expression of solids (optional, if results are requested to be reported on dry weight basis. Note: do not use if results are to be reported by QuantIMS since it performs all necessary moisture corrections.)

12.2.5 If peaks are present in the region of the ion chromatogram which do not meet the qualitative criteria listed in section 12.1, calculate an Estimated Maximum Possible Concentration (EMPC). Use the equation in section 12.2.2, except that As should represent the sum of the area under the one peak and of the other peak area calculated using the theoretical chlorine isotope ratio. The peak selected to calculate the theoretical area should be the one which gives the lower of the two possible results (i.e. the EMPC will always be lower than the result calculated from the uncorrected areas).

12.2.6 If the concentration in the final extract of any PCB isomer exceeds the upper method calibration limits, a dilution of the extract or a re-extraction of a smaller portion of the sample must be performed. Dilutions of up to 1/10 may be performed on the extract. If compound concentrations exceeding the calibration range cannot be brought within the calibration range by a 1/10 dilution, extraction of a smaller aliquot of sample may be performed or the sample may be analyzed by a more appropriate analytical technique such as HRGC/LRMS. Consultation with the client should occur before any re-extraction is performed. The lab may report the measured concentration and indicate that the value exceeds the calibration limit by flagging the results with "E". Consultation with the client should occur before compounds are reported which exceed the calibration range.

12.3 The estimated minimum level (EML) is defined as the lowest concentration at which an analyte can be measured reliably with common laboratory interferences present assuming a sample is extracted at the recommended weight or volume and is carried through all normal extraction and analysis procedures. The EML's for different matrices and extract volumes are listed in **Table 4**. Deviations from the extraction amounts or final volumes listed will result in corresponding changes in the actual sample ML.

12.4 Flag all compound results in the sample which are below the estimated minimum level with a "J" qualifier.

12.5 Flag all compound results in the sample which were detected in the method blank with a "B" qualifier.

12.6 Flag all compound results in the sample which are above the upper calibration limit with an "E" qualifier.

12.7 Flag all compound results in the sample which are "Estimated Maximum Possible Concentrations" with a "Q" qualifier.

12.8 Flag compound results in the sample that may contain co-eluting compounds with a "C" qualifier.

12.8.1 Flag congeners known to coelute with a higher numbered congener with a "C" qualifier.

12.8.2 Flag congeners that coelute with a lower numbered congener with a "Cx" qualifier where x is the CAS PCB number of the lowest numbered congener in the coeluting group.

12.9 Flag compound results in the sample that may be affected by ion suppression with a "S" qualifier.

12.10 Data review

12.10.1 Refer to Figure 3 for an example data review checklists used to perform and document the review of the data. Using the data review checklist, the analyst also creates a

narrative which includes any qualifications of the sample data.

12.10.2 The analyst who performs the initial data calculations must initial and date the front chromatogram of the raw data package to document that they have performed the qualitative and quantitative analysis on the sample data.

12.10.3 A second analyst must verify all qualitative peak identifications. If discrepancies are found, the data must be returned to the analyst who performed the initial peak identification for resolution.

12.10.4 A second analyst must check all hand calculation and data entry into calculation programs, databases, or spreadsheets at a frequency of 100 percent. If discrepancies are found, the data must be returned to the analyst who performed the initial calculation for resolution.

12.10.5 The reviewing analyst must initial and date the front chromatogram of the raw data package to document that they have performed the second level review on the sample data.

12.10.6 All items listed on the data review checklist must be checked by both the analyst who performed the initial qualitative and quantitative analysis and the analyst who performed the second level review. An example data review checklist is shown in Figure 3.

13 Method Performance

13.1 Method Detection Limit

A valid method detection limit must be generated for representative analytes of interest. The MDL must be below the reporting limit for each analyte. The procedure for determination of the method detection limit is given in 40 CFR Part 136, Appendix B, and further defined in QA Policy #: QA-005.

13.2 Training Qualification

The group/team leader has the responsibility to ensure that an associate who has been properly trained in its use and has the required experience performs this procedure.

14 Pollution Prevention

14.1 All attempts will be made to minimize the use of solvents and standard materials.

15 Waste Management

15.1 All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and

the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

15.2 Waste Streams Produced by the Procedure: The following waste streams are produced when this method is carried out.

- Waste methylene chloride from sample preparation, glassware rinsing and sodium sulfate pre-rinsing shall be placed in the flammable waste stream, contained in a steel satellite accumulation container or flammable solvent container.
- Waste acetone and hexane from glassware and acid rinsing shall be placed in the flammable waste stream, contained in a steel satellite accumulation container or flammable solvent container.
- Miscellaneous disposable glassware, chemical resistant gloves, bench paper and similar materials shall be placed in the incinerable laboratory waste stream, contained in a steel or poly satellite accumulation container.
- Extracted PUF filters, XAD-2 resin, paper funnel filters, glass wool, fish/crawfish and soil contaminated with methylene chloride shall be placed in the flammable waste stream, contained in a steel or poly satellite accumulation container.
- Contaminated sulfuric acid used during extract cleanup shall be placed in the acidic waste stream, contained in a poly satellite accumulation container.
- Extracted aqueous samples, contaminated with methylene chloride shall be placed in the organic water waste stream, contained in a poly satellite accumulation container.

16 References

16.1 STL Quality Management Plan (current revision).

16.2 STL Knoxville Laboratory Quality Manual (LQM), current revision.

16.3 USEPA SW-846 "Test Methods for Evaluating Solid Waste" Third Edition.

16.4 Method 1613: Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS [Revision B], EPA#: 821/B-94-005a YEAR: 1994

16.5 Method 1668: Toxic Polychlorinated Biphenyls by Isotope Dilution High Resolution Gas Chromatography/High Resolution Mass Spectrometry [Draft], EPA#: 821/R-97-001 YEAR: 1997.

16.6 Ballschmiter, K. and M. Zell, "Analysis of Polychlorinated Biphenyls (PCB) by Glass Capillary Gas Chromatography", *Fresenius Z. Anal. Chem.*, 302:20-31 (1980).

16.7 Schulte, E. and R. Malisch, "Berechnung der Wahren PCB-Gehalte in Umweltproben I. Ermittlung der Zusammensetzung Zweier Technischer PCB-Gemische," *Fresenius Z. Anal. Chem.*, 314:545-551 (1983).

16.8 Guitart, R., P. Puig and J. Gómez-Catalán, "Requirement for a Standardized Nomenclature Criterion for PCBs: Computer-Assisted Assignment of Correct Congener Denomination and Numbering," *Chemosphere*, 27(8):1451-1459 (1993).

16.9 Rigaudy, J. and Klesney, S.P., Nomenclature of Organic Chemistry, Pergamon, 1979.

16.10 Pretsch, Clerc, Seibl, Simon, Tables of Spectral Data for Structure Determination of Organic Compounds, Second Edition, Springer-Verlag, 1989.

16.11 CRC Handbook of Chemistry and Physics, 71st edition, CRC Press, 1990-1991.

17 Miscellaneous

17.1 Deviations from EPA Method 1668, Revision A.

17.1.1 Additional recovery standards are used in this procedure. The additional standards are listed in Table 1.

17.1.2 Additional labeled standards are used in this procedure as field sampling surrogates. The additional standards are listed in Table 1.

17.1.3 A solvent mixture of acetone: hexane (1:1 volume) is used instead of toluene for extractions of solids and samples containing particles.

17.1.4 The method authors had observed that when their columns were degraded, PCBs 156 and 157 became resolved. The method indicates that the compounds must coelute within 2 seconds. Using constant flow conditions, this laboratory has resolved PCB 156 from PCB 157 on columns that are not degraded. This procedure does not require the coelution of the two isomers, but requires that the retention times may not change significantly in relative retention times, in accordance with section 10.3.5.6.

17.1.5 The calibration procedure in the method calls for a single point standard for the non-Toxic/LOC congeners. This procedure uses a multi-point calibration for all 209 congeners.

17.1.6 The calibration verification procedures in the method call for updating the retention times, relative retention times and response factors for non-Toxic compounds during daily calibration and use the retention times, relative retention times and response factors from the initial calibration for Toxic and LOC compounds. This laboratory uses the retention times, relative retention times and response factors from the initial calibration for all 209 compounds. The practice of updating the relative retention times of only a subset of compounds causes significant error in the linear regression prediction formulas used by targeting software to identify the compounds. This procedure has provisions for updating all RT's and RRT's from the calibration verification.

17.1.7 The EMLs listed in Table 4 differ from those listed in the reference method. The EMLs are set above the mean plus 2 standard deviations for the higher of detections or EDLs for method blanks. In no case is the EML lower than the low calibration limit. The survey period was approximately 14 months.

17.2 Summary of modifications to SOP from previous revision.

17.2.1 Added section 2.1, indicating the use of sample screening. Removed reference to 10g sample size in section 2.2.

17.2.2 Added sections 3.4, 3.6, 3.14, 3.20, and 3.26.

17.2.3 Added subsections to section 6.8.1, specifying GPC apparatus components.

17.2.4 Removed requirement to bake sodium sulfate. Performance is better with methylene chloride rinse.

17.2.5 Changed storage temperature for Florisil® to 125-135 °C.

17.2.6 Modified section 7.12.5.4, changed concentration to 1000 ng/mL

17.2.7 Inserted 3 notes, in sections 7.12.7, 7.12.9 and 7.12.11 describing the high and low concentration spiking solutions used, depending on final volume targeted.

17.2.8 Modified section 7.12.15, added dual final volume information.

17.2.9 Modified section 9.4 to include consultation with the Project Manager for method blank detections above the EML.

17.2.10 Re-ordered subsections and modified section 10. Added triplicate analysis of 5 congener mixes for retention time assignment. Added multi-point calibration of all 209 congeners.

17.2.11 Modified section 10.2.2 and added section 10.2.2.1 to describe performing mass resolution and mass accuracy checks on masses throughout the MID groups.

17.2.12 Added section 10.2.6.4 describing the assignment of analyte retention times.

17.2.13 Added section 11.4 and subsections, describing the procedure for screening and assigning sample preparation protocols.

17.2.14 Added section 11.8.4.14, describing the micro-concentration of aqueous samples to 20 µL.

17.2.15 Added section 11.8.4.15 and subsection, describing the dilution of extracts according to the assigned protocol.

17.2.16 Added Table 12 - Assignment of Sample Preparation Protocols

17.2.17 Table 1 - Deleted 3L6, Added 1L, 4L, 9L, 19L, 54L, 79L, 104L, 127L, 155L, 188L, and 205L. Added CAS Registry Numbers. Changed usage on several labeled standards.

17.2.18 Table 2 – Replaced with values from 1668A. Added additional recovery standards and sampling surrogates. Calculated new RRT & limits where applicable.

17.2.19 Revised values in Table 3 to reflect new minimum calibration level, CS-0.5. Dropped the high level standard for sampling surrogates. Added LCLs for biological tissues.

Added footnote describing application of multipliers for additional preparation protocols.

17.2.20 Replaced Table 4 to reflect updated estimated minimum levels. Added EMLs for biological tissues. Added footnote describing application of multipliers for additional preparation protocols.

17.2.21 Table 5 – Added additional analytes and labeled standards. Added concentrations for 20µL extracts.

17.2.22 Table 6 – Added additional analytes and labeled standards. Changed CS0.2 to CS0.5. Added footnote identifying level 3 as the calibration verification level.

17.2.23 Table 8 - Changed monitored masses for nona and deca.

17.2.24 Table 9 - Replaced calculated ratios and limits with 1668A ratios and limits.

17.2.25 Table 10 – Added additional analytes and labeled standards. Expressed limits in percent instead of concentration.

17.3 List of tables and figures referenced in the body of the SOP.

17.3.1 Table 1 - Polychlorinated Biphenyls Determined by Isotope Dilution and Internal Standard High Resolution Gas Chromatography (HRGC)/High Resolution Mass Spectrometry (HRMS)

17.3.2 Table 2 - RT References, Quantitation References, Retention Times (RT), and Relative Retention Times (RRTs) for the 209 CB congeners on SPB-Octyl

17.3.3 Table 3– Estimated Minimum Levels Based on Various Final Extract Volumes

17.3.4

17.3.5 Table 5-Concentration of Stock & Spiking Solutions Containing PCBs & Labeled Compounds

17.3.6 Table 6 - Concentration of PCBs in Calibration and Calibration Verification Solutions

17.3.7 Table 7 - Window Defining Mixture and SPB-Octyl Resolution Test Compounds

17.3.8 Table 8 - Ions Monitored for HRGC/HRMS Analysis of PCBs

17.3.9 Table 9 - Theoretical Ion Abundance Ratios and Their Control Limits for PCBs.

17.3.10 Table 10-Acceptance Criteria for Performance Tests

17.3.11 Table 11- Retention Times of Isomers on SPB-Octyl Column for PCB Standard Mixes

17.3.12 Table 12- Assignment of Sample Preparation Protocols

17.3.13 Figure 1 - Recommended GC Operating Conditions

17.3.14 Figure 2 - Recommended MID Descriptors

17.3.15 Figure 3- Example Data Review Checklist

17.3.16 Figure 4- Analysis of PCB's by HRGC/LRMS (Flowchart)

17.3.17 History of Revisions

REV NO.	DATE	PAGES AFFECTED	REASON FOR REVISION
0	09/28/99	All	Initial Revision of Method
1	10/12/01	See KNOX-ID-0013-R1	Updated based on EPA1668A
2	01/17/02	See KNOX-ID-0013-R2	Updated based on EPA1668A
3	06/01/05	See Section 17.2	Updated based on EPA1668A

Table 1

Polychlorinated Biphenyls Determined by HRGC/HRMS

BZ/IUPAC Number[1]	PCB Chemical Structure Name[2]	CAS Registry[3] Number	Labeled Analog	CAS Registry[3]	Usage
1	2-monochlorobiphenyl	2051-60-7	$^{13}C_{12}$-2-monochlorobiphenyl	234432-85-0	Internal Std
2	3-monochlorobiphenyl	2051-61-8			
3	4-monochlorobiphenyl	2051-62-9	$^{13}C_{12}$-4-monochlorobiphenyl	208263-77-8	Internal Std
4	2,2'-dichlorobiphenyl	13029-08-8	$^{13}C_{12}$-2,2'-dichlorobiphenyl	234432-86-1	Internal Std
5	2,3-dichlorobiphenyl	16605-91-7			
6	2,3'-dichlorobiphenyl	25569-80-6			
7	2,4-dichlorobiphenyl	33284-50-3			
8	2,4'-dichlorobiphenyl	34883-43-7	$^{13}C_{12}$-2,4'-dichlorobiphenyl		Surrogate Std
9	2,5-dichlorobiphenyl	34883-39-1	$^{13}C_{12}$-2,5-dichlorobiphenyl	250694-89-4	Recovery Std
10	2,6-dichlorobiphenyl	33146-45-1			
11	3,3'-dichlorobiphenyl	2050-67-1			
12	3,4-dichlorobiphenyl	2974-92-7			
13	3,4'-dichlorobiphenyl	2974-90-5			
14	3,5-dichlorobiphenyl	34883-41-5			
15	4,4'-dichlorobiphenyl	2050-68-2	$^{13}C_{12}$-4,4'-dichlorobiphenyl	208263-67-6	Internal Std
16	2,2',3-trichlorobiphenyl	38444-78-9			
17	2,2',4-trichlorobiphenyl	37680-66-3			
18	2,2',5-trichlorobiphenyl	37680-65-2			
19	2,2',6-trichlorobiphenyl	38444-73-4	$^{13}C_{12}$-2,2',6-trichlorobiphenyl	234432-87-2	Internal Std
20	2,3,3'-trichlorobiphenyl	38444-84-7			
21	2,3,4-trichlorobiphenyl	55702-46-0			
22	2,3,4'-trichlorobiphenyl	38444-85-8			
23	2,3,5-trichlorobiphenyl	55720-44-0			
24	2,3,6-trichlorobiphenyl	55702-45-9			
25	2,3',4-trichlorobiphenyl	55712-37-3			
26	2,3',5-trichlorobiphenyl	38444-81-4			
27	2,3',6-trichlorobiphenyl	38444-76-7			
28	2,4,4'-trichlorobiphenyl	7012-37-5	$^{13}C_{12}$-2,4,4'-trichlorobiphenyl	208263-76-7	Cleanup Std
29	2,4,5-trichlorobiphenyl	15862-07-4			
30	2,4,6-trichlorobiphenyl	35693-92-6			
31	2,4',5-trichlorobiphenyl	16606-02-3	$^{13}C_{12}$-2,4',5-trichlorobiphenyl		Recovery Std
32	2,4',6-trichlorobiphenyl	38444-77-8	$^{13}C_{12}$-2,4',6-trichlorobiphenyl		Recovery Std
33	2',3,4-trichlorobiphenyl (2,3',4'-trichlorobiphenyl)	38444-86-9			
34	2',3,5-trichlorobiphenyl (2,3',5'-trichlorobiphenyl)	37680-68-5			
35	3,3',4-trichlorobiphenyl	37680-69-6			
36	3,3',5-trichlorobiphenyl	38444-87-0			
37	3,4,4'-trichlorobiphenyl	38444-90-5	$^{13}C_{12}$-3,4,4'-trichlorobiphenyl	208263-79-0	Internal Std
38	3,4,5-trichlorobiphenyl	53555-66-1			
39	3,4',5-trichlorobiphenyl	38444-88-1			
40	2,2',3,3'-tetrachlorobiphenyl	38444-93-8			
41	2,2',3,4-tetrachlorobiphenyl	52663-59-9			
42	2,2',3,4'-tetrachlorobiphenyl	36559-22-5			
43	2,2',3,5-tetrachlorobiphenyl	70362-46-8			
44	2,2',3,5'-tetrachlorobiphenyl	41464-39-5			
45	2,2',3,6-tetrachlorobiphenyl	70362-45-7			
46	2,2',3,6'-tetrachlorobiphenyl	41464-47-5			
47	2,2',4,4'-tetrachlorobiphenyl	2437-79-8			
48	2,2',4,5-tetrachlorobiphenyl	70362-47-9			
49	2,2',4,5'-tetrachlorobiphenyl	41464-40-8			
50	2,2',4,6-tetrachlorobiphenyl	62796-65-0			
51	2,2',4,6'-tetrachlorobiphenyl	68194-04-7			
52	2,2',5,5'-tetrachlorobiphenyl	35693-99-3	$^{13}C_{12}$-2,2',5,5'-tetrachlorobiphenyl	160901-66-6	Recovery Std
53	2,2',5,6'-tetrachlorobiphenyl	41464-41-9			
54	2,2',6,6'-tetrachlorobiphenyl	15968-05-5	$^{13}C_{12}$-2,2',6,6'-tetrachlorobiphenyl	234432-88-3	Internal Std
55	2,3,3',4-tetrachlorobiphenyl	74338-24-2			
56	2,3,3',4'-tetrachlorobiphenyl	41464-43-1			

BZ/IUPAC Number[1]	PCB Chemical Structure Name[2]	CAS Registry[3] Number	Labeled Analog	CAS Registry[3]	Usage
57	2,3,3',5-tetrachlorobiphenyl	70424-67-8			
58	2,3,3',5'-tetrachlorobiphenyl	41464-49-7			
59	2,3,3',6-tetrachlorobiphenyl	74472-33-6			
60	2,3,4,4'-tetrachlorobiphenyl	33025-41-1			
61	2,3,4,5-tetrachlorobiphenyl	33284-53-6			
62	2,3,4,6-tetrachlorobiphenyl	54230-22-7			
63	2,3,4',5-tetrachlorobiphenyl	74472-34-7			
64	2,3,4',6-tetrachlorobiphenyl	52663-58-8			
65	2,3,5,6-tetrachlorobiphenyl	33284-54-7			
66	2,3',4,4'-tetrachlorobiphenyl	32598-10-0			
67	2,3',4,5-tetrachlorobiphenyl	73575-53-8			
68	2,3',4,5'-tetrachlorobiphenyl	73575-52-7			
69	2,3',4,6-tetrachlorobiphenyl	60233-24-1			
70	2,3',4',5-tetrachlorobiphenyl	32598-11-1			
71	2,3',4',6-tetrachlorobiphenyl	41464-46-4			
72	2,3',5,5'-tetrachlorobiphenyl	41464-42-0			
73	2,3',5',6-tetrachlorobiphenyl	74338-23-1			
74	2,4,4',5-tetrachlorobiphenyl	32690-93-0			
75	2,4,4',6-tetrachlorobiphenyl	32598-12-2			
76	2',3,4,5-tetrachlorobiphenyl (2,3',4',5'-tetrachlorobiphenyl)	70362-48-0			
77	3,3',4,4'-tetrachlorobiphenyl	32598-13-3	$^{13}C_{12}$-3,3',4,4'-tetrachlorobiphenyl	160901-67-7	Internal Std
78	3,3',4,5-tetrachlorobiphenyl	70362-49-1			
79	3,3',4,5'-tetrachlorobiphenyl	41464-48-6	$^{13}C_{12}$-3,3',4,5'-tetrachlorobiphenyl		Surrogate Std
80	3,3',5,5'-tetrachlorobiphenyl	33284-52-5			
81	3,4,4',5-tetrachlorobiphenyl	70362-50-4	$^{13}C_{12}$-3,4,4',5-tetrachlorobiphenyl	160901-68-8	Internal Std
82	2,2',3,3',4-pentachlorobiphenyl	52663-62-4			
83	2,2',3,3',5-pentachlorobiphenyl	60145-20-2			
84	2,2',3,3',6-pentachlorobiphenyl	52663-60-2			
85	2,2',3,4,4'-pentachlorobiphenyl	65510-45-4			
86	2,2',3,4,5-pentachlorobiphenyl	55312-69-1			
87	2,2',3,4,5'-pentachlorobiphenyl	38380-02-8			
88	2,2',3,4,6-pentachlorobiphenyl	55215-17-3			
89	2,2',3,4,6'-pentachlorobiphenyl	73575-57-2			
90	2,2',3,4',5-pentachlorobiphenyl	68194-07-0			
91	2,2',3,4',6-pentachlorobiphenyl	68194-05-8			
92	2,2',3,5,5'-pentachlorobiphenyl	52663-61-3			
93	2,2',3,5,6-pentachlorobiphenyl	73575-56-1			
94	2,2',3,5,6'-pentachlorobiphenyl	73575-55-0			
95	2,2',3,5',6-pentachlorobiphenyl	38379-99-6	$^{13}C_{12}$-2,2',3,5',6-pentachlorobiphenyl		Surrogate Std
96	2,2',3,6,6'-pentachlorobiphenyl	73575-54-9			
97	2,2',3',4,5-pentachlorobiphenyl (2,2',3,4',5'-pentachlorobiphenyl)	41464-51-1			
98	2,2',3',4,6-pentachlorobiphenyl (2,2',3,4',6'-pentachlorobiphenyl)	60233-25-2			
99	2,2',4,4',5-pentachlorobiphenyl	38380-01-7			
100	2,2',4,4',6-pentachlorobiphenyl	39485-83-1			
101	2,2',4,5,5'-pentachlorobiphenyl	37680-73-2	$^{13}C_{12}$-2,2',4,5,5'-pentachlorobiphenyl	160901-69-9	Recovery Std
102	2,2',4,5,6-pentachlorobiphenyl	68194-06-9			
103	2,2',4,5',6-pentachlorobiphenyl	60145-21-3			
104	2,2',4,6,6'-pentachlorobiphenyl	56558-16-8	$^{13}C_{12}$-2,2',4,6,6'-pentachlorobiphenyl	234432-89-4	Internal Std
105	2,3,3',4,4'-pentachlorobiphenyl	32598-14-4	$^{13}C_{12}$-2,3,3',4,4'-pentachlorobiphenyl	160901-70-2	Internal Std
106	2,3,3',4,5-pentachlorobiphenyl	70424-69-0			
107/109	2,3,3',4',5-pentachlorobiphenyl	70424-68-9			
108/107	2,3,3',4,5'-pentachlorobiphenyl	70362-41-3			
109/108	2,3,3',4,6-pentachlorobiphenyl	74472-35-8			
110	2,3,3',4',6-pentachlorobiphenyl	38380-03-9			
111	2,3,3',5,5'-pentachlorobiphenyl	39635-32-0	$^{13}C_{12}$-2,3,3',5,5'-pentachlorobiphenyl	160901-71-3	Cleanup Std
112	2,3,3',5,6-pentachlorobiphenyl	74472-36-9			
113	2,3,3',5',6-pentachlorobiphenyl	68194-10-5			
114	2,3,4,4',5-pentachlorobiphenyl	74472-37-0	$^{13}C_{12}$-2,3,4,4',5-pentachlorobiphenyl	160901-72-4	Internal Std
115	2,3,4,4',6-pentachlorobiphenyl	74472-38-1			

BZ/IUPAC Number[1]	PCB Chemical Structure Name[2]	CAS Registry[3] Number	Labeled Analog	CAS Registry[3]	Usage
116	2,3,4,5,6-pentachlorobiphenyl	18259-05-7			
117	2,3,4',5,6-pentachlorobiphenyl	68194-11-6			
118	2,3',4,4',5-pentachlorobiphenyl	31508-00-6	$^{13}C_{12}$-2,3',4,4',5-pentachlorobiphenyl	160901-73-5	Internal Std
119	2,3',4,4',6-pentachlorobiphenyl	56558-17-9			
120	2,3',4,5,5'-pentachlorobiphenyl	68194-12-7			
121	2,3',4,5',6-pentachlorobiphenyl	56558-18-0			
122	2',3,3',4,5-pentachlorobiphenyl (2,3,3',4',5'-pentachlorobiphenyl)	76842-07-4			
123	2',3,4,4',5-pentachlorobiphenyl (2,3',4,4',5'-pentachlorobiphenyl)	65510-44-3	$^{13}C_{12}$-2',3,4,4',5-pentachlorobiphenyl	160901-74-6	Internal Std
124	2',3,4,5,5'-pentachlorobiphenyl (2,3',4',5',5-pentachlorobiphenyl)	70424-70-3			
125	2',3,4,5,6'-pentachlorobiphenyl (2,3',4',5',6-pentachlorobiphenyl)	74472-39-2			
126	3,3',4,4',5-pentachlorobiphenyl	57465-28-8	$^{13}C_{12}$-3,3',4,4',5-pentachlorobiphenyl	160901-75-7	Internal Std
127	3,3',4,5,5'-pentachlorobiphenyl	39635-33-1	$^{13}C_{12}$-3,3',4,5,5'-pentachlorobiphenyl		Recovery Std
128	2,2',3,3',4,4'-hexachlorobiphenyl	38380-07-3			
129	2,2',3,3',4,5-hexachlorobiphenyl	55215-18-4			
130	2,2',3,3',4,5'-hexachlorobiphenyl	52663-66-8			
131	2,2',3,3',4,6-hexachlorobiphenyl	61798-70-7			
132	2,2',3,3',4,6'-hexachlorobiphenyl	38380-05-1			
133	2,2',3,3',5,5'-hexachlorobiphenyl	35694-04-3			
134	2,2',3,3',5,6-hexachlorobiphenyl	52704-70-8			
135	2,2',3,3',5,6'-hexachlorobiphenyl	52744-13-5			
136	2,2',3,3',6,6'-hexachlorobiphenyl	38411-22-2			
137	2,2',3,4,4',5-hexachlorobiphenyl	35694-06-5			
138	2,2',3,4,4',5'-hexachlorobiphenyl	35065-28-2	$^{13}C_{12}$-2,2',3,4,4',5'-hexachlorobiphenyl	160901-76-8	Recovery Std
139	2,2',3,4,4',6-hexachlorobiphenyl	56030-56-9			
140	2,2',3,4,4',6'-hexachlorobiphenyl	59291-64-4			
141	2,2',3,4,5,5'-hexachlorobiphenyl	52712-04-6			
142	2,2',3,4,5,6-hexachlorobiphenyl	41411-61-4			
143	2,2',3,4,5,6'-hexachlorobiphenyl	68194-15-0			
144	2,2',3,4,5',6-hexachlorobiphenyl	68194-14-9			
145	2,2',3,4,6,6'-hexachlorobiphenyl	74472-40-5			
146	2,2',3,4',5,5'-hexachlorobiphenyl	51908-16-8			
147	2,2',3,4',5,6-hexachlorobiphenyl	68194-13-8			
148	2,2',3,4',5,6'-hexachlorobiphenyl	74472-41-6			
149	2,2',3,4',5',6-hexachlorobiphenyl	38380-04-0			
150	2,2',3,4',6,6'-hexachlorobiphenyl	68194-08-1			
151	2,2',3,5,5',6-hexachlorobiphenyl	52663-63-5			
152	2,2',3,5,6,6'-hexachlorobiphenyl	68194-09-2			
153	2,2',4,4',5,5'-hexachlorobiphenyl	35065-27-1	$^{13}C_{12}$-2,2',4,4',5,5'-hexachlorobiphenyl		Surrogate Std
154	2,2',4,4',5,6'-hexachlorobiphenyl	60145-22-4			
155	2,2',4,4',6,6'-hexachlorobiphenyl	33979-03-2	$^{13}C_{12}$-2,2',4,4',6,6'-hexachlorobiphenyl	234432-90-7	Internal Std
156	2,3,3',4,4',5-hexachlorobiphenyl	38380-08-4	$^{13}C_{12}$-2,3,3',4,4',5-hexachlorobiphenyl	160901-77-9	Internal Std
157	2,3,3',4,4',5'-hexachlorobiphenyl	69782-90-7	$^{13}C_{12}$-2,3,3',4,4',5'-hexachlorobiphenyl	160901-78-0	Internal Std
158	2,3,3',4,4',6-hexachlorobiphenyl	74472-42-7			
159	2,3,3',4,5,5'-hexachlorobiphenyl	39635-35-3			
160	2,3,3',4,5,6-hexachlorobiphenyl	41411-62-5			
161	2,3,3',4,5',6-hexachlorobiphenyl	74472-43-8			
162	2,3,3',4',5,5'-hexachlorobiphenyl	39635-34-2			
163	2,3,3',4',5,6-hexachlorobiphenyl	74472-44-9			
164	2,3,3',4',5',6-hexachlorobiphenyl	74472-45-0			
165	2,3,3',5,5',6-hexachlorobiphenyl	74472-46-1			
166	2,3,4,4',5,6-hexachlorobiphenyl	41411-63-6			
167	2,3',4,4',5,5'-hexachlorobiphenyl	52663-72-6	$^{13}C_{12}$-2,3',4,4',5,5'-hexachlorobiphenyl	161627-18-5	Internal Std
168	2,3',4,4',5',6-hexachlorobiphenyl	59291-65-5			
169	3,3',4,4',5,5'-hexachlorobiphenyl	32774-16-6	$^{13}C_{12}$-3,3',4,4',5,5'-hexachlorobiphenyl	160901-79-1	Internal Std
170	2,2',3,3',4,4',5-heptachlorobiphenyl	35065-30-6	$^{13}C_{12}$-2,2',3,3',4,4',5-heptachlorobiphenyl	160901-80-4	Internal Std
171	2,2',3,3',4,4',6-heptachlorobiphenyl	52663-71-5			
172	2,2',3,3',4,5,5'-heptachlorobiphenyl	52663-74-8			
173	2,2',3,3',4,5,6-heptachlorobiphenyl	68194-16-1			
174	2,2',3,3',4,5,6'-heptachlorobiphenyl	38411-25-5			

BZ/IUPAC Number[1]	PCB Chemical Structure Name[2]	CAS Registry[3] Number	Labeled Analog	CAS Registry[3]	Usage
175	2,2',3,3',4,5',6-heptachlorobiphenyl	40186-70-7			
176	2,2',3,3',4,6,6'-heptachlorobiphenyl	52663-65-7			
177	2,2',3,3',4',5,6-heptachlorobiphenyl (2,2',3,3',4,5',6'-heptachlorobiphenyl)	52663-70-4			
178	2,2',3,3',5,5',6-heptachlorobiphenyl	52663-67-9	$^{13}C_{12}$-2,2',3,3',5,5',6-heptachlorobiphenyl	160901-81-5	Cleanup Std
179	2,2',3,3',5,6,6'-heptachlorobiphenyl	52663-64-6			
180	2,2',3,4,4',5,5'-heptachlorobiphenyl	35065-29-3	$^{13}C_{12}$-2,2',3,4,4',5,5'-heptachlorobiphenyl	160901-82-6	Recovery Std
181	2,2',3,4,4',5,6-heptachlorobiphenyl	74472-47-2			
182	2,2',3,4,4',5,6'-heptachlorobiphenyl	60145-23-5			
183	2,2',3,4,4',5',6-heptachlorobiphenyl	52663-69-1			
184	2,2',3,4,4',6,6'-heptachlorobiphenyl	74472-48-3			
185	2,2',3,4,5,5',6-heptachlorobiphenyl	52712-05-7			
186	2,2',3,4,5,6,6'-heptachlorobiphenyl	74472-49-4			
187	2,2',3,4',5,5',6-heptachlorobiphenyl	52663-68-0			
188	2,2',3,4',5,6,6'-heptachlorobiphenyl	74487-85-7	$^{13}C_{12}$-2,2',3,4',5,6,6'-heptachlorobiphenyl	234432-91-8	Internal Std
189	2,3,3',4,4',5,5'-heptachlorobiphenyl	39635-31-9	$^{13}C_{12}$-2,3,3',4,4',5,5'-heptachlorobiphenyl	160901-83-7	Internal Std
190	2,3,3',4,4',5,6-heptachlorobiphenyl	41411-64-7			
191	2,3,3',4,4',5',6-heptachlorobiphenyl	74472-50-7			
192	2,3,3',4,5,5',6-heptachlorobiphenyl	74472-51-8			
193	2,3,3',4',5,5',6-heptachlorobiphenyl	69782-91-8			
194	2,2',3,3',4,4',5,5'-octachlorobiphenyl	35694-08-7	$^{13}C_{12}$-2,2',3,3',4,4',5,5'-octachlorobiphenyl	208263-74-5	Recovery Std
195	2,2',3,3',4,4',5,6-octachlorobiphenyl	52663-78-2			
196	2,2',3,3',4,4',5,6'-octachlorobiphenyl	42740-50-1			
197	2,2',3,3',4,4',6,6'-octachlorobiphenyl	33091-17-7			
198	2,2',3,3',4,5,5',6-octachlorobiphenyl	68194-17-2			
199/200	2,2',3,3',4,5,6,6'-octachlorobiphenyl	52663-73-7			
200/201	2,2',3,3',4,5',6,6'-octachlorobiphenyl	40186-71-8			
201/199	2,2',3,3',4,5,5',6'-octachlorobiphenyl	52663-75-9			
202	2,2',3,3',5,5',6,6'-octachlorobiphenyl	2136-99-4	$^{13}C_{12}$-2,2',3,3',5,5',6,6'-octachlorobiphenyl	105600-26-8	Internal Std
203	2,2',3,4,4',5,5',6-octachlorobiphenyl	52663-76-0			
204	2,2',3,4,4',5,6,6'-octachlorobiphenyl	74472-52-9			
205	2,3,3',4,4',5,5',6-octachlorobiphenyl	74472-53-0	$^{13}C_{12}$-2,3,3',4,4',5,5',6-octachlorobiphenyl	234446-64-1	Internal Std
206	2,2',3,3',4,4',5,5',6-nonachlorobiphenyl	40186-72-9	$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-nonachlorobiphenyl	208263-75-6	Internal Std
207	2,2',3,3',4,4',5,6,6'-nonachlorobiphenyl	52663-79-3			
208	2,2',3,3',4,5,5',6,6'-nonachlorobiphenyl	52663-77-1	$^{13}C_{12}$-2,2',3,3',4,5,5',6,6'-nonachlorobiphenyl	234432-92-9	Internal Std
209	2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl	2051-24-3	$^{13}C_{12}$-decachlorobiphenyl	160901-84-8	Internal Std

1. The BZ number is from Ballschmiter and Zell (1980). The IUPAC number, when different from the BZ, follows the recommended changes to the BZ number per Schulte and Malisch (1983) and Guitart et al. (1993).

2. The chemical structure names are from Ballschmiter and Zell (1980). IUPAC nomenclature structure names are listed in parenthesis when different from the BZ name (source CAS Registry).

3. Chemical Abstract Service Registry number (source CAS Registry and 1668A Table 1).

Table 2

RT References, Quantitation References, Retention Times (RT), and Relative Retention Times (RRTs) for the 209 CB congeners on SPB-Octyl.

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
Monochlorobiphenyls							
1	1L	9L	9L	13:43	0.725 7	0.7125-0.7390	30
1	3L	9L	9L	16:20	0.864 2	0.8510-0.8774	30
1	1	1L	1L	13:44	1.001 2	0.9951-1.0073	10
1	2	3L	1L/3L	16:08	0.987 8	0.9847-0.9908	6
1	3	3L	3L	16:21	1.001 0	0.9980-1.0041	6
Dichlorobiphenyls							
2	4L	9L	9L	16:39	0.881 0	0.8677-0.8942	30
2	9L	9	9L	18:54	1.000 0	1.0000	25
2	8L	4L	4L/15L	19:56	1.197 2	1.1942-1.2002	6
2	15L	9L	9L	23:25	1.239 0	1.2302-1.2478	20
2	4	4L	4L	16:40	1.001 0	0.9960-1.0060	10
2	10	4L	4L/15L	16:53	1.014 0	1.0110-1.0170	6
2	9	4L	4L/15L	18:55	1.136 1	1.1331-1.1391	6
2	7	4L	4L/15L	19:07	1.148 1	1.1451-1.1512	6
2	6	4L	4L/15L	19:26	1.167 2	1.1642-1.1702	6
2	5	4L	4L/15L	19:48	1.189 2	1.1862-1.1922	6
2	8	4L	4L/15L	19:56	1.197 2	1.1942-1.2002	6
2	14	15L	4L/15L	21:42	0.926 7	0.9246-0.9288	6
2	11	15L	4L/15L	22.42	0.969 4	0.9673-0.9715	6
2	13	15L	4L/15L	23.03	0.984 3	0.9822-0.9865	6
2	12	15L	4L/15L	23:06	0.986 5	0.9843-0.9886	6
2	13/12	15L	4L/15L	23:04	0.985 1	0.9829-0.9872	6
2	15	15L	15L	23:26	1.000 7	0.9972-1.0043	10
Trichlorobiphenyls							
3	19L	32L	32L	20:18	0.813 6	0.8096-0.8177	30
3	32L	32L	32L	24:57	1.000 0	1.0000	6
3	31L	31L	31L	26:25	1.000 0	1.0000	6
3	28L	31L	31L	26:44	1.012 0	1.0069-1.0170	20
3	37L	31L	31L	31:10	1.179 8	1.1739-1.1857	30
3	19	19L	19L	20:19	1.000 8	0.9967-1.0049	10
3	30	19L	19L/37L	22.15	1.096 1	1.0936-1.0985	6
3	18	19L	19L/37L	22:23	1.102 6	1.1002-1.1051	6
3	30/18	19L	19L/37L	22.19	1.099 3	1.0969-1.1018	6
3	17	19L	19L/37L	22:49	1.124	1.1215-	6

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
					0	1.1264	
3	27	19L	19L/37L	23:06	1.137	1.1355-1.1404	6
3	24	19L	19L/37L	23.14	1.144	1.1420-1.1470	6
3	16	19L	19L/37L	23:25	1.153	1.1511-1.1560	6
3	32	19L	19L/37L	24:57	1.229	1.2266-1.2315	6
3	34	19L	19L/37L	25:17	1.245	1.2430-1.2479	6
3	23	19L	19L/37L	25:26	1.252	1.2504-1.2553	6
3	29	19L	19L/37L	25.47	1.270	1.2660-1.2742	10
3	26	19L	19L/37L	25:48	1.270	1.2668-1.2750	10
3	26/29	19L	19L/37L	25:48	1.270	1.2668-1.2750	10
3	25	37L	19L/37L	26:04	0.836	0.8348-0.8380	6
3	31	37L	19L/37L	26:25	0.847	0.8460-0.8492	6
3	28	37L	19L/37L	26:44	0.857	0.8551-0.8604	10
3	20	37L	19L/37L	26:49	0.860	0.8578-0.8631	10
3	28/20	37L	19L/37L	26:47	0.859	0.8567-0.8620	10
3	21	37L	19L/37L	26:58	0.865	0.8626-0.8679	10
3	33	37L	19L/37L	27:01	0.866	0.8642-0.8695	10
3	21/33	37L	19L/37L	26:59	0.865	0.8631-0.8684	10
3	22	37L	19L/37L	27:29	0.881	0.8802-0.8834	6
3	36	37L	19L/37L	29:05	0.933	0.9316-0.9348	6
3	39	37L	19L/37L	29.30	0.946	0.9449-0.9481	6
3	38	37L	19L/37L	30:10	0.967	0.9663-0.9695	6
3	35	37L	19L/37L	30:42	0.985	0.9834-0.9866	6
3	37	37L	37L	31:11	1.000	0.9989-1.0021	6
Tetrachlorobiphenyls							
4	54L	52L	52L	23:50	0.826	0.8203-0.8319	20
4	52L	52L	52L	28:51	1.000	1.0000	25
4	79L	81L	54L/81L/77L	37:16	0.971	0.9700-0.9726	6
4	81L	52L	52L	38:22	1.329	1.3241-1.3356	20
4	77L	52L	52L	39:01	1.352	1.3466-1.3582	20
4	54	54L	54L	23.51	1.000	0.9972-1.0042	10
4	50	54L	54L/81L/77L	26:07	1.095	1.0923-1.0993	10
4	53	54L	54L/81L/77L	26:09	1.097	1.0937-1.1007	10
4	50/53	54L	54L/81L/77L	26:08	1.096	1.0930-1.1000	10
4	45	54L	54L/81L/77L	26:55	1.129	1.1259-1.1329	10
4	51	54L	54L/81L/77L	26:58	1.131	1.1280-1.1350	10
4	45/51	54L	54L/81L/77L	26.57	1.130	1.1273-1.1343	10
4	46	54L	54L/81L/77L	27:18	1.145	1.1434-	6

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
					5	1.1476	
					1.206	1.2042-	
4	52	54L	54L/81L/77L	28:45	3	1.2084	6
					1.211	1.2091-	
4	73	54L	54L/81L/77L	28:52	2	1.2133	6
					1.215	1.2133-	
4	43	54L	54L/81L/77L	28:58	4	1.2175	6
					1.222	1.2189-	
4	69	54L	54L/81L/77L	29.08	4	1.2259	10
					1.228	1.2245-	
4	49	54L	54L/81L/77L	29:16	0	1.2315	10
					1.225	1.2217-	
4	69/49	54L	54L/81L/77L	29:12	2	1.2287	10
					1.239	1.2378-	
4	48	54L	54L/81L/77L	29:33	9	1.2420	6
					1.251	1.2476-	
4	65	54L	54L/81L/77L	29:49	0	1.2545	10
					1.251	1.2483-	
4	47	54L	54L/81L/77L	29:50	7	1.2552	10
					1.253	1.2503-	
4	44	54L	54L/81L/77L	29:53	8	1.2573	10
					1.251	1.2483-	
4	44/47/65	54L	54L/81L/77L	29:50	7	1.2552	10
					1.262	1.2594-	
4	62	54L	54L/81L/77L	30:06	9	1.2664	10
					1.264	1.2608-	
4	75	54L	54L/81L/77L	30:08	3	1.2678	10
					1.267	1.2636-	
4	59	54L	54L/81L/77L	30:12	1	1.2706	10
					1.265	1.2615-	
4	59/62/75	54L	54L/81L/77L	30:09	0	1.2685	10
					1.276	1.2748-	
4	42	54L	54L/81L/77L	30:26	9	1.2790	6
					1.295	1.2916-	
4	41	54L	54L/81L/77L	30:52	1	1.2986	10
					1.299	1.2958-	
4	71	54L	54L/81L/77L	30:58	3	1.3028	10
					1.259	1.2559-	
4	40	54L	54L/81L/77L	30:01	4	1.2629	10
					1.299	1.2958-	
4	41/40/71	54L	54L/81L/77L	30:58	3	1.3028	10
					1.309	1.3070-	
4	64	54L	54L/81L/77L	31:12	1	1.3112	6
					0.833	0.8323-	
4	72	81L	54L/81L/77L	31:59	6	0.8349	6
					0.841	0.8406-	
4	68	81L	54L/81L/77L	32:18	9	0.8432	6
					0.854	0.8527-	
4	57	81L	54L/81L/77L	32:46	0	0.8553	6
					0.862	0.8610-	
4	58	81L	54L/81L/77L	33:05	3	0.8636	6
					0.865	0.8645-	
4	67	81L	54L/81L/77L	33:13	8	0.8671	6
					0.873	0.8719-	
4	63	81L	54L/81L/77L	33:30	2	0.8745	6
					0.880	0.8775-	
4	61	81L	54L/81L/77L	33:46	1	0.8827	12
					0.883	0.8805-	
4	70	81L	54L/81L/77L	33:53	1	0.8858	12
					0.884	0.8814-	
4	76	81L	54L/81L/77L	33:55	0	0.8866	12
					0.884	0.8827-	
4	74	81L	54L/81L/77L	33:57	9	0.8871	10
					0.884	0.8814-	
4	61/70/74/76	81L	54L/81L/77L	33:55	0	0.8866	12
					0.892	0.8914-	
4	66	81L	54L/81L/77L	34:15	7	0.8940	6
					0.898	0.8970-	
4	55	81L	54L/81L/77L	34:28	3	0.8997	6
					0.913	0.9123-	
4	56	81L	54L/81L/77L	35:03	6	0.9149	6
					0.919	0.9179-	
4	60	81L	54L/81L/77L	35:16	2	0.9205	6

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
4	80	81L	54L/81L/77L	35:32	0.926 2	0.9248-0.9275	6
4	79	81L	54L/81L/77L	37:16	0 971 3	0 9700-0.9726	6
4	78	81L	54L/81L/77L	37:52	0.987 0	0 9857-0.9883	6
4	81	81L	81L	38:23	1.000 4	0.9991-1.0017	6
4	77	77L	77L	39:02	1.000 4	0.9991-1.0017	6
Pentachlorobiphenyls							
5	104L	101L	101L	29:46	0.825 7	0.8211-0.8303	20
5	95L	104L	104L/123L/114L/118L/105L/126 L	33:00	1.108 6	1.1058-1.1114	10
5	101L	101L	101L	36:03	1.000 0	1.0000	25
5	111L	101L	101L	38:51	1.077 7	1.0730-1.0823	20
5	123L	101L	101L	41:01	1.137 8	1 1331-1.1424	20
5	118L	101L	101L	41:21	1.147 0	1.1424-1.1516	20
5	114L	101L	101L	41:57	1.163 7	1.1590-1.1683	20
5	105L	101L	101L	42:44	1.185 4	1.1808-1.1900	20
5	127L	127L	127L	44:09	1.000 0	1.0000	25
5	126L	101L	101L	45:57	1.274 6	1.2700-1.2792	20
5	104	104L	104L	29:46	1.000 0	0.9972-1.0028	10
5	96	104L	104L/123L/114L/118L/105L/126 L	30:17	1.017 4	1.0146-1.0202	10
5	103	104L	104L/123L/114L/118L/105L/126 L	32:11	1.081 2	1.0795-1.0829	6
5	94	104L	104L/123L/114L/118L/105L/126 L	32:29	1.091 3	1.0896-1.0929	6
5	95	104L	104L/123L/114L/118L/105L/126 L	33:00	1.108 6	1.1058-1.1114	10
5	100	104L	104L/123L/114L/118L/105L/126 L	33:06	1.112 0	1.1092-1.1148	10
5	93	104L	104L/123L/114L/118L/105L/126 L	33:14	1.116 5	1.1137-1.1193	10
5	102	104L	104L/123L/114L/118L/105L/126 L	33:21	1.120 4	1.1176-1.1232	10
5	98	104L	104L/123L/114L/118L/105L/126 L	33:26	1.123 2	1.1204-1.1260	10
5	95/100/93/102/98	104L	104L/123L/114L/118L/105L/126 L	33:13	1.115 9	1.1131-1.1187	15
5	88	104L	104L/123L/114L/118L/105L/126 L	33:48	1.135 5	1.1321-1.1389	12
5	91	104L	104L/123L/114L/118L/105L/126 L	33:55	1.139 4	1.1366-1.1422	10
5	88/91	104L	104L/123L/114L/118L/105L/126 L	33:52	1.137 7	1.1344-1.1411	12
5	84	104L	104L/123L/114L/118L/105L/126 L	34:14	1.150 1	1.1484-1.1517	6
5	89	104L	104L/123L/114L/118L/105L/126 L	34:44	1.166 9	1 1652-1.1685	6
5	121	104L	104L/123L/114L/118L/105L/126 L	34:57	1.174 1	1 1725-1.1758	6
5	92	123L	104L/123L/114L/118L/105L/126 L	35:26	0.863 9	0.8627-0.8651	6
5	113	104L	104L/123L/114L/118L/105L/126 L	36:01	0.878 1	0.8761-0.8801	10
5	90	104L	104L/123L/114L/118L/105L/126 L	36:03	0.878 9	0.8769-0 8809	10
5	101	104L	104L/123L/114L/118L/105L/126 L	36:04	0 879 3	0.8773-0.8813	10
5	113/90/101	104L	104L/123L/114L/118L/105L/126 L	36.03	0.878 9	0.8769-0.8809	10

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
			104L/123L/114L/118L/105L/126		0.893	0.8911-	
5	83	104L	L	36:39	5	0.8960	12
			104L/123L/114L/118L/105L/126		0.894	0.8923-	
5	99	104L	L	36:41	4	0.8964	10
			104L/123L/114L/118L/105L/126		0.893	0.8915-	
5	83/99	104L	L	36:40	9	0.8964	12
			104L/123L/114L/118L/105L/126		0.898	0.8972-	
5	112	104L	L	36:51	4	0.8996	6
			104L/123L/114L/118L/105L/126		0.906	0.9037-	
5	119	104L	L	37:12	9	0.9102	16
			104L/123L/114L/118L/105L/126		0.906	0.9037-	
5	108	104L	L	37:12	9	0.9102	16
			104L/123L/114L/118L/105L/126		0.909	0.9057-	
5	86	104L	L	37:17	0	0.9122	16
			104L/123L/114L/118L/105L/126		0.909	0.9057-	
5	97	104L	L	37:17	0	0.9122	16
			104L/123L/114L/118L/105L/126		0.910	0.9074-	
5	125	104L	L	37:21	6	0.9139	16
			104L/123L/114L/118L/105L/126		0.912	0.9102-	
5	87	104L	L	37:25	2	0.9143	10
	108/119/86/97/125/8		104L/123L/114L/118L/105L/126		0.909	0.9065-	
5	7	104L	L	37:19	8	0.9130	16
			104L/123L/114L/118L/105L/126		0.925	0.9228-	
5	117	104L	L	37:57	2	0.9277	12
			104L/123L/114L/118L/105L/126		0.927	0.9248-	
5	116	104L	L	38:02	3	0.9297	12
			104L/123L/114L/118L/105L/126		0.928	0.9265-	
5	85	104L	L	38:05	5	0.9305	10
			104L/123L/114L/118L/105L/126		0.926	0.9240-	
5	117/116/85	104L	L	38:00	5	0.9289	12
			104L/123L/114L/118L/105L/126		0.933	0.9309-	
5	110	104L	L	38:16	0	0.9350	10
			104L/123L/114L/118L/105L/126		0.933	0.9317-	
5	115	104L	L	38:18	8	0.9358	10
			104L/123L/114L/118L/105L/126		0.933	0.9313-	
5	110/115	104L	L	38:17	4	0.9354	10
			104L/123L/114L/118L/105L/126		0.942	0.9415-	
5	82	104L	L	38:40	7	0.9439	6
			104L/123L/114L/118L/105L/126		0.947	0.9464-	
5	111	104L	L	38:52	6	0.9488	6
			104L/123L/114L/118L/105L/126		0.959	0.9581-	
5	120	104L	L	39:21	4	0.9606	6
			104L/123L/114L/118L/105L/126		0.991	0.9890-	
5	107	104L	L	40:39	1	0.9931	10
			104L/123L/114L/118L/105L/126		0.991	0.9894-	
5	124	104L	L	40:40	5	0.9935	10
			104L/123L/114L/118L/105L/126		0.991	0.9890-	
5	107/124	104L	L	40:39	1	0.9931	10
			104L/123L/114L/118L/105L/126		0.997	0.9959-	
5	109	104L	L	40:54	2	0.9984	6
					1.000	0.9992-	
5	123	123L	123L	41:02	4	1.0016	6
			104L/123L/114L/118L/105L/126		1.003	1.0024-	
5	106	123L	L	41:10	7	1.0049	6
					1.000	0.9992-	
5	118	118L	118L	41:22	4	1.0016	6
			104L/123L/114L/118L/105L/126		1.011	1.0101-	
5	122	118L	L	41:49	3	1.0125	6
					1.000	0.9992-	
5	114	114L	114L	41:58	4	1.0016	6
					0.999	0.9984-	
5	105	105L	105L	42:43	6	1.0008	6
			104L/123L/114L/118L/105L/126		1.033	1.0320-	
5	127	105L	L	44:09	2	1.0343	6
					1.000	0.9993-	
5	126	126L	126L	45:58	4	1.0015	6
Hexachlorobiphenyls							
					0.799	0.7960-	
6	155L	138L	138L	35:44	7	0.8034	20
					0.905	0.9035-	
6	153L	167L	155L/156L/157L/167L	43:17	2	0.9069	10
					1.000		
6	138L	138L	138L	44:41	0	1.0000	100

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
6	167L	138L	138L	47:49	1.070	1.0664-1.0739	20
6	156L	138L	138L	25:05	1.098	1.0974-1.0996	6
6	157L	138L	138L	25:08	1.099	1.0959-1.1033	20
6	156L/157L	138L	138L	25:07	1.099	1.0981-1.1003	6
6	169L	138L	138L	28:30	1.174	1.1738-1.1761	6
6	155	155L	155L	35:44	1.000	0.9977-1.0023	10
6	152	155L	155L/156L/157L/167L	36:07	1.010	1.0093-1.0121	6
6	150	155L	155L/156L/157L/167L	36:15	1.014	1.0131-1.0159	6
6	136	155L	155L/156L/157L/167L	36:44	1.028	1.0266-1.0294	6
6	145	155L	155L/156L/157L/167L	37:00	1.035	1.0340-1.0368	6
6	148	155L	155L/156L/157L/167L	34:26	1.075	1.0742-1.0770	6
6	151	155L	155L/156L/157L/167L	39:10	1.096	1.0938-1.0984	10
6	135	155L	155L/156L/157L/167L	39:17	1.099	1.0970-1.1017	10
6	154	155L	155L/156L/157L/167L	39:21	1.101	1.0989-1.1035	10
6	151/135/154	155L	155L/156L/157L/167L	39:15	1.098	1.0961-1.1007	10
6	144	155L	155L/156L/157L/167L	39:47	1.113	1.1119-1.1147	6
6	147	155L	155L/156L/157L/167L	40:09	1.123	1.1213-1.1259	10
6	149	155L	155L/156L/157L/167L	40:12	1.125	1.1227-1.1273	10
6	147/149	155L	155L/156L/157L/167L	40:10	1.124	1.1217-1.1264	10
6	134	155L	155L/156L/157L/167L	40:27	1.132	1.1297-1.1343	10
6	143	155L	155L/156L/157L/167L	40:30	1.133	1.1311-1.1357	10
6	134/143	155L	155L/156L/157L/167L	40:29	1.132	1.1306-1.1353	10
6	139	155L	155L/156L/157L/167L	40:47	1.141	1.1390-1.1437	10
6	140	155L	155L/156L/157L/167L	40:48	1.141	1.1395-1.1441	10
6	139/140	155L	155L/156L/157L/167L	40:47	1.141	1.1390-1.1437	10
6	131	155L	155L/156L/157L/167L	41:03	1.148	1.1474-1.1502	6
6	142	155L	155L/156L/157L/167L	41:13	1.153	1.1521-1.1549	6
6	132	155L	155L/156L/157L/167L	41:36	1.164	1.1618-1.1665	10
6	133	155L	155L/156L/157L/167L	41:57	1.174	1.1726-1.1754	6
6	165	167L	155L/156L/157L/167L	42:23	0.886	0.8853-0.8874	6
6	146	167L	155L/156L/157L/167L	42:38	0.891	0.8906-0.8926	6
6	161	167L	155L/156L/157L/167L	42:47	0.894	0.8937-0.8958	6
6	153	167L	155L/156L/157L/167L	43:17	0.905	0.9035-0.9069	10
6	168	167L	155L/156L/157L/167L	43:21	0.906	0.9048-0.9083	10
6	153/168	167L	155L/156L/157L/167L	43:19	0.905	0.9041-0.9076	10
6	141	167L	155L/156L/157L/167L	43:34	0.911	0.9101-0.9122	6
6	130	167L	155L/156L/157L/167L	44:01	0.920	0.9195-	6

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
					5	0.9216	
					0.925	0.9240-	
6	137	167L	155L/156L/157L/167L	44:14	1	0.9261	6
					0.927	0.9268-	
6	164	167L	155L/156L/157L/167L	44:22	8	0.9289	6
					0.934	0.9324-	
6	138	167L	155L/156L/157L/167L	44:42	8	0.9373	14
					0.934	0.9324-	
6	163	167L	155L/156L/157L/167L	44:42	8	0.9373	14
					0.936	0.9341-	
6	129	167L	155L/156L/157L/167L	44:47	6	0.9390	14
					0.938	0.9369-	
6	160	167L	155L/156L/157L/167L	44:53	7	0.9404	10
					0.936	0.9341-	
6	138/163/129/160	167L	155L/156L/157L/167L	44:47	6	0.9390	14
					0.942	0.9418-	
6	158	167L	155L/156L/157L/167L	45:05	8	0.9439	6
					0.961	0.9599-	
6	166	167L	155L/156L/157L/167L	45:59	7	0.9634	10
					0.965	0.9634-	
6	128	167L	155L/156L/157L/167L	46:46	1	0.9669	10
					0.963	0.9617-	
6	128/166	167L	155L/156L/157L/167L	46:04	4	0.9651	10
					0.982	0.9815-	
6	159	167L	155L/156L/157L/167L	46:59	6	0.9836	6
					0.989	0.9881-	
6	162	167L	155L/156L/157L/167L	47:18	2	0.9902	6
					1.000	0.9990-	
6	167	167L	155L/156L/157L/167L	47:49	0	1.0010	6
		156L/157			0.999	0.9983-	
6	156	L	156L/157L	49:05	3	1.0003	6
		156L/157			1.000	0.9990-	
6	157	L	156L/157L	49:09	7	1.0024	10
		156L/157			1.000	0.9990-	
6	156/157	L	156L/157L	45:07	0	1.0010	6
					0.994	0.9940-	
6	169	169L	169L	52:31	9	0.9959	6
Heptachlorobiphenyls							
					0.829	0.8254-	
7	188L	180L	180L	41:51	5	0.8337	20
					0.893	0.8892-	
7	178L	180L	180L	45:05	6	0.8981	20
					1.000		
7	180L	180L	180L	50:27	0	1.0000	100
					0.941	0.9372-	
7	170L	180L	180L	51:54	9	0.9466	20
					1.092	1.0867-	
7	189L	180L	180L	55:06	2	1.0976	20
					1.000	0.9988-	
7	188	188L	188L	41:51	0	1.0012	6
					1.011	1.0100-	
7	179	188L	188L/189L	42:19	2	1.0123	6
					1.021	1.0203-	
7	184	188L	188L/189L	42:45	5	1.0227	6
					1.033	1.0323-	
7	176	188L	188L/189L	43:15	5	1.0346	6
					1.045	1.0442-	
7	186	188L	188L/189L	43:45	4	1.0466	6
					1.077	1.0765-	
7	178	188L	188L/189L	45:06	7	1.0789	6
					1.093	1.0924-	
7	175	188L	188L/189L	45:46	6	1.0948	6
					1.100	1.0988-	
7	187	188L	188L/189L	46:02	0	1.1012	6
					1.104	1.1035-	
7	182	188L	188L/189L	46:14	7	1.1059	6
					1.115	1.1147-	
7	183	188L	188L/189L	46:42	9	1.1171	6
					1.120	1.1191-	
7	185	188L	188L/189L	46:53	3	1.1215	6
					1.117	1.1167-	
7	183/185	188L	188L/189L	46:47	9	1.1191	6
7	174	188L	188L/189L	47:02	1.123	1.1227-	6

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
					9	1.1251	
					1.135	1.1338-	
7	177	188L	188L/189L	47:30	0	1.1362	6
					1.143	1.1426-	
7	181	188L	188L/189L	47:52	8	1.1450	6
					1.150	1.1489-	
7	171	188L	188L/189L	48:10	9	1.1529	10
					1 151	1.1501-	
7	173	188L	188L/189L	48:11	3	1.1525	6
					1.150	1.1489-	
7	171/173	188L	188L/189L	48:10	9	1.1529	10
					0.903	0.9026-	
7	172	189L	188L/189L	49:47	5	0.9044	6
					0.909	0.9083-	
7	192	189L	188L/189L	50:06	3	0.9102	6
					0 915	0.9144-	
7	193	189L	188L/189L	50:26	3	0.9162	6
					0.915	0.9147-	
7	180	189L	188L/189L	50:27	6	0.9165	6
					0.915	0.9144-	
7	180/193	189L	188L/189L	50:26	3	0.9162	6
					0.922	0.9220-	
7	191	189L	188L/189L	50:51	9	0.9238	6
					0.941	0.9410-	
7	170	189L	188L/189L	51:54	9	0.9428	6
					0.951	0.9507-	
7	190	189L	188L/189L	52:26	6	0.9525	6
					1.000	0.9994-	
7	189	189L	189L	55:07	3	1 0012	6
Octachlorobiphenyls							
					0.829	0.8264-	
8	202L	194L	194L	47:31	3	0.8322	20
					1.409	1.4039-	
8	194L	138L	178L	57:18	0	1.4141	25
					1.008	1.0044-	
8	205L	194L	194L	57:48	7	1.0131	30
					1.000	0.9986-	
8	202	202L	202L	47:32	4	1.0021	10
					1.021	1.0193-	
8	201	202L	202L/205L	48:31	0	1.0228	10
					1.035	1.0340-	
8	204	202L	202L/205L	49:11	1	1.0361	6
					1.040	1.0396-	
8	197	202L	202L/205L	49:27	7	1.0417	6
					1.045	1.0442-	
8	200	202L	202L/205L	49:40	2	1.0463	6
					1.042	1.0417-	
8	197/200	202L	202L/205L	49:33	8	1.0438	6
					1.104	1.1031-	
8	198	202L	202L/205L	52:30	9	1.1066	10
					1.105	1.1045-	
8	199	202L	202L/205L	52.32	6	1.1066	6
					1.105	1.1035-	
8	198/199	202L	202L/205L	52:31	2	1.1070	10
					0.920	0.9198-	
8	196	205L	202L/205L	53:13	7	0.9216	6
					0.924	0.9236-	
8	203	205L	202L/205L	53:26	5	0.9253	6
					0.950	0.9493-	
8	195	205L	202L/205L	54:55	1	0.9510	6
					0.991	0.9908-	
8	194	205L	202L/205L	57:19	6	0.9925	6
					1.000	0.9994-	
8	205	205L	205L	57:49	3	1.0012	6
Nonachlorobiphenyls							
					0.951	0.9488-	
9	208L	194L	194L	54:32	7	0.9546	20
					1 040	1.0358-	
9	206L	194L	194L	59:36	1	1.0445	30
					1.000	0 9994-	
9	208	208L	208L	54:33	3	1.0012	6
					1.018	1.0174-	
9	207	208L	208L/206L	55:32	3	1 0193	6

Cl No[1]	IUPAC No[2,3]	RT Ref[4]	Quantitation Reference[5]	RT[6]	RRT[7]	RRT Limit[8]	RT Win[9] (sec)
					1.000	0.9994-	
9	206	206L	206L	59:37	3	1.0011	6
Decachlorobiphenyls							
				1:01:1	1 068	1.0643-	
10	209L	194L		4	6	1.0730	30
				1:01:1	1.000	0.9995-	
10	209	209L	209L	5	3	1.0011	6

1. Number of chlorines on congener.
2. Suffix "L" indicates labeled compound.
3. Multiple congeners in a box indicates a group of congeners that co-elute or may not be adequately resolved on a 30-m SPBOctyl column. Congeners included in the group are listed as the last entry in the box
4. Retention time reference that is used to locate target congener.
5. Quantitation reference that is used to calculate the concentration of the target congener or labeled standard.
6. Retention time of target congener.
7. RRT between the RT for the congener and RT for the reference.
8. Nominal limits based on an ± 0.5% of the RRT, adjusted for the nearest eluted isomer.
9. RT window width for congener or group of two or more congeners.
10. Labeled congeners that form the quantitation reference. Areas from the exact m/z's of the congeners listed in the quantitation reference are summed, and divided by the number of congeners in the quantitation reference. For example, for congener 10, the areas at the exact m/z's for 4L and 15L are summed and the sum is divided by 2 (because there are 2 congeners in the quantitation reference).

Table 3

Low Calibration Levels (LCLs) Based on Final Extract Volumes

		20 µL Extract Volume		100µL Extract Volume	
Analyte	Minimum Cal. Level CS0.5 (ng/mL)	Water 1L (ng/L)	Solids and Tissues 10g (ng/g)	Water 1L (ng/L)	Solids and Tissues 10g (ng/g)
Monochlorobiphenyls	0.5	0.01[1]	0.001[1]	0.05	0.005
Dichlorobiphenyls	0.5	0.01[1]	0.001[1]	0.05	0.005
Trichlorobiphenyls	0.5	0.01	0.001	0.05	0.005
Tetrachlorobiphenyls	0.5	0.01	0.001	0.05	0.005
Pentachlorobiphenyls	0.5	0.01	0.001	0.05	0.005
Hexachlorobiphenyls	0.5	0.01	0.001	0.05	0.005
Heptachlorobiphenyls	0.5	0.01	0.001	0.05	0.005
Octachlorobiphenyls	0.5	0.01	0.001	0.05	0.005
Nonachlorobiphenyls	0.5	0.01	0.001	0.05	0.005
Decachlorobiphenyl	0.5	0.01	0.001	0.05	0.005

1. This value reflects the LCL. Reliable detection at this level may not be attained due to evaporative loss in adjusting the extract volume to 20 µL for these homolog groups.

2. The values for solids and tissues reflect the LCLs for Protocol 1 as described in section 11.4. If the sample is prepared by another protocol described in that section, the LCLs shown in this table are multiplied by the EML multiplier, shown in the section 11.4 table.

Table 4

Estimated Minimum Levels – Matrix and Concentration

Parameter	Water ng/L	Solids ng/g	Tissues ng/g	Solid Wastes ng/g	100 uL Extract ng/mL
PCB 1	0.040	0.01	0.01	0.01	1.0
PCB 2	0.040	0.01	0.01	0.01	1.0
PCB 3	0.040	0.01	0.01	0.01	1.0
PCB 4	0.060	0.02	0.02	0.02	2.0
PCB 5	0.040	0.01	0.01	0.01	1.0
PCB 6	0.040	0.01	0.01	0.01	1.0
PCB 7	0.040	0.01	0.01	0.01	1.0
PCB 8	0.060	0.02	0.02	0.02	2.0
PCB 9	0.040	0.01	0.01	0.01	1.0
PCB 10	0.040	0.01	0.01	0.01	1.0
PCB 11	0.060	0.02	0.02	0.02	2.0
PCB 12/PCB 13	0.060	0.01	0.01	0.01	1.0
PCB 14	0.040	0.01	0.01	0.01	1.0
PCB 15	0.040	0.01	0.01	0.01	1.0
PCB 16	0.040	0.01	0.01	0.01	1.0
PCB 17	0.040	0.01	0.01	0.01	1.0
PCB 18/PCB 30	0.060	0.02	0.02	0.02	2.0
PCB 19	0.040	0.01	0.01	0.01	1.0
PCB 20/PCB 28	0.040	0.02	0.02	0.02	2.0
PCB 21/PCB33	0.040	0.01	0.01	0.01	1.0
PCB 22	0.040	0.01	0.01	0.01	1.0
PCB 23	0.040	0.01	0.01	0.01	1.0
PCB 24	0.040	0.01	0.01	0.01	1.0
PCB 25	0.040	0.01	0.01	0.01	1.0
PCB 26/PCB 29	0.040	0.01	0.01	0.01	1.0
PCB 27	0.040	0.01	0.01	0.01	1.0
PCB 31	0.040	0.02	0.02	0.02	2.0
PCB 32	0.040	0.01	0.01	0.01	1.0
PCB 34	0.040	0.01	0.01	0.01	1.0
PCB 35	0.040	0.01	0.01	0.01	1.0
PCB 36	0.040	0.01	0.01	0.01	1.0
PCB 37	0.040	0.01	0.01	0.01	1.0
PCB 38	0.040	0.01	0.01	0.01	1.0
PCB 39	0.040	0.01	0.01	0.01	1.0
PCB 40/PCB41/PCB 71	0.040	0.01	0.01	0.01	1.0
PCB 42	0.040	0.01	0.01	0.01	1.0
PCB 43/PCB 73	0.040	0.01	0.01	0.01	1.0
PCB 44/PCB 47/PCB 65	0.040	0.01	0.01	0.01	1.0
PCB 45/PCB 51	0.040	0.01	0.01	0.01	1.0
PCB 46	0.040	0.01	0.01	0.01	1.0
PCB 48	0.040	0.01	0.01	0.01	1.0
PCB 49/PCB 69	0.040	0.01	0.01	0.01	1.0
PCB 50/PCB 53	0.040	0.01	0.01	0.01	1.0
PCB 52	0.040	0.01	0.01	0.01	1.0
PCB 54	0.040	0.01	0.01	0.01	1.0
PCB 55	0.040	0.01	0.01	0.01	1.0
PCB 56	0.040	0.01	0.01	0.01	1.0
PCB 57	0.040	0.01	0.01	0.01	1.0
PCB 58	0.040	0.01	0.01	0.01	1.0
PCB 59/PCB 62/PCB 75	0.040	0.01	0.01	0.01	1.0
PCB 60	0.040	0.01	0.01	0.01	1.0
PCB 61/PCB 70/PCB 74/PCB 76	0.040	0.02	0.02	0.02	2.0

Parameter	Water ng/L	Solids ng/g	Tissues ng/g	Solid Wastes ng/g	100 uL Extract ng/mL
PCB 63	0.040	0.01	0.01	0.01	1.0
PCB 64	0.040	0.01	0.01	0.01	1.0
PCB 66	0.040	0.01	0.01	0.01	1.0
PCB 67	0.040	0.01	0.01	0.01	1.0
PCB 68	0.040	0.01	0.01	0.01	1.0
PCB 72	0.040	0.01	0.01	0.01	1.0
PCB 77	0.040	0.01	0.01	0.01	1.0
PCB 78	0.040	0.01	0.01	0.01	1.0
PCB 79	0.040	0.01	0.01	0.01	1.0
PCB 80	0.040	0.01	0.01	0.01	1.0
PCB 81	0.040	0.01	0.01	0.01	1.0
PCB 82	0.040	0.01	0.01	0.01	1.0
PCB 83	0.040	0.01	0.01	0.01	1.0
PCB 84	0.040	0.01	0.01	0.01	1.0
PCB 85/PCB 116/PCB 117	0.040	0.01	0.01	0.01	1.0
PCB 86/PCB 87/PCB 97/PCB 109/PCB 119/PCB 125	0.040	0.01	0.01	0.01	1.0
PCB 88/PCB 91	0.040	0.01	0 01	0.01	1.0
PCB 89	0.040	0.01	0.01	0.01	1.0
PCB 90/PCB 101/PCB 113	0.040	0.01	0.01	0.01	1.0
PCB 92	0.040	0.01	0.01	0.01	1.0
PCB 93/PCB 100	0.040	0.01	0.01	0.01	1.0
PCB 94	0.040	0.01	0.01	0.01	1.0
PCB 95	0.040	0.01	0.01	0.01	1.0
PCB 96	0.040	0.01	0.01	0.01	1.0
PCB 98/PCB 102	0.040	0.01	0.01	0.01	1.0
PCB 99/PCB 112	0.040	0.01	0.01	0.01	1.0
PCB 103	0.040	0.01	0.01	0.01	1.0
PCB 104	0.040	0.01	0.01	0 01	1.0
PCB 105	0.040	0.01	0 01	0.01	1 0
PCB 106	0.040	0.01	0.01	0.01	1 0
PCB 107	0.040	0.01	0.01	0.01	1.0
PCB 108/PCB 124	0.040	0.01	0.01	0.01	1.0
PCB 110/PCB 115	0.040	0.01	0.01	0.01	1.0
PCB 111	0.040	0.01	0.01	0.01	1.0
PCB 114	0.040	0.01	0.01	0.01	1.0
PCB 118	0.040	0.01	0.01	0.01	1.0
PCB 120	0.040	0.01	0.01	0.01	1.0
PCB 121	0.040	0.01	0.01	0.01	1.0
PCB 122	0.040	0.01	0.01	0.01	1.0
PCB 123	0.040	0.01	0.01	0.01	1.0
PCB 126	0.040	0.01	0.01	0.01	1.0
PCB 127	0.040	0.01	0.01	0.01	1.0
PCB 128/PCB 166	0.040	0.01	0.01	0.01	1.0
PCB 129/PCB 138/PCB 163	0.040	0.01	0.01	0.01	1.0
PCB 130	0.040	0.01	0.01	0.01	1.0
PCB 131	0 040	0.01	0.01	0.01	1.0
PCB 132	0.040	0.01	0.01	0.01	1.0
PCB 133	0.040	0.01	0.01	0.01	1 0
PCB 134/PCB 143	0.040	0.01	0.01	0.01	1.0
PCB 135/PCB 151	0.040	0.01	0.01	0.01	1 0
PCB 136	0.040	0.01	0.01	0.01	1.0
PCB 137/PCB 164	0.040	0.01	0.01	0 01	1.0
PCB 139/PCB 140	0.040	0.01	0.01	0 01	1.0
PCB 141	0.040	0 01	0.01	0 01	1.0
PCB 142	0.040	0.01	0.01	0.01	1.0
PCB 144	0.040	0.01	0.01	0.01	1.0
PCB 145	0 040	0.01	0 01	0.01	1.0
PCB 146	0.040	0.01	0 01	0.01	1.0

Parameter	Water ng/L	Solids ng/g	Tissues ng/g	Solid Wastes ng/g	100 uL Extract ng/mL
PCB 147/PCB 149	0.040	0.01	0.01	0.01	1.0
PCB 148	0 040	0.01	0.01	0.01	1.0
PCB 150	0.040	0.01	0.01	0.01	1 0
PCB 152	0.040	0.01	0.01	0.01	1.0
PCB 153/PCB 168	0.040	0.01	0.01	0.01	1.0
PCB 154	0.040	0.01	0.01	0.01	1.0
PCB 155	0.040	0.01	0.01	0.01	1.0
PCB 156/PCB 157	0.040	0.01	0.01	0.01	1.0
PCB 158	0.040	0.01	0.01	0.01	1.0
PCB 159	0.040	0.01	0.01	0.01	1.0
PCB 160	0.040	0.01	0.01	0.01	1.0
PCB 161	0.040	0.01	0.01	0.01	1.0
PCB 162	0.040	0.01	0.01	0.01	1.0
PCB 165	0.040	0.01	0.01	0.01	1.0
PCB 167	0.040	0.01	0.01	0.01	1.0
PCB 169	0.040	0.01	0.01	0.01	1.0
PCB 170	0.040	0 01	0.01	0.01	1.0
PCB 171/PCB 173	0.040	0.01	0.01	0.01	1.0
PCB 172	0.040	0.01	0.01	0.01	1.0
PCB 174	0.040	0.01	0.01	0.01	1.0
PCB 175	0.040	0.01	0.01	0.01	1.0
PCB 176	0.040	0.01	0.01	0.01	1.0
PCB 177	0.040	0.01	0.01	0.01	1.0
PCB 178	0.040	0.01	0.01	0.01	1.0
PCB 179	0.040	0.01	0.01	0.01	1.0
PCB 180/PCB 193	0.040	0.01	0.01	0.01	1.0
PCB 181	0.040	0.01	0.01	0.01	1.0
PCB 182	0.040	0.01	0 01	0.01	1.0
PCB 183/PCB 185	0.040	0.01	0.01	0.01	1.0
PCB 184	0.040	0.01	0.01	0 01	1.0
PCB 186	0.040	0.01	0.01	0.01	1.0
PCB 187	0.040	0.01	0.01	0.01	1.0
PCB 188	0.040	0.01	0.01	0.01	1.0
PCB 189	0.040	0.01	0.01	0.01	1.0
PCB 190	0.040	0.01	0.01	0.01	1.0
PCB 191	0.040	0.01	0.01	0 01	1.0
PCB 192	0.040	0.01	0.01	0 01	1.0
PCB 194	0.040	0.01	0.01	0.01	1.0
PCB 195	0.040	0.01	0.01	0.01	1 0
PCB 196	0.040	0.01	0.01	0.01	1 0
PCB 197/PCB 200	0.040	0.01	0.01	0.01	1.0
PCB 198/PCB 199	0.040	0.01	0.01	0.01	1.0
PCB 201	0.040	0.01	0.01	0.01	1 0
PCB 202	0.040	0.01	0.01	0.01	1.0
PCB 203	0.040	0.01	0 01	0.01	1.0
PCB 204	0.040	0.01	0.01	0.01	1.0
PCB 205	0.040	0 01	0.01	0.01	1.0
PCB 206	0.040	0.01	0 01	0.01	1.0
PCB 207	0.040	0.01	0.01	0.01	1.0
PCB 208	0.040	0.01	0.01	0.01	1.0
PCB 209	0.040	0.01	0 01	0.01	1.0

The estimated minimum level (EML) is defined as the lowest concentration at which an analyte can be measured reliably with common laboratory interferences present assuming a sample is extracted at the recommended weight or volume and is carried through all normal extraction and analysis procedures The values for solids, tissues and solid wastes reflect the EMLs for Protocol 1 as described in section 11.4. If the sample is prepared by another protocol described in that section, the LCLs shown in this table are multiplied by the EML multiplier, shown in the section 11.4 table. The EMLs are based on the mean plus 2 standard deviations for matrix-pooled historical blank data and calibration data obtained while performing EPA 1668A. The survey period was fourteen months, ending in February 2004. Individual EMLs may be adjusted to reflect more recent data.

Table 5

Concentration of Stock and Spiking Solutions Containing PCBs and Labeled Compounds

				Solution concentration (ng/mL)			
				Labeled compound		PAR	
PCB Congener	BZ/ IUPAC	Standard Source	Catalog Number	Stock[1]	Spiking[2]	Stock[3]	Spiking[4]
2-MoCB	1	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
4-MoCB	3	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2'-DiCB	4	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
4,4'-DiCB	15	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',6-TrCB	19	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
3,4,4'-TrCB	37	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',6,6'-TeCB	54	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
3,3',4,4'-TeCB	77	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
3,4,4',5-TeCB	81	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',4,6,6'-PeCB	104	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,3,3',4,4'-PeCB	105	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,3,4,4',5-PeCB	114	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,3',4,4',5-PeCB	118	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2',3,4,4',5-PeCB	123	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
3,3',4,4',5-PeCB	126	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',4,4',6,6'-HxCB	155	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,3,3',4,4',5-HxCB	156	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,3,3',4,4',5'-HxCB	157	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,3',4,4',5,5'-HxCB	167	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
3,3',4,4',5,5'-HxCB	169	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',3,3',4,4',5-HpCB	170	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',3,4,4',5,5'-HpCB	180	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',3,4',5,6,6'-HpCB	188	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,3,3',4,4',5,5'-HpCB	189	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',3,3',5,5',6,6'-OcCB	202	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,3,3',4,4',5,5',6-OcCB	205	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',3,3',4,4',5,5',6-NoCB	206	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
2,2',3,3',4',5,5',6,6'-NoCB	208	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
DeCB	209	AccuStd	S-99994-4x	---	---	4000	1.0/5.0
All other CB congeners	NA	AccuStd	S-99994-4x			4000	1.0/5.0
Labeled Internal Standards							
$^{13}C_{12}$-2-chlorobiphenyl	1L	Cambridge	EC-4908	1000	2.0/10	---	---
$^{13}C_{12}$-4-chlorobiphenyl	3L$_{12}$	Cambridge	EC-4990	1000	2.0/10	---	---
$^{13}C_{12}$-2,2'-dichlorobiphenyl	4L	Cambridge	EC-4911	1000	2.0/10	---	---
$^{13}C_{12}$-4,4'-dichlorobiphenyl	15L	Cambridge	EC-1402	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',6-trichlorobiphenyl	19L	Cambridge	EC-4909	1000	2.0/10	---	---
$^{13}C_{12}$-3,4,4'-trichlorobiphenyl	37L	Cambridge	EC-4901	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',6,6'-tetrachlorobiphenyl	54L	Cambridge	EC-4912	1000	2.0/10	---	---
$^{13}C_{12}$-3,3',4,4'-tetrachlorobiphenyl	77L	Cambridge	EC-1404	1000	2.0/10	---	---
$^{13}C_{12}$-3,4,4',5-tetrachlorobiphenyl	81L	Cambridge	EC-1412	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',4,6,6'-pentachlorobiphenyl	104L	Cambridge	EC-4910	1000	2.0/10	---	---
$^{13}C_{12}$-2,3,3',4,4'-pentachlorobiphenyl	105L	Cambridge	EC-1420	1000	2.0/10	---	---
$^{13}C_{12}$2,3,4,4',5-pentachlorobiphenyl -	114L	Cambridge	EC-4902	1000	2.0/10	---	---
$^{13}C_{12}$-2,3',4,4',5-pentachlorobiphenyl	118L	Cambridge	EC-1435	1000	2.0/10	---	---
$^{13}C_{12}$-2',3,4,4',5-pentachlorobiphenyl	123L	Cambridge	EC-4904	1000	2.0/10	---	---
$^{13}C_{12}$-3,3',4,4',5-pentachlorobiphenyl	126L	Cambridge	EC-1425	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',4,4',6,6'-hexachlorobiphenyl	155L	Cambridge	EC-4167	1000	2.0/10	---	---
$^{13}C_{12}$-2,3,3',4,4',5-hexachlorobiphenyl	156L	Cambridge	EC-1422	1000	2.0/10	---	---
$^{13}C_{12}$-2,3,3',4,4',5'-hexachlorobiphenyl	157L	Cambridge	EC-4051	1000	2.0/10	---	---
$^{13}C_{12}$-2,3',4,4',5,5'-hexachlorobiphenyl	167L	Cambridge	EC-4050	1000	2.0/10	---	---
$^{13}C_{12}$-3,3',4,4',5,5'-hexachlorobiphenyl	169L	Cambridge	EC-1416	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',3,3',4,4',5-heptachlorobiphenyl	170L	Cambridge	EC-4905	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',3,4',5,6,6'-heptachlorobiphenyl	188L	Cambridge	EC-4913	1000	2.0/10	---	---
$^{13}C_{12}$-2,3,3',4,4',5,5'-heptachlorobiphenyl	189L	Cambridge	EC-1409	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-octachlorobiphenyl	202L	Cambridge	EC-1408	1000	2.0/10	---	---
$^{13}C_{12}$-2,3,3',4,4',5,5',6-octachlorobiphenyl	205L	Cambridge	EC-4199	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-nonachlorobiphenyl	206L	Cambridge	EC-4900	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',3,3',4,5,5',6,6'-nonachlorobiphenyl	208L	Cambridge	EC-1419	1000	2.0/10	---	---
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl	209L	Cambridge	EC-1410	1000	2.0/10	---	---

Table 5 Continued

PCB Congener	BZ/ IUPAC	Standard Source	Catalog Number	Solution concentration (ng/mL) Labeled compound Stock	Labeled compound Spiking	PAR Stock	PAR Spiking
Labeled Recovery Standards[5]							
$^{13}C_{12}$-2,5-dichlorobiphenyl	9L	Cambridge	EC-4165	1000	100	---	---
$^{13}C_{12}$-2,4',5-trichlorobiphenyl	31L	Wellington	MBP-31	1000	100	---	---
$^{13}C_{12}$-2,4',6-trichlorobiphenyl	32L	Cambridge	EC-4163	1000	100	---	---
$^{13}C_{12}$-2,2',5,5'-tetrachlorobiphenyl	52L	Cambridge	EC-1424	1000	100	---	---
$^{13}C_{12}$-2,2',4,5,5'-pentachlorobiphenyl	101L	Cambridge	EC-1405	1000	100	---	---
$^{13}C_{12}$-3,3',4,5,5'-pentachlorobiphenyl	127L	Cambridge	EC-1421	1000	100	---	---
$^{13}C_{12}$-2,2',3,4,4',5'-hexachlorobiphenyl	138L	Cambridge	EC-1436	1000	100	---	---
$^{13}C_{12}$-2,2',3,4,4',5,5'-heptachlorobiphenyl	180L	Cambridge	EC-1407	1000	100	---	---
$^{13}C_{12}$-2,2',3,3',4,4',5,5'-octachlorobiphenyl	194L	Cambridge	EC-1418	1000	100	---	---
Cleanup Standards[6]							
$^{13}C_{12}$-2,4,4'-trichlorobiphenyl	28L	Cambridge	EC-1413	5000	2.0/10	---	---
$^{13}C_{12}$-2,3,3',5,5'-pentachlorobiphenyl	111L	Cambridge	EC-1415	5000	2.0/10	---	---
$^{13}C_{12}$-2,2',3,3',5,5',6-heptachlorobiphenyl	178L	Cambridge	EC-1417	5000	2.0/10	---	---
Labeled Surrogate Standards[7]							
$^{13}C_{12}$-2,4'-dichlorobiphenyl	8L	Cambridge	EC-5095	5000	50	---	---
$^{13}C_{12}$-3,3',4,5'-tetrachlorobiphenyl	79L	Cambridge	EC-5048	5000	50	---	---
$^{13}C_{12}$-2,2',3,5',6-pentachlorobiphenyl	95L	Wellington	MBP-95	5000	50	---	---
$^{13}C_{12}$-2,2',4,4',5,5'-hexachlorobiphenyl	153L	Cambridge	EC-1406	5000	50	---	---

Notes:

1. Section 7.12.5.2– prepared in nonane and diluted to prepare spiking solution
2. Section 7.12.9– prepared in acetone from stock solution. Concentrations listed are for 20µL and 100µL final extract volumes.
3. Section 7.12.5.1 – prepared in nonane and diluted to prepare spiking solution.
4. Section 7.12.7– prepared in acetone from stock solution. Concentrations listed are for 20µL and 100µL final extract volumes.
5. Section 7.12.15– prepared in nonane and added to concentrated extract prior to injection.
6. Section 7.12.11– prepared in hexane and added to extract prior to cleanup. Concentrations listed are for 20µL and 100µL final extract volumes
7. Section 7.12.13– prepared in nonane and added to XAD tube prior to sampling.

Table 6
Concentration of PCBs in Calibration Verification Solutions

Analyte Type	BZ/IUPAC[1]	CS 0.5 ng/mL	CS 1 ng/mL	CS 2 ng/mL	CS 3[2] ng/mL	CS 4 ng/mL	CS 5 ng/mL
Congeners							
2-MoCB	1	0.5	1.0	5.0	50	400	2000
4-MoCB	3	0.5	1.0	5.0	50	400	2000
2,2'-DiCB	4	0.5	1.0	5.0	50	400	2000
4,4'-DiCB	15	0.5	1.0	5.0	50	400	2000
2,2',6'-TrCB	19	0.5	1.0	5.0	50	400	2000
3,4,4'-TrCB	37	0.5	1.0	5.0	50	400	2000
2,2',6,6'-TeCB	54	0.5	1.0	5.0	50	400	2000
3,3',4,4'-TeCB	77	0.5	1.0	5.0	50	400	2000
3,4,4',5-TeCB	81	0.5	1.0	5.0	50	400	2000
2,2',4.6,6'-PeCB	104	0.5	1.0	5.0	50	400	2000
2,3,3',4,4'-PeCB	105	0.5	1.0	5.0	50	400	2000
2,3,4,4',5-PeCB	114	0.5	1.0	5.0	50	400	2000
2,3',4,4',5-PeCB	118	0.5	1.0	5.0	50	400	2000
2',3,4.4',5-PeCB	123	0.5	1.0	5.0	50	400	2000
3,3',4,4',5-PeCB	126	0.5	1.0	5.0	50	400	2000
2,2',4,4',6,6'-HxCB	155	0.5	1.0	5.0	50	400	2000
2,3,3',4,4',5-HxCB	156	0.5	1.0	5.0	50	400	2000
2,3,3',4,4',5'-HxCB	157	0.5	1.0	5.0	50	400	2000
2,3',4,4',5,5'-HxCB	167	0.5	1.0	5.0	50	400	2000
3,3',4,4',5,5'-HxCB	169	0.5	1.0	5.0	50	400	2000
2,2',3,4',5,6,6'-HpCB	188	0.5	1.0	5.0	50	400	2000
2,3,3',4.4',5,5'-HpCB	189	0.5	1.0	5.0	50	400	2000
2.2',3.3',5.5',6,6'-OcCB	202	0.5	1.0	5.0	50	400	2000
2,3,3',4,4',5.5',6-OcCB	205	0.5	1.0	5.0	50	400	2000
2.2',3.3',4,4'.5,5',6-NoCB	206	0.5	1.0	5.0	50	400	2000
2.2',3.3',4',5,5',6,6'-NoCB	208	0.5	1.0	5.0	50	400	2000
DeCB	209	0.5	1.0	5.0	50	400	2000
All other CB congeners		0.5	1.0	5.0	50	400	2000
Labeled Congeners							
$^{13}C_{12}$-2-MoCB	1L	100	100	100	100	100	100
$^{13}C_{12}$-4-MoCB	3L	100	100	100	100	100	100
$^{13}C_{12}$-2,2'-DiCB	4L	100	100	100	100	100	100
$^{13}C_{12}$-4,4'-DiCB	15L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',6-TrCB	19L	100	100	100	100	100	100
$^{13}C_{12}$-3.4,4'-TrCB	37L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	100	100	100	100	100	100
$^{13}C_{12}$-3,3',4.4'-TeCB	77L	100	100	100	100	100	100
$^{13}C_{12}$-3,4,4',5-TeCB	81L	100	100	100	100	100	100
$^{13}C_{12}$-2.2',4.6,6'-PeCB	104L	100	100	100	100	100	100
$^{13}C_{12}$-2,3,3',4,4'-PeCB	105L	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,4',5-PeCB	114L	100	100	100	100	100	100
$^{13}C_{12}$-2,3',4,4',5-PeCB	118L	100	100	100	100	100	100
$^{13}C_{12}$-2',3,4.4',5-PeCB	123L	100	100	100	100	100	100
$^{13}C_{12}$-3,3',4.4',5-PeCB	126L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	100	100	100	100	100	100
$^{13}C_{12}$-2,3,3',4,4',5-HxCB	156L	100	100	100	100	100	100
$^{13}C_{12}$-2,3,3',4,4',5'-HxCB	157L	100	100	100	100	100	100
$^{13}C_{12}$-2,3',4,4',5,5'-HxCB	167L	100	100	100	100	100	100
$^{13}C_{12}$-3,3',4,4',5.5'-HxCB	169L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',3,3',4.4',5-HpCB	170L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',3,4',5.6,6'-HpCB	188L	100	100	100	100	100	100
$^{13}C_{12}$-2,3,3',4.4',5,5'-HpCB	189L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',3,3',5.5',6,6'-OcCB	202L	100	100	100	100	100	100
$^{13}C_{12}$-2,3,3',4.4',5.5',6-OcCB	205L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',3,3',4',5,5',6,6'-NoCB	208L	100	100	100	100	100	100
$^{13}C_{12}$-DeCB	209L	100	100	100	100	100	100
Cleanup Standards							
$^{13}C_{12}$-2.4,4'-TriCB	28L	0.5	1.0	5.0	50	400	--
$^{13}C_{12}$-2,3,3',5,5'-PeCB	111L	0.5	1.0	5.0	50	400	--
$^{13}C_{12}$-2.2',3,3',5.5',6-HpCB	178L	0.5	1.0	5.0	50	400	--

Table 6 Continued

Analyte Type	BZ/IUPAC[1]	CS 0.5 ng/mL	CS 1 ng/mL	CS 2 ng/mL	CS 3[2] ng/mL	CS 4 ng/mL	CS 5 ng/mL
Recovery Standards							
$^{13}C_{12}$-2,5-DiCB	9L	100	100	100	100	100	100
$^{13}C_{12}$-2,4',5-TriCB	31L	100	100	100	100	100	100
$^{13}C_{12}$-2,4',6-TriCB	32L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',5,5'-TeCB	52L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',4',5,5'-PeCB	101L	100	100	100	100	100	100
$^{13}C_{12}$-3,3',4,5,5'-PeCB	127L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',3',4,4',5'-HxCB	138L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',3,4,4',5,5'-HpCB	180L	100	100	100	100	100	100
$^{13}C_{12}$-2,2',3,3',4,4',5,5'-OcCB	194L	100	100	100	100	100	100
Labeled Sampling Surrogates							
$^{13}C_{12}$-2,4'-DiCB	8L	0.5	1.0	5.0	50	400	--
$^{13}C_{12}$-3,3',4,5'-TeCB	79L	0.5	1.0	5.0	50	400	--
$^{13}C_{12}$-2,2',3,5',6-PeCB	95L	0.5	1.0	5.0	50	400	--
$^{13}C_{12}$-2,2',4,4',5,5'-HxCB	153L	0.5	1.0	5.0	50	400	--

Notes:
1. Suffix "L" indicates labeled compound
2. Section 15.3, calibration verification solution

Table 7

GC Window Defining Mixture

SPB-Octyl

Congener Group	First Eluted		Last Eluted	
Mono	1	2-	3	4-
Di	4	2,2'-	15	4,4'-
Tri	19	2,2',6-	37	3,4,4'-
Tetra	54	2,2',6,6'-	77	3,3',4,4'-
Penta	104	2,2',4,6,6'-	126	3,3',4,4',5-
Hexa	155	2,2',4,4',6,6'-	169	3,3',4,4',5,5'-
Hepta	188	2,2',3,4',5,6,6'-	189	2,3,3',4,4',5,5'-
Octa	202	2,2',3,3',5,5',6,6'-	205	2,3,3',4,4',5,5',6-
Nona	208	2,2',3,3',4,5,5',6,6'-	206	2,2',3,3',4,4',5,5',6-
Deca	209	2,2',3,3',4,4',5,5',6,6'-	209	2,2',3,3',4,4',5,5',6,6'-

SPB-Octyl Resolution Test Compounds

23	2,3,5-trichlorobiphenyl
34	2',3,5-trichlorobiphenyl (2,3',5'-trichlorobiphenyl)
182	2,2',3,4,4',5,6'-heptachlorobiphenyl
187	2,2',3,4',5,5',6-heptachlorobiphenyl

Table 8

Ions Monitored for HRGC/HRMS Analysis of PCBs

Descriptor	Accurate Mass	Ion ID	Elemental Composition	Analyte
1	188.0393	M	$C_{12}H_9{}^{35}Cl$	Mono
	190.0363	M+2	$C_{12}H_9{}^{37}Cl$	Mono
	192.9888	Lock	C_5F_7	PFK
	200.0795	M	$^{13}C_{12}H_9{}^{35}Cl$	Mono-13C12
	202.0766	M+2	$^{13}C_{12}H_9{}^{37}Cl$	Mono-13C12
	222.0003	M	$C_{12}H_8{}^{35}Cl_2$	Di
	223.9974	M+2	$C_{12}H_8{}^{35}Cl{}^{37}Cl$	Di
	234.0406	M	$^{13}C_{12}H_8{}^{35}Cl_2$	Di-13C
	236.0376	M+2	$^{13}C_{12}H_8{}^{35}Cl{}^{37}Cl$	Di-13C
	255.9613	M	$C_{12}H_7{}^{35}Cl_3$	Tri
	257.9584	M+2	$C_{12}H_7{}^{35}Cl_2{}^{37}Cl$	Tri
	268.0016	M	$^{13}C_{12}H_7{}^{35}Cl_3$	Tri-13C
	268.9824	QC	C_5F_{11}	PFK
	269.9986	M+2	$^{13}C_{12}H_7{}^{35}Cl_2{}^{37}Cl$	Tri-13C
	289.9224	M	$C_{12}H_6{}^{35}Cl_4$	Tetra
	291.9194	M+2	$C_{12}H_6{}^{35}Cl_3{}^{37}Cl$	Tetra
2	255.9613	M	$C_{12}H_7{}^{35}Cl_3$	Tri
	257.9584	M+2	$C_{12}H_7{}^{35}Cl_2{}^{37}Cl$	Tri
	268.0016	M	$^{13}C_{12}H_7{}^{35}Cl_3$	Tri-13C
	268.9824	Lock	C_5F_{11}	PFK
	269.9986	M+2	$^{13}C_{12}H_7{}^{35}Cl_2{}^{37}Cl$	Tri-13C
	289.9224	M	$C_{12}H_6{}^{35}Cl_4$	Tetra
	291.9194	M+2	$C_{12}H_6{}^{35}Cl_3{}^{37}Cl$	Tetra
	301.9626	M	$^{13}C_{12}H_6{}^{35}Cl_4$	Tetra-13C
	303.9597	M+2	$^{13}C_{12}H_6{}^{35}Cl_3{}^{37}Cl$	Tetra-13C
	325.8804	M+2	$C_{12}H_5{}^{35}Cl_4{}^{37}Cl$	Penta
	327.8775	M+4	$C_{12}H_5{}^{35}Cl_3{}^{37}Cl_2$	Penta
	337.9207	M+2	$^{13}C_{12}H_5{}^{35}Cl_4{}^{37}Cl$	Penta-13C
	339.9178	M+4	$^{13}C_{12}H_5{}^{35}Cl_3{}^{37}Cl_2$	Penta-13C
	342.9792	QC	C_8F_{13}	PFK
	359.8415	M+2	$C_{12}H_4{}^{35}Cl_5{}^{37}Cl$	Hexa
	361.8385	M+4	$C_{12}H_4{}^{35}Cl_4{}^{37}Cl_2$	Hexa
	371.8817	M+2	$^{13}C_{12}H_4{}^{35}Cl_5{}^{37}Cl$	Hexa-13C
	373.8788	M+4	$^{13}C_{12}H_4{}^{35}Cl_4{}^{37}Cl_2$	Hexa-13C

Table 8 Continued

Ions Monitored for HRGC/HRMS Analysis of PCDDs and PCDFs

Descriptor	Accurate Mass	Ion ID	Elemental Composition	Analyte
3	325.8804	M+2	$C_{12}H_5{}^{35}Cl_4{}^{37}Cl$	Penta
	327.8775	M+4	$C_{12}H_5{}^{35}Cl_3{}^{37}Cl_2$	Penta
	337.9207	M+2	$^{13}C_{12}H_5{}^{35}Cl_4{}^{37}Cl$	Penta-13C
	339.9178	M+4	$^{13}C_{12}H_5{}^{35}Cl_3{}^{37}Cl_2$	Penta-13C
	342.9792	Lock	C_8F_{13}	PFK
	359.8415	M+2	$C_{12}H_4{}^{35}Cl_5{}^{37}Cl$	Hexa
	361.8385	M+4	$C_{12}H_4{}^{35}Cl_4{}^{37}Cl_2$	Hexa
	371.8817	M+2	$^{13}C_{12}H_4{}^{35}Cl_5{}^{37}Cl$	Hexa-13C
	373.8788	M+4	$^{13}C_{12}H_4{}^{35}Cl_4{}^{37}Cl_2$	Hexa-13C
	393.8025	M+2	$C_{12}H_3{}^{35}Cl_6{}^{37}Cl$	Hepta
	395.7995	M+4	$C_{12}H_3{}^{35}Cl_5{}^{37}Cl_2$	Hepta
	405.8428	M+2	$^{13}C_{12}H_3{}^{35}Cl_6{}^{37}Cl$	Hepta-13C
	407.8398	M+4	$^{13}C_{12}H_3{}^{35}Cl_5{}^{37}Cl_2$	Hepta-13C
	427.7635	M+2	$C_{12}H_2{}^{35}Cl_7{}^{37}Cl$	Octa
	429.7606	M+4	$C_{12}H_2{}^{35}Cl_6{}^{37}Cl_2$	Octa
	430.9728	QC	C_9F_{17}	PFK
	439.8038	M+2	$^{13}C_{12}H_2{}^{35}Cl_7{}^{37}Cl$	Octa-13C
	441.8008	M+4	$^{13}C_{12}H_2{}^{35}Cl_6{}^{37}Cl_2$	Octa-13C
4	393.8025	M+2	$C_{12}H_3{}^{35}Cl_6{}^{37}Cl$	Hepta
	395.7995	M+4	$C_{12}H_3{}^{35}Cl_5{}^{37}Cl_2$	Hepta
	404.9760	Lock	$C_{10}F_{15}$	PFK
	405.8428	M+2	$^{13}C_{12}H_3{}^{35}Cl_6{}^{37}Cl$	Hepta-13C
	407.8398	M+4	$^{13}C_{12}H_3{}^{35}Cl_5{}^{37}Cl_2$	Hepta-13C
	427.7635	M+2	$C_{12}H_2{}^{35}Cl_7{}^{37}Cl$	Octa
	429.7606	M+4	$C_{12}H_2{}^{35}Cl_6{}^{37}Cl_2$	Octa
	439.8038	M+2	$^{13}C_{12}H_2{}^{35}Cl_7{}^{37}Cl$	Octa-13C
	441.8008	M+4	$^{13}C_{12}H_2{}^{35}Cl_6{}^{37}Cl_2$	Octa-13C
	461.7246	M+2	$C_{12}H^{35}Cl_7{}^{37}Cl_2$	Nona
	463.7216	M+4	$C_{12}H^{35}Cl_6{}^{37}Cl_3$	Nona
	473.7648	M+2	$^{13}C_{12}H^{35}Cl_7{}^{37}Cl_2$	Nona-13C
	475.7619	M+4	$^{13}C_{12}H^{35}Cl_6{}^{37}Cl_3$	Nona-13C
	495.6856	M+2	$C_{12}{}^{35}Cl_8{}^{37}Cl_2$	Deca
	497.6826	M+4	$C_{12}{}^{35}Cl_7{}^{37}Cl_3$	Deca
	504.9697	QC	$C_{12}F_{19}$	PFK
	507.7258	M+2	$^{13}C_{12}{}^{35}Cl_8{}^{37}Cl_2$	Deca-13C
	509.7229	M+4	$^{13}C_{12}{}^{35}Cl_7{}^{37}Cl_3$	Deca-13C

1. Nuclidic masses used: H = 1.007825 C = 12.00000 ^{13}C = 13.003355 F = 18.9984
O = 15.994915 ^{35}Cl = 34.968853 ^{37}Cl = 36.965903

Table 9

Theoretical Ion Abundance Ratios and Their Control Limits for PCBs

Chlorine Atoms	m/z's Forming Ratios	Theoretical Ratio	Lower QC Limit	Upper QC Limit
1	m/m+2	3.13	2.66	3.60
2	m/m+2	1.56	1.33	1.79
3	m/m+2	1.04	0.88	1.20
4	m/m+2	0.77	0.65	0.89
5	m+2/m+4	1.55	1.32	1.78
6	m+2/m+4	1.24	1.05	1.43
7	m+2/m+4	1.05	0.89	1.21
8	m+2/m+4	0.89	0.76	1.02
9	m+2/m+4	0.77	0.65	0.89
10	m+2/m+4	0.69	0.59	0.79

Table 10
Acceptance Criteria for Performance Tests

PCB congener	IUPAC	Test Conc. (ng/mL)[1]	IPR RSD (%)	IPR X (%)	OPR(LCS) (%)	VER (%)
Toxic & LOC Congeners						
2-chlorobiphenyl	1	50	40	60-140	50-150	70-130
4-chlorobiphenyl	3	50	40	60-140	50-150	70-130
2,2'-dichlorobiphenyl	4	50	40	60-140	50-150	70-130
4,4'-dichlorobiphenyl	15	50	40	60-140	50-150	70-130
2,2',6-trichlorobiphenyl	19	50	40	60-140	50-150	70-130
3,4,4'-trichlorobiphenyl	37	50	40	60-140	50-150	70-130
2,2',6,6'-tetrachlorobiphenyl	54	50	40	60-140	50-150	70-130
3,3',4,4'-tetrachlorobiphenyl	77	50	40	60-140	50-150	70-130
3,4,4',5-tetrachlorobiphenyl	81	50	40	60-140	50-150	70-130
2,2'4,6,6'-pentachlorobiphenyl	104	50	40	60-140	50-150	70-130
2,3,3',4,4'-pentachlorobiphenyl	105	50	40	60-140	50-150	70-130
2,3,4,4',5-pentachlorobiphenyl	114	50	40	60-140	50-150	70-130
2,3',4,4',5-pentachlorobiphenyl	118	50	40	60-140	50-150	70-130
2',3',4,4',5-pentachlorobiphenyl	123	50	40	60-140	50-150	70-130
3,3',4,4',5-pentachlorobiphenyl	126	50	40	60-140	50-150	70-130
2,2',4,4',6,6'-hexachlorobiphenyl	155	50	40	60-140	50-150	70-130
2,3,3',4,4',5-hexachlorobiphenyl	156	50	40	60-140	50-150	70-130
2,3,3',4,4',5'-hexachlorobiphenyl	167	50	40	60-140	50-150	70-130
3,3',4,4',5,5'-hexachlorobiphenyl	169	50	40	60-140	50-150	70-130
2,2',3,4'5,6,6'-heptachlorobiphenyl	188	50	40	60-140	50-150	70-130
2,3,3',4,4',5,5'-heptachlorobiphenyl	189	50	40	60-140	50-150	70-130
2,2',3,3',5,5',6,6'-octachlorobiphenyl	202	50	40	60-140	50-150	70-130
2,3,3',4,4',5,5',6-octachlorobiphenyl	205	50	40	60-140	50-150	70-130
2,2',3,3',4,4',5,5',6-nonachlorobiphenyl	206	50	40	60-140	50-150	70-130
2,2',3,3',4,5,5',6,6'-nonachlorobiphenyl	208	50	40	60-140	50-150	70-130
2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl	209	50	40	60-140	50-150	70-130
All other congeners		50	NA	NA	NA	70-130[2],40-160[3]
Labeled Internal Standards						
$^{13}C_{12}$-2-chlorobiphenyl	1L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-4-chlorobiphenyl	3L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2'-dichlorobiphenyl	4L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-4,4'-dichlorobiphenyl	15L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',6-trichlorobiphenyl	19L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-3,4,4'-trichlorobiphenyl	37L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',6,6'-tetrachlorobiphenyl	54L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-3,3',4,4'-tetrachlorobiphenyl	77L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-3,4,4',5-tetrachlorobiphenyl	81L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',4,6,6'-pentachlorobiphenyl	104L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,3,3',4,4'-pentachlorobiphenyl	105L	100	50	35-135	30-140	50-150
$^{13}C_{12}$2,3,4,4',5-pentachlorobiphenyl -	114L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,3',4,4',5-pentachlorobiphenyl	118L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2',3,4,4',5-pentachlorobiphenyl	123L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-3,3',4,4',5-pentachlorobiphenyl	126L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',4,4',6,6'-hexachlorobiphenyl	155L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,3,3',4,4',5-hexachlorobiphenyl	156L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,3,3',4,4',5'-hexachlorobiphenyl	157L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,3',4,4',5,5'-hexachlorobiphenyl	167L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-3,3',4,4',5,5'-hexachlorobiphenyl	169L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',3,4',5,6,6'-heptachlorobiphenyl	188L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,3,3',4,4',5,5'-heptachlorobiphenyl	189L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-octachlorobiphenyl	202L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,3,3',4,4',5,5',6-octachlorobiphenyl	205L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-nonachlorobiphenyl	206L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',3,3',4,5,5',6,6'-nonachlorobiphenyl	208L	100	50	35-135	30-140	50-150
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl	209L	100	50	35-135	30-140	50-150
Cleanup standards						
$^{13}C_{12}$-2,4,4'-trichlorobiphenyl	28L	100	45	45-120	40-125	60-130
$^{13}C_{12}$-2,3,3',5,5'-pentachlorobiphenyl	111L	100	45	45-120	40-125	60-130
$^{13}C_{12}$-2,2',3,3',5,5',6-heptachlorobiphenyl	178L	100	45	45-120	40-125	60-130
Labeled Surrogate Standards						
$^{13}C_{12}$-2,4'-trichlorobiphenyl	8L	50	NA	NA	NA	70-130
$^{13}C_{12}$-3,3',4,5'-tetrachlorobiphenyl	79L	50	NA	NA	NA	70-130
$^{13}C_{12}$-2,2',3,5',6-pentachlorobiphenyl	95L	50	NA	NA	NA	70-130
$^{13}C_{12}$-2,2',4,4',5,5'-hexachlorobiphenyl	153L	50	NA	NA	NA	70-130

1 Test concentrations are based on ng/mL in the sample extract or standard solution.
2 If the concentration is within 70-130% of the test concentration then the ICAL RF is used.
3 If the concentration is outside the 70-130% limit but within 40-160% of the test concentration then the VER daily RF is used.

Table 11

Retention Times of Isomers on the SPB-Octyl Column for the PCB Standard Mixes[1,2]

PCB Congener Mix 1 (Accustandard S-4687-A)[1]

Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT
1	2	16:11	4	78	37:58	6	161	42:50
2	10	16:55	4	81	38:28	6	153	43:21
2	9	18:59	5	96	30.22	6	130	44:05
2	6	19:29	5	103	32:15	6	129	44:52
2	8	19:59	5	95	33:09	6	166	46:04
2	14	21:45	5	88	33:56	6	159	47:03
2	11	22:46	5	89	34:48	6	167	47 52
3	30	22:19	5	92	35:33	6	156	49 10
3	27	23:10	5	113	36:05	7	179	42:25
3	32	24:05	5	83	36:43	7	176	43:22
3	34	25:21	5	119	37:16	7	178	45:09
3	26	25:51	5	87	37:30	7	175	45:53
3	31	26:32	5	85	38:00	7	183	46:46
3	33	27:06	5	82	38:48	7	177	47:38
3	36	29:09	5	120	39:29	7	171	48:17
3	38	30:12	5	124	40:43	7	172	49:51
3	35	30:46	5	106	41:17	7	191	50:57
4	50	26:11	5	122	41:56	7	170	51:58
4	45	27:01	5	105	42:51	7	190	52:32
4	52	28:48	5	127	44:13	8	200/201	48:33
4	49	29:19	6	152	36:12	8	204	49:13
4	75	30:12	6	136	36:49	8	199/200	49:43
4	41	30:56	6	148	38:32	8	198	52:34
4	72	32:02	6	151	39:13	8	196	53:17
4	57	32:49	6	144	39:51	8	195	54:58
4	63	33:38	6	143	40:35	8	194	57:22
4	66	34:20	6	142	41:19	9	207	55:38
4	79	37:19	6	133	42:03			

PCB Congener Mix 2 (Accustandard S-4687-B)[1]

Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT
2	7	19:10	4	55	34:32	6	139	40:49
2	5	19:54	4	60	35:25	6	132	41:41
2	12	23:09	5	94	32:37	6	165	42:25
3	18	22:27	5	100	33:11	6	168	43:24
3	24	23:17	5	91	33:59	6	137	44:17
3	23	25:28	5	121	35:00	6	160	44:56
3	28	26:52	5	90	36:07	6	128	46:13
3	22	27:35	5	99	36:45	6	162	47:22
3	39	29:34	5	109/108	37:16	6	157	49:13
4	53	26:14	5	117	38:00	7	184	42:48
4	51	27:02	5	111	38:56	7	186	43:51
4	73	28:55	5	108/107	40:43	7	187	46:05
4	48	29:37	5	118	41:27	7	185	46:56
4	62	30:14	5	114	42:03	7	181	47:55
4	71	31:02	6	150	36:23	7	192	50:08
4	68	32:21	6	145	37:05	8	197	49:29
4	58	33:08	6	135	39:20	8	201/199	52:35
4	61	33.51	6	149	40:14	8	203	53:29

Table 11 Continued

Retention Times of Isomers on the SPB-Octyl Column for the PCB Standard Mixes[1,2]

PCB Congener Mix 3 (Accustandard S-4687-C) [1]

Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT
2	13	23:10	4	80	35:36	6	140	40:51
3	17	22:53	5	93	33:18	6	146	42:42
3	29	25:51	5	84	34:22	6	141	43:41
3	20	26:54	5	101	36:12	6	164	44:30
4	46	27:22	5	112	36:54	6	158	45:09
4	65	29:52	5	86	37:25	7	182	46:21
4	59	30:17	5	116	38.06	7	174	47:05
4	40	31:02	5	107/109	40:58	7	173	48:14
4	67	33:16	6	154	39:24	7	193	50:32
4	76	33:58	6	147	40:16			

PCB Congener Mix 4 (Accustandard S-4687-D) [1]

Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT
3	25	26:08	4	64	31:17	5	123	41:06
3	21	27:01	4	70	33:58	6	134	40:32
4	69	29:14	5	102	33:26	6	131	41:08
4	47	29:56	5	97	37:25	6	163	44:47
4	42	30:31	5	115	38:22	7	180	50:33

PCB Congener Mix 5 (Accustandard S-4687-E) [1]

Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT	Cl Level	BZ No.[3]	RT
1	1	13:46	4	74	34:00	6	169	52 38
1	3	16:23	4	56	35:07	7	188	41:58
2	4	16:47	4	77	39:07	7	189	55:11
2	15	23:33	5	104	29:53	8	202	47:35
3	19	20:23	5	98	33:29	8	205	57:52
3	16	23:28	5	125	37:25	9	208	54:35
3	37	31:18	5	110	38:23	9	206	59:43
4	54	23:55	5	126	46:02	10	209	1:01:22
4	43	29:06	6	155	35:48			
4	44	30:00	6	138	44:47			

Notes:

1 Accustandard products S-4687-A to S-4687-E have been replaced by Accustandard product M-1668A-1 to M-1668A-5.

2 Each congener mix is analyzed in triplicate to establish the retention times of the PCB isomers in the absence of co-eluting isomers. The elution order listed here is used to assign peak identifications in the separate mixture analysis. The average retention time established in the analysis of the separate mixtures is then used to establish relative retention times. (See sections 10.2.3)

3 BZ/IUPAC Number, if different.

Table 12

Assignment of Sample Preparation Protocols						
With Associated Sample Weights, Volumes, and Concentration Factors						
Estimated Concentration of Largest Congener Peak (4X Largest Congener Conc) (ng/g)	Protocol Number and Name	Sample Amount Extracted (g)	Volume of Spiking Solution Used (mL)	Extract Used (%)	Dilution Factor	EML & Calibration Range Multiplier
0-9	1 – Default, Clean	10	1	100	1	1
10-249	2 – Low Level	10	1	100	5	5
250-1999	3 – Medium Level	5	2	50	10	40
1999-10000	4- High Level	2	4	25	10	200

Figure 1

Recommended GC Operating Conditions

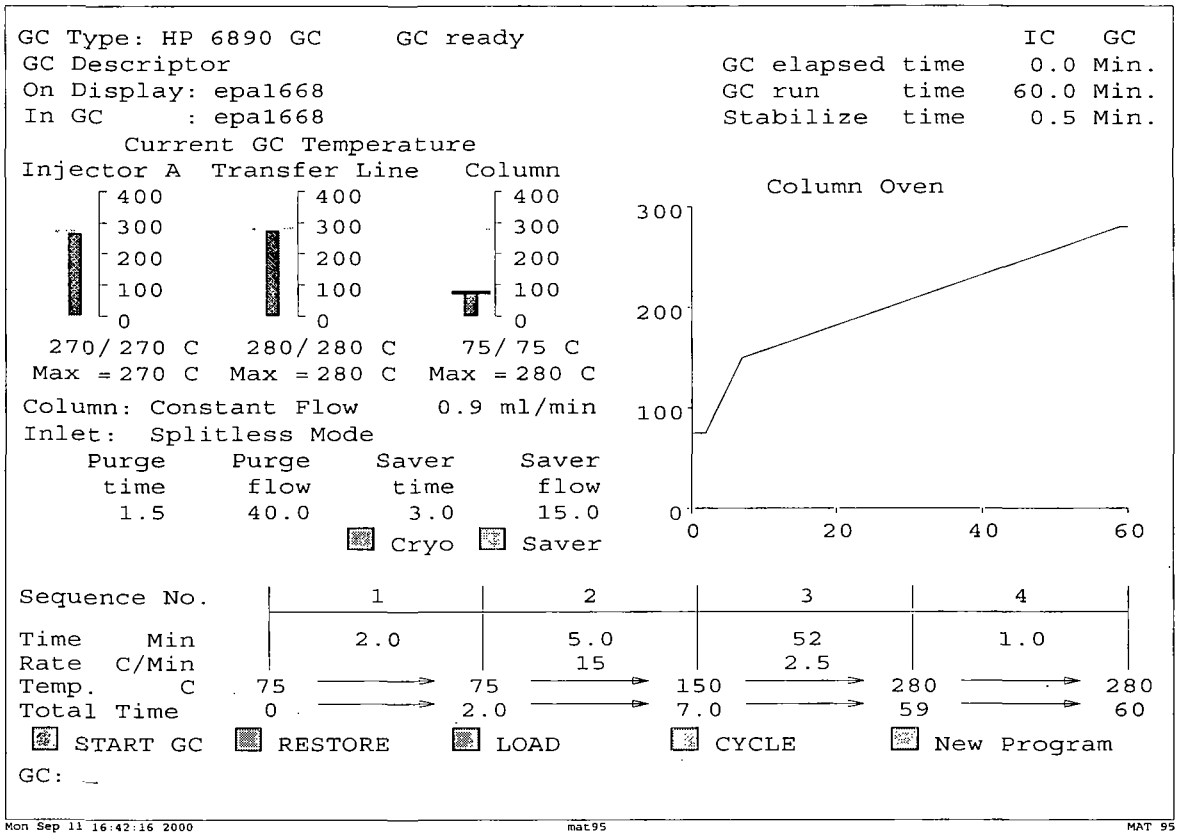
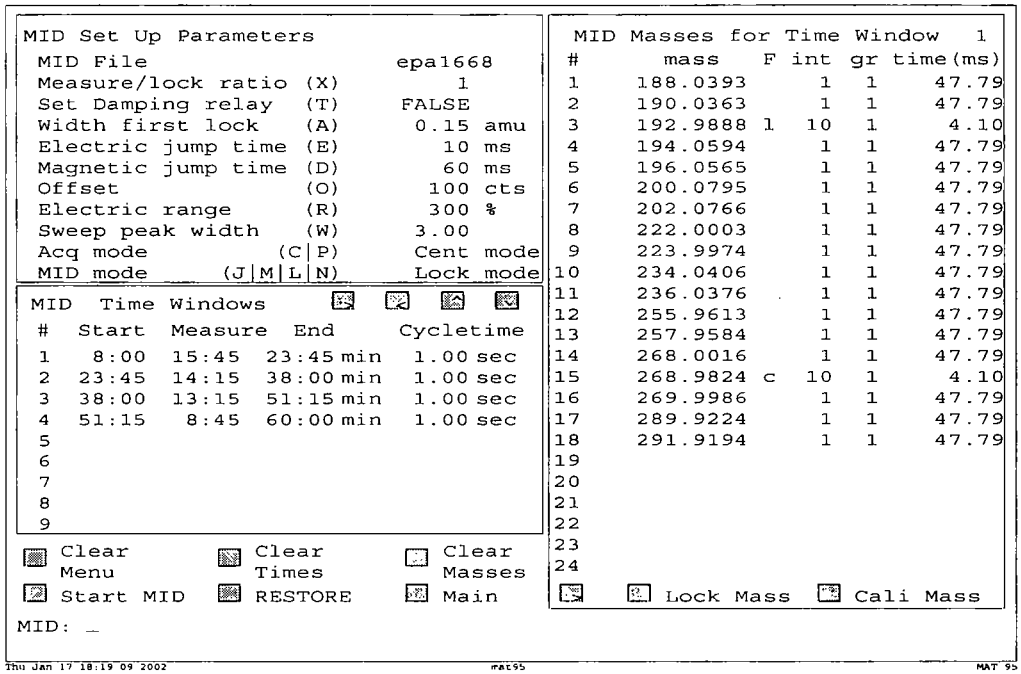


Figure 2

Recommended MID Descriptors



MID Set Up Parameters

MID File		epa1668
Measure/lock ratio	(X)	1
Set Damping relay	(T)	FALSE
Width first lock	(A)	0.15 amu
Electric jump time	(E)	10 ms
Magnetic jump time	(D)	60 ms
Offset	(O)	100 cts
Electric range	(R)	300 %
Sweep peak width	(W)	3.00
Acq mode	(C|P)	Cent mode
MID mode	(J|M|L|N)	Lock mode

MID Time Windows

#	Start	Measure	End	Cycletime
1	8:00	15:45	23:45 min	1.00 sec
2	23:45	14:15	38:00 min	1.00 sec
3	38:00	13:15	51:15 min	1.00 sec
4	51:15	8:45	60:00 min	1.00 sec
5				
6				
7				
8				
9				

Clear Menu | Clear Times | Clear Masses
Start MID | RESTORE | Main

MID Masses for Time Window 1

#	mass	F	int	gr	time(ms)
1	188.0393		1	1	47.79
2	190.0363		1	1	47.79
3	192.9888	l	10	1	4.10
4	194.0594		1	1	47.79
5	196.0565		1	1	47.79
6	200.0795		1	1	47.79
7	202.0766		1	1	47.79
8	222.0003		1	1	47.79
9	223.9974		1	1	47.79
10	234.0406		1	1	47.79
11	236.0376		1	1	47.79
12	255.9613		1	1	47.79
13	257.9584		1	1	47.79
14	268.0016		1	1	47.79
15	268.9824	c	10	1	4.10
16	269.9986		1	1	47.79
17	289.9224		1	1	47.79
18	291.9194		1	1	47.79
19					
20					
21					
22					
23					
24					

Lock Mass | Cali Mass

MID: _

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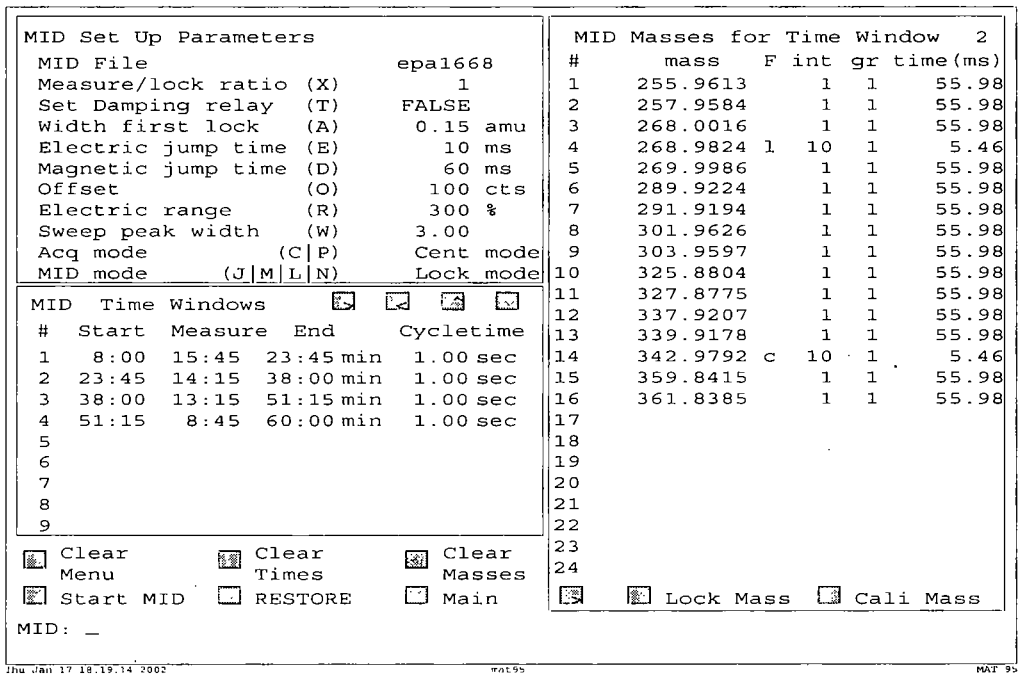

MID Set Up Parameters

MID File		epa1668
Measure/lock ratio	(X)	1
Set Damping relay	(T)	FALSE
Width first lock	(A)	0.15 amu
Electric jump time	(E)	10 ms
Magnetic jump time	(D)	60 ms
Offset	(O)	100 cts
Electric range	(R)	300 %
Sweep peak width	(W)	3.00
Acq mode	(C|P)	Cent mode
MID mode	(J|M|L|N)	Lock mode

MID Time Windows

#	Start	Measure	End	Cycletime
1	8:00	15:45	23:45 min	1.00 sec
2	23:45	14:15	38:00 min	1.00 sec
3	38:00	13:15	51:15 min	1.00 sec
4	51:15	8:45	60:00 min	1.00 sec
5				
6				
7				
8				
9				

Clear Menu | Clear Times | Clear Masses
Start MID | RESTORE | Main

MID Masses for Time Window 2

#	mass	F	int	gr	time(ms)
1	255.9613		1	1	55.98
2	257.9584		1	1	55.98
3	268.0016		1	1	55.98
4	268.9824	l	10	1	5.46
5	269.9986		1	1	55.98
6	289.9224		1	1	55.98
7	291.9194		1	1	55.98
8	301.9626		1	1	55.98
9	303.9597		1	1	55.98
10	325.8804		1	1	55.98
11	327.8775		1	1	55.98
12	337.9207		1	1	55.98
13	339.9178		1	1	55.98
14	342.9792	c	10	1	5.46
15	359.8415		1	1	55.98
16	361.8385		1	1	55.98
17					
18					
19					
20					
21					
22					
23					
24					

Lock Mass | Cali Mass

MID: _

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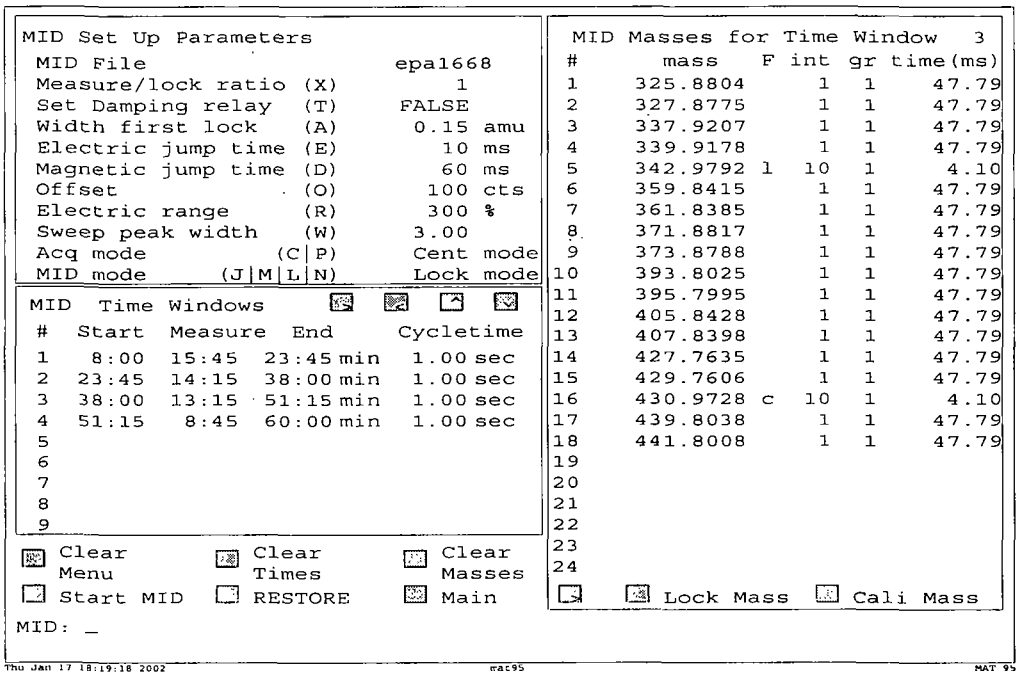
Figure 2 Continued

Recommended MID Descriptors



MID Set Up Parameters

MID File		epa1668
Measure/lock ratio	(X)	1
Set Damping relay	(T)	FALSE
Width first lock	(A)	0.15 amu
Electric jump time	(E)	10 ms
Magnetic jump time	(D)	60 ms
Offset	(O)	100 cts
Electric range	(R)	300 %
Sweep peak width	(W)	3.00
Acq mode	(C|P)	Cent mode
MID mode	(J|M|L|N)	Lock mode

MID Time Windows

#	Start	Measure	End	Cycletime
1	8:00	15:45	23:45 min	1.00 sec
2	23:45	14:15	38:00 min	1.00 sec
3	38:00	13:15	51:15 min	1.00 sec
4	51:15	8:45	60:00 min	1.00 sec
5				
6				
7				
8				
9				

Clear Menu | Clear Times | Clear Masses
Start MID | RESTORE | Main

MID: _

MID Masses for Time Window 3

#	mass	F	int	gr	time(ms)
1	325.8804		1	1	47.79
2	327.8775		1	1	47.79
3	337.9207		1	1	47.79
4	339.9178		1	1	47.79
5	342.9792	l	10	1	4.10
6	359.8415		1	1	47.79
7	361.8385		1	1	47.79
8	371.8817		1	1	47.79
9	373.8788		1	1	47.79
10	393.8025		1	1	47.79
11	395.7995		1	1	47.79
12	405.8428		1	1	47.79
13	407.8398		1	1	47.79
14	427.7635		1	1	47.79
15	429.7606		1	1	47.79
16	430.9728	c	10	1	4.10
17	439.8038		1	1	47.79
18	441.8008		1	1	47.79
19					
20					
21					
22					
23					
24					

Lock Mass | Cali Mass

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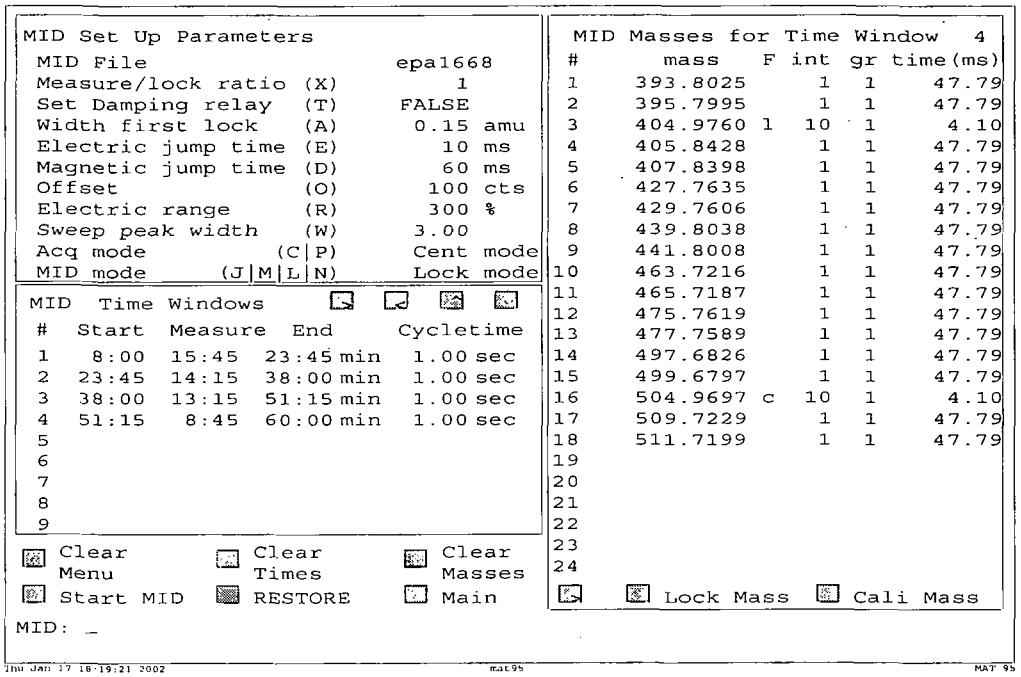


MID Set Up Parameters

MID File		epa1668
Measure/lock ratio	(X)	1
Set Damping relay	(T)	FALSE
Width first lock	(A)	0.15 amu
Electric jump time	(E)	10 ms
Magnetic jump time	(D)	60 ms
Offset	(O)	100 cts
Electric range	(R)	300 %
Sweep peak width	(W)	3.00
Acq mode	(C|P)	Cent mode
MID mode	(J|M|L|N)	Lock mode

MID Time Windows

#	Start	Measure	End	Cycletime
1	8:00	15:45	23:45 min	1.00 sec
2	23:45	14:15	38:00 min	1.00 sec
3	38:00	13:15	51:15 min	1.00 sec
4	51:15	8:45	60:00 min	1.00 sec
5				
6				
7				
8				
9				

Clear Menu | Clear Times | Clear Masses
Start MID | RESTORE | Main

MID: _

MID Masses for Time Window 4

#	mass	F	int	gr	time(ms)
1	393.8025		1	1	47.79
2	395.7995		1	1	47.79
3	404.9760	l	10	1	4.10
4	405.8428		1	1	47.79
5	407.8398		1	1	47.79
6	427.7635		1	1	47.79
7	429.7606		1	1	47.79
8	439.8038		1	1	47.79
9	441.8008		1	1	47.79
10	463.7216		1	1	47.79
11	465.7187		1	1	47.79
12	475.7619		1	1	47.79
13	477.7589		1	1	47.79
14	497.6826		1	1	47.79
15	499.6797		1	1	47.79
16	504.9697	c	10	1	4.10
17	509.7229		1	1	47.79
18	511.7199		1	1	47.79
19					
20					
21					
22					
23					
24					

Lock Mass | Cali Mass

Thu Jan 17 18:19:21 2002 mat95 MAT 95

Figure 3

Example Data Review Checklist

STL Knoxville Specialty Organics Group GC/MS Initial Calibration Data Review / Narrative Checklist
Method or SOP Number: _____

PFK Date/Time:	Inst:	Win Filename:	Col Perf Filename:

CS1 Filename	CS2 Filename	CS3 Filename	CS4 Filename	CS5 Filename

Review Items	N/A	Yes	No	If No, why is data reportable?	2nd Level
1. Was the mass resolution documented before beginning the initial calibration (HRMS only)?					
2. Was the instrument resolution >10,000 (<100 ppm) on PFK m/z 304.9824 and m/z 380.9760 (at reduced voltage) (HRMS only)?					
3. Was the measured exact mass of m/z 380.9760 (PFK) within 5 ppm at reduced accelerating voltage (HRMS only)?					
4. Was the Window Defining Mixture analyzed and the MID switchpoints set to encompass the retention time windows of each congener group?					
5. Was the Column Performance solution analyzed and the control criteria met?					
6. Were the calibration standard solutions, at the number and concentrations specified in the Method/SOP, analyzed?					
7. Was date/time of analysis verified between analysis header and logbook as correct?					
8. Were the response factors calculated for each labeled standard and unlabeled native analyte using the Method/SOP specified reference compound, quantitation ions, and formula?					
9. Is the %RSD acceptable for all unlabeled native analytes? • Specify QC Limit;_____					
10. Is the %RSD acceptable for all labeled internal standards? • Specify QC Limit;_____					
11. Are all S/N ratios ≥10 for the GC signals in each EICP (extracted ion chromatographic profile) including internal standards?					
12. Are the ion abundance ratios for all labeled and unlabeled analytes within the specified control limits?					
13. If manual integrations were performed, are they clearly identified, initialed and dated?					
14. If criteria were not met, was a NCM generated, approved by supervisor, and copy included in folder?					
15. Does the ICAL folder contain complete data in the following order? Data review checklist, a complete runlog, Avg. %RSD summary, Ratio summary, Calculation summary, PFK resolution/peak match documentation (HRMS only), and Total RIC, EICP's and manual integration - for window and all standards, in order from low to high standard.					

Analyst:	Date:	2nd Level Reviewer :	Date:
Comments:		Comments:	

Figure 3 **Continued**

Example Data Review Checklist

STL Knoxville Specialty Organics Group GC/MS Continuing Calibration Review / Narrative Checklist
Method or SOP Number: _____

Start PFK:		CS3 Filename:		Win Filename:		Inst:	
End PFK:				Col Perf Filename:		ICAL Date:	

Review Items	N/A	Yes	No	If No, why is data reportable?	2nd Level
1. Was the mass resolution documented at both the beginning and end of the 12 hour shift (HRMS only)?					
2. Was the instrument resolution >10,000 (<100 ppm) on PFK m/z 304.9824 and m/z 380.9760 (at reduced voltage) (HRMS only)?					
3. Was the measured exact mass of m/z 380.9760 (PFK) within 5 ppm at reduced accelerating voltage (HRMS only)?					
4. Was date/time of analysis verified between analysis header and logbook as correct?					
5. Was the Window Defining Mixture analyzed and the MID switchpoints set to encompass the retention time windows of each congener group?					
6. Was the Column Performance solution analyzed and the control criteria met?					
7. Was the continuing calibration performed at the beginning of the 12 hour period after successful mass resolution and GC resolution performance check?					
8. Were the response factors calculated for each labeled standard and unlabeled native analyte using the SOP specified reference compound, quantitation ions, and formula.					
9. Are %D acceptable for all unlabeled native analytes in the calibration? • Specify QC Limit:_____					
10. Are %D acceptable for all labeled standards in the calibration? • Specify QC Limit:_____					
11. Are all S/N ratios ≥10 for the GC signals in each EICP (extracted ion chromatographic profile) including internal standards?					
12. Are the ion abundance ratios for all labeled and unlabeled analytes within the specified control limits?					
13. If manual integrations were performed, are they clearly identified, initialed and dated?					
14. If criteria were not met, was a NCM generated, approved by supervisor, and copy included in folder?					
15. Does the CCAL folder contain **complete** data in the following order? Data review checklist, a **complete** runlog, CCAL summary, Ratio summary, Calculation summary, PFK resolution/peak match documentation (HRMS only), and Total RIC, EICP's and manual integration - for window and both standards.					

Analyst:	Date:	2nd Level Reviewer :	Date:
Comments:		Comments:	

Figure 3 **Continued**

Example Data Review Checklist

STL Knoxville Specialty Organics Group GC/MS Data Review / Narrative Checklist LOT #_____
Method or SOP Number: _____ **Page 1 of 2**

Batch Number:	

Review Items	N/A	Yes	No	Why is data reportable?	2nd Level
A. Initial Calibration					
1. Was the correct ICAL used for quantitation? (Check 1-2 compounds for batch by manually calculating concentration using the ICAL avg. RF.)					
B. Continuing Calibration					
1. Has a Continuing Calibration Checklist been completed for each analytical batch?					
C. Client Sample AND QC Sample Results					
1. Were all special project requirements met?					
2. Were the header information, prep factors, and dilution factors verified?					
3. Was date/time of analysis verified between analysis header and logbook as correct?					
4. Sample analyses done within preparation and analytical holding time (HT)? *If no, list samples:* _____				HT expired upon receipt. * Client requested analysis after HT expired. Re-extraction done after HT expired. See Comment no. _____.	
5. Are internal standards within QC limits? *If no, list samples and reason (e.g.,* **sur1***):* Sample Reason Sample Reason _____				* **[sup]** Ion suppression due to matrix. * **[low]** Low recovery, S/N >10 and EDL<ML. **[sam]** Not enough sample to re-extract. **[dil]** Dilution showed acceptable %R. **[mtx]** Obvious matrix interference. Further cleanup not possible. * **[unk]** At client's request, data was flagged as estimated and released without further investigation. **[com]** See Comment no. _____.	
6. Were the following qualitative criteria met for all reported analytes: • All analytes within Method/SOP retention time criteria and both ions maximized within ±2 seconds. • The ion abundance ratios for all labeled and unlabeled analytes within the specified control limits. • All peaks ≥2.5 S/N					
7. Were peaks ≥2.5 S/N, which did not meet the above criteria, properly calculated and reported as EMPCs?					
8. Are positive results within calibration range? *If no, list samples:* _____				Sample extracted at lowest possible volume	
11. If manual integrations were performed, are they clearly identified, initialed and dated?					
12. Final report acceptable? (Results correct, DLs calculated correctly, units correct, IS %R correct, appropriate flags used, dilution factor correct, and extraction/ analysis dates correct.)					
13. Was a narrative prepared and all deviations noted?					

* Such action must be taken in consultation with client.

Figure 3 **Continued**

Example Data Review Checklist

STL Knoxville Specialty Organics Group GC/MS Data Review / Narrative Checklist LOT #_____
Method or SOP Number: _____ **Page 2 of 2**

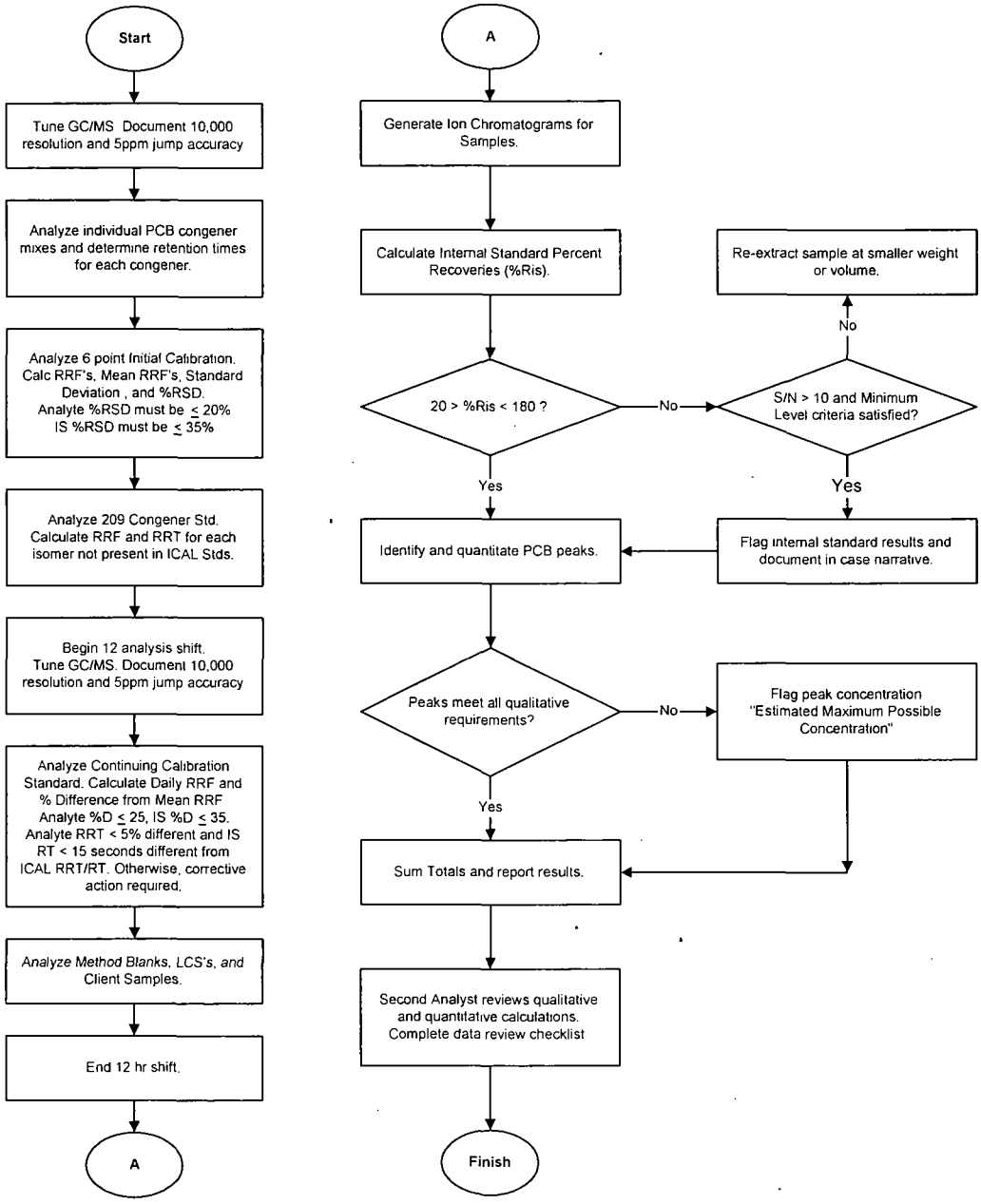
D. Preparation/Matrix QC	N/A	Yes	No	Why is data reportable?	2nd Level
1. LCS done per prep batch and all analytes within laboratory established QC limits? *If no, list LCS ID:* _____				MS/MSD %R and all sample surrogate %R good indicating that problem was confined to the LCS. * Reanalysis not possible-insufficient sample. LCS %R high and affected analyte(s) were <MI. in associated samples. See Comment no._____.	
2. Method blank done per prep batch and method blank or instrument blank analyzed with each sequence?					
3. Method blank internal standard recoveries within QC limits? *If no, list blank ID:* _____				* Internal standards are high and blank demonstrates that analysis is free of contaminants. * Sample internal standards OK and there is no analytes >MI. in samples associated with blank.	
4. Are all analytes present in the method blank ≤ MI.? *If no, list blank ID:* _____				Sample results are > 20x higher than blank. * There is no analyte > RL in the samples associated with method blank. * Reanalysis not possible-insufficient sample	
4. MS/MSD done per batch and are all recoveries and RPDs within laboratory generated QC limits? *If no, list MS/MSD ID:* _____				LCS showed acceptable results indicating sample matrix effects. LCS showed acceptable results. High native analyte concentration relative to spike level. LCS showed acceptable results. RPD out due to lack of sample homogeneity. See Comment no._____.	
E. Other					
1. Are all nonconformances documented appropriately and copy included with deliverable?					

Analyst:	Date:	Analyst:	Date:
Comments:		Comments:	

* Such action must be taken in consultation with client.

Figure 4

Analysis of PCB's by HRGC/HRMS



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STANDARD OPERATING PROCEDURE

The Determination of Lipids in Tissues, Fats, and Plants

Reference Methods: N/A

SOP NUMBER:	KM-L-003-Rev.0
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	N/A

APPROVAL

Glen A. Coder — 1/26/05
Glen Coder, Assistant General Manager — Date

Bruce Warden — 1/20/05
Bruce Warden, General Manager — Date

Julie Trivedi — 1/26/05
Julie Trivedi, Quality Manager — Date

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1. Purpose

The purpose of this SOP is to describe the process utilized to determine the percentage of lipid present in biological tissues, fats and plants.

2. Scope and Application

2.1 The policies and procedures contained in this SOP are applicable to all personnel involved in the determination of the percent lipid in biological tissues, fats and plants.

3. Summary of Method

3.1 An aliquot of a sample extract is placed into a pre-weighed aluminum weighing pan and the solvent is allowed to evaporate. The percentage of lipid present in the sample is then determined gravimetrically.

4. Interferences

4.1 Foreign material that falls into the weighing pans while the solvent is evaporating will bias the percent lipid result; therefore it is recommended to loosely cover the weighing pans with aluminum foil during the solvent evaporation step.

5. Safety

5.1 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials.

5.2 A reference file of Material Safety Data Sheets (MSDS) is made available to all personnel involved in the chemical analysis, and is located at the front desk. A formal safety plan has been prepared and is distributed to all personnel with documented training.

6. Definitions

6.1 Definitions of terms found in this SOP can be found in the Pace Quality Manual. When definitions are not consistent with NELAC defined terms, an explanation will be provided in this SOP or the Pace Analytical Services' Quality Manual Glossary, Section 12.0.

7. Responsibilities and Distribution

7.1 Analyst – Any analyst using this procedure is responsible for reading, understanding, and following this SOP. Any deviation from this SOP must be reported to the appropriate supervisor. The analyst must make their recommendations for changing the SOP to their supervisor or the QM in writing.

7.2 Assistant General Manager – The Assistant General Manager must ensure that all analysts are properly trained and qualified to use this procedure. The Assistant General Manager is also responsible to ensure that the SOP is followed. The Assistant General Manager is responsible for reviewing the SOP and communicating recommended changes to the QM.

7.3 Quality Manager (QM) – The QM is responsible for monitoring the implementation of the SOPs. The QM shall participate in the revision of the SOP and make sure it is current. The QM shall review and approve all SOPs.

7.4 General Manager – The General Manager has overall responsibility for ensuring that SOPs are prepared and implemented for all activities appropriate to the laboratory. The General Manager shall review and approve all SOPs

7.5 Distribution – The official version of this SOP is the signed hardcopy version found in the laboratory. A copy of the SOP shall be kept in the department for reference.

7.6 Revision – This SOP shall be reviewed every two years at a minimum. Independent of the minimum review frequency, revisions shall be incorporated as needed if procedures or methods change.

8. Sample Collection, Preservation and Handling

8.1 After the extraction process is complete, sample extracts must be stored in the appropriate location until the time of percent lipid determination.

9. Equipment and Supplies

9.1 Aluminum weighing pans

9.2 Pipet or syringe capable of accurately measuring one mililiter

9.3 Analytical Balance, 4 place

9.4 Aluminum foil

10. Reagents and Standards

10.1 Not Applicable.

11. Calibration

11.1 The analytical balance used during this procedure must be calibrated prior to use each day. Refer to the most current version of MN-BE-006 for the proper procedure to calibrate the analytical balance.

12. Procedure

12.1 Label one aluminum pan for each sample to be analyzed with the appropriate laboratory sample number.

12.2 Weigh the pre-labeled aluminum pan. Electronically download the value into the appropriate calculation sheet.

12.3 Enter the sample weight extracted, the final volume of the sample extract, and the aliquot volume used for the lipid determination into the appropriate calculation sheet.

12.4 Place a 1.0mL aliquot of sample extract into the weighing pan. If there is not sufficient sample extract volume, a lesser volume may be used. Enter the volume of sample extract aliquot placed into the appropriate calculation sheet.

12.5 Place the weighing pan onto a drying rack at room temperature or into a fume-hood for a minimum of 12 hours to allow for the extraction solvent to evaporate. The weighing pans may be lightly covered with aluminum foil to prevent foreign matter from falling into the pans during the solvent evaporation process.

12.6 After all the solvent has evaporated, weigh the sample and the pan. Electronically download this value into the appropriate calculation sheet as the "gross dry weight".

12.7 Determine the Net Dry Weight for each sample by subtracting the pan weight value from the gross dry weight value.

12.8 Determine the percent lipid for each extract using the following calculation

$$\% \text{ Lipid} = \{(NDW * V)/ (W*A)\} *100$$

Where:

NDW = Net Dry Weight (g)

V = Volume of extract (mL)

W = Weight of sample extracted (g)

A = Volume of extract aliquot used for lipid determination

12.8 Report the final percent lipid as a percentage with three significant figures or two decimal places.

13. Quality Control

13.1 The percent lipid determination must be performed on all method blanks, laboratory control spike/laboratory control spike duplicates, matrix spike/matrix spike duplicates and sample duplicates associated to an extraction batch.

13.2 The percent lipid results for all matrix spike/matrix spike duplicates and sample duplicates should be compared to the parent sample result to determine if there are any obvious irregularities with the determined results.

13.3 Calculations performed as part of this procedure by one analyst must be reviewed by another analyst that is familiar with the method.

14. Method Performance

14.1 There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures.

14.1.1 The analyst must read and understand this procedure with written documentation maintained in the training file.

14.1.2 An initial demonstration of capability (IDC) must be performed. A record of the IDC will be maintained in his/her file with written authorization from the Laboratory Manager and Quality Manager.

15. Pollution Prevention and Waste Management

15.1 The quantity of chemicals purchased is based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes reflect anticipated usage and reagent stability.

15.2 Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner. For further information on waste management consult the current version of ALL-C-001, *Sample Management*.

16. References

16.1 Randall, R.C., Lee, H., Ozretich, R.J., Lake, J.L., and Pruell, Pruell, R.J. "Evaluation of Selected Lipid Methods for Normalizing Pollutant Bioaccumulation". Environmental Toxicology and Chemistry, Vol 10, p. 1431-1436, (1991)

17. Tables, Diagrams, Flowcharts, Appendices, Addenda etc.

17.1 Not applicable –

18. Revisions

Revision Number	Reason for Change	Date
KM-L-003-Rev.0	Converted SVO 59 Rev 0 to new format.	20Jan2005

TITLE: Total Organic Carbon Analysis on the Apollo 9000 Using EPA 600 4-79-020, Revised March 1983, Method 415.1 and EPA Manual SW846, 3rd Edition, Method 9060

MATRICES:

This SOP pertains to drinking waters, ground waters, surface waters, domestic and industrial wastes, soil, and biological samples.

DETECTION LIMITS:

Reporting Limits are used in the absence of Project or State Specific Required Detection Limits. The determinative method contains the current method detection limits (MDL) and Reporting Limits. See Table A for summary.

The method detection limits are obtained by multiplying the student t value by the standard deviation in the method detection limit study. A minimum of seven replicates is used. The spikes go through the same procedure, as the samples spiked at a concentration were the resulting MDL is suspected to be within a factor of ten less than the spike. Cited from 40CFR part 136 and the WI Department of Natural Resources.

1.0 **SCOPE AND APPLICATION:**

1.1 This SOP pertains to drinking waters, ground waters, surface waters, domestic and industrial wastes and soil samples.

1.2 This SOP covers the run types: Duplicate, Quadruplicate and a modified version of Quadruplicate (using two injections).

2.0 **SUMMARY OF THE TEST METHOD:**

2.1 The sample is injected in a combustion furnace where it heats up and reacts with the catalyst that is contained in the furnace. The product of this reaction is CO2 gas, which is then blown into the non-dispersive infrared detector (NDIR). The NDIR uses electromagnetic radiation or infrared energy to measure the CO2. This measurement is proportional to the carbon in the sample. In order to analyze for TOC the sample must first have the Inorganic Carbon (IC) taken out by either being purged with acid for a water matrix or prepped with acid and heated for a soil matrix.

3.0 **DEFINITIONS**:

3.1 Calibration Blank: A volume of reagent water. The calibration blank is used as the low standard when running a calibration curve.

3.2 Calibration Standard: A solution prepared from the dilution of a stock standard and taken through the preparation steps. The calibration solutions are used to calibrate the instrument response with respect to analyte concentration.

3.3 Calibration Verification Solution (ICV/CCV): A solution of method analytes, used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The Initial Calibration Verification (ICV) is analyzed after the calibration

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curve and before samples are analyzed. The Continuing Calibration Verification (CCV) is analyzed after every 10 samples.

3.4 Calibration Verification Blank (ICB/CCB): A solution of blank reagent water, used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The Initial Calibration Blank (ICB) is analyzed after the calibration curve and before samples are analyzed. The Continuing Calibration Blank (CCB) is analyzed after every 10 samples.

3.5 Method Blank (MB): An aliquot of reagent water or sample matrices (catfish for biota samples) that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with other samples. The MB is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

3.6 Matrix Spike (MS) and Matrix Spike Duplicate (MSD): The MS is an aliquot of an environmental sample to which known quantities of the method analytes are added in the laboratory. The MS is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the MS corrected for background concentrations.

3.7 Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

3.8 Lab Control Spike (LCS) and Lab Control Spike Duplicate (LCSD): The LCS is an aliquot of reagent water or other blank matrices to which known quantities of the method analyte is added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements.

3.9 Standard Stock Solution: A concentrated solution containing one or more method analytes prepared in the laboratory using assayed reference material or purchase from a reputable commercial source. Two stock solutions are made from different sources. One is used for the calibration curve and the other is for spiking and continuing check standards.

3.10 Total Carbon (TC): The measurement of all the carbon in the sample, both inorganic and organic.

3.11 Total Organic Carbon (TOC): All carbon atoms covalently bonded in organic molecules. To measure TOC, all the inorganic carbon is removed by addition of acid and purging: the result is that only organic carbon is left. Dissolved TOC is filtered through 0.45 um pore filter prior to analysis.

3.12 Total Inorganic Carbon (TIC): The measurement of the total inorganic carbon is found by subtracting the Total Organic Carbon from the Total Carbon. TIC= TC - TOC

4.0 **INTERFERENCES:**

4.1 Carbonate and bicarbonate carbon represent interferences under the terms of this test and must be removed or accounted for in the final calculation.

4.2 When dealing with a water matrix, this SOP is applicable only to homogenous samples which can be injected into the apparatus reproducibly by means of a micro-liter type syringe or pipet. For soil matrix, this SOP is applicable only to those samples that can be adequately ground with mortar and pestle to result in a fairly homogenous sample.

5.0 **SAFETY:**

5.1 Safety is everyone's business at En Chem, Inc. and everyone is responsible for assisting in reducing unsafe and unhealthy working conditions or potential hazards. The company provides you with a safe place to work, but we need your cooperation to keep it safe. When you see something that does not look safe, or you see someone working in an unsafe manner, mention it to your supervisor.

5.2 All samples should be treated as hazardous. Safety glasses, gloves, and lab coats are to be worn. The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. However, each chemical compound should be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by a safe technique. A reference file of material safety data sheets should also be made available to all personnel involved in the chemical analysis.

5.3 Required Safety Equipment is listed Table B.

6.0 **EQUIPMENT AND SUPPLIES:**

6.1 See Tables C and D for summary.

7.0 **REAGENTS AND STANDARDS:**

7.1 See Tables E and F for summary.

8.0 **SAMPLE COLLECTION, PRESERVATION, SHIPMENT AND STORAGE:**

8.1 Water samples are collected in glass 40 ml VOA vials or 4 oz glass jars, which are acidified with H_2SO_4 to a pH of <2. Samples are shipped to the lab on ice and stored at 4°C until time of analysis.

8.2 Soil samples are collected in 4 oz glass jars. Samples are shipped to the lab on ice and stored at 4°C until time of analysis.

8.3 See Table G for a summary.

9.0 **QUALITY CONTROL:**

9.1 Demonstration of Capability - The initial demonstration of capability is used to characterize instrument performance (determination of linear range and laboratory control sample) and laboratory performance (determination of MDLs) prior to performing analyses by this method. The analyst must perform an IDC before they are allowed to analyze samples.

9.1.1 Initial Demonstration of Capability (IDC) – Analysts must perform initial demonstration of capability before analyzing samples.

9.1.1(a) The analyst will run four replicates of the LCS solution.

9.1.1(b) Calculate the mean, average recovery (x), and the standard deviation of the recovery (s). The recovery of each compound must fall within 80 – 120% of true value. If IDC is outside acceptable limits, corrective action must be taken.

9.1.2 Linear Calibration Range - The linear calibration range must be determined initially and verified whenever a significant change in instrument response is observed or expected. The initial demonstration of linearity must use sufficient standards to insure that the resulting curve is linear. The verification of linearity must use a minimum of a blank and three standards. If any verification data exceeds the initial values by $\pm$ 10%, linearity must be reestablished. If any portion of the range is shown to be nonlinear, sufficient standards must be used to clearly define the nonlinear portion.

9.1.3 Method Detection Limits- MDLs must be established for all analytes, using reagent water (blank) fortified at a concentration of 2-3 times the estimated instrument detection limit. To determine MDL values, take a minimum of seven replicate aliquots of the fortified reagent water and process through the entire analytical method. Perform all calculations defined in the method and report the concentration values in the appropriate units. Calculate the MDL as follows:

$$MDL = (t) \times (S)$$

Where,

t = student's t value for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom [t = 3.14 for seven replicates]. The t-value changes accordingly when more than 7 replicates are used.

S= standard deviation of the replicate analyses

MDLs are determined annually or whenever there is a significant change in the background or instrument response.

9.2 A Method Blank (MB) must be prepared and analyzed with every sample batch or every 20 samples whichever is more frequent. The data obtained is used to assess contamination from the laboratory environment. Values that exceed the EQL indicate laboratory or reagent

contamination should be suspected and corrective actions must be taken before continuing the analysis. Values that are between the MDL and EQL are evaluated based on the concentration in the samples compared to the concentration in the blank.

9.3 Laboratory Control Sample (LCS) - When beginning the use of this method and on a continuing basis, verify the calibration standards and acceptable instrument performance with the preparation of a LCS. If the determined concentrations are not within the in-house control limits performance of the determinative step is unacceptable. The source of the problem must be identified and corrected before either proceeding on with the initial demonstration or MDLs or continuing with on-going analyses. A LCS must be performed with every batch or every 20 environmental samples, which ever is more frequent. A LCSD is performed when requested by the client or when there is insufficient sample volume to perform a matrix spike / matrix spike duplicate.

9.4 A matrix spike / matrix spike duplicate (MS/MSD) must be prepared and analyzed with 20 samples for EPA 415.1 and every 10 samples for SW846 9060 whichever is more frequent. The MS must be a duplicate of the aliquot used for sample analysis. The analyte concentration must be high enough to be detected above the original sample and should not be less than four times the MDL. Calculate the percent recovery, corrected for concentration measured in the parent sample, and compare to the in-house generated limits. If no in-house limits are in used then a range of 80 - 120% will be used. Once 30 sample points are determined in-house limits will be generated.

9.5 See Tables H for a summary. See Table I for QC acceptance criteria.

10.0 **CALIBRATION AND STANDARDIZATION**:

The Apollo 9000 TOC Analyzer may be set up in different ways to accommodate the analysis of waters or soils. Analysis for these two matrices will be dealt with in separate sections.

Waters TOC configuration

10.1 Routine Operation

10.1.1 Check levels of acid in vial at position 1011. If it is under half full, fill with 21% phosphoric acid reagent.

10.1.2 Rinse 1L amber bottle and fill with DI H_2O Daily.

10.1.3 Make sure the U-shaped corrosive scrubber has the copper side connected to the tube labeled "Cu In" which is connected to the permeation dryer tube. If copper side is looking dark, then replace with new copper granules. When being used regularly, this is normally done once a month. The Tin needs to be replaced every 6-12 months.

10.1.4 Check that the compressed air tank has more than 500 psi; if it doesn't then replace tank before turning on. Check the airflow with an air flow meter. If the flow is lower than 180 mL/min or higher than 210 mL/min adjust regulator on tank until the airflow is within the desired amount.

10.1.5 Log on to computer, which interfaces with the Apollo 9000. Click on icon named "Apollo 9000". Instrument will initialize at this point.

10.1.6 Start the TOC Apollo program and click on Run in the menu. Click on Setup in the menu and then select instrument. Change System from Standby to Ready. Select your initials from the list or type them in. Select "With Autosampler" from the drop down combo box and check both "0.8mm Particulate Kit Installed" as well as "Autosampler Sparge Option".

10.1.7 Before beginning any analysis verify that the sparge tube and water trap are empty, if not; empty via menu commands under Setup, Diagnostics, Syringe.

10.1.8 Wait until the baseline is stable before analyzing. Sample baseline should be in the low teens before starting. If it is closer to twenty adjust the baseline zero knob to lower the baseline. If this cannot be done ask primary analyst. DO NOT TOUCH SPAN KNOB!

10.1.9 Select calibration curve by clicking menu command Setup, Calibration, Set Active, and TOC Curve. Choose the most current or "toc water" calibration curve for the "1-20, 1-400" range.

10.1.10 Click menu command Run.

10.2 Calibration - If calibrating use the following steps, if calibration remains valid from previous day (verified by analyzing a CCV) proceed to section 11.

10.2.1 Click on "Sample Setup" and select New from the File menu. Click Sample Type and select "Blank TOC_TC Rng 1", change the reps to 6 and press the down arrow. This step runs a blank that in effect zeros the instrument to the background of the water that is used.

10.2.2 First prepare each standard according to standard calibration table. Now click Sample Type and select "TOC Standard". Doing this pops up a window in which you should select 0-20, 1-400 as the range. This pops up another window with all of the standards from the curve you have selected as the default curve. Select the standard you are running, click Exit, and then change the reps to 3. If you have more standards to enter press the down arrow.

10.2.3 Repeat step 10.2.2 until all of the standards are entered and ready to run. Once they are all ready, click on the Save/Use button and save the run in the following format DDMMYY.

10.2.4 Making sure the standard locations match the locations written on the run log, load tray with vials filled with calibration standards. Since calibration will be sparged internally, vials are filled ¾ to the top. Click "Start" button.

10.2.5 Calibration takes approximately 3 hours. When complete, the Calibration Curve screen will automatically open. Check the use box next to each of the standards and click the Recalc button. This will create a seven-point calibration curve. Curve will be 1st order linear. The r-value must be greater than 0.995, if not recalibrate.

Soils TOC (STOC) configuration

10.3 Routine Operation - Beginning with unit in Shutdown mode

10.3.1 Open the door and take the "Cu In" tube out of the copper side of the tin/copper scrubber. Note its position prior to removing (i.e. how much tube is actually inside the U tube). Connect this tube to the tube that exits the soil sampler.

10.3.2 Turn power on (black switch). Indicator light shows when the boat sampler furnace is warmed up.

10.3.3 Log on to computer, which interfaces with the Apollo 9000. Click on icon named "Apollo 9000". Machine will initialize at this point.

10.3.4 Click on the Setup drop down menu and select Instrument.

10.3.5 Check that the compressed air tank has more than 500 psi; if it doesn't then replace tank before turning on. Check the airflow with an air flow meter. If the flow is lower than 180 mL/min or higher than 210 mL/min adjust regulator on tank until the airflow is within the desired amount.

10.3.6 Select calibration curve by clicking menu command Setup, Calibration, Set Active, TOC Curve. Choose "Boat Calibration for Aux".

10.3.7 Click menu command Run.

10.3.8 The soil samples are crushed with a mortar and pestle, to get the sample as homogeneous as possible. It is not possible to obtain a completely homogeneous mixture of soil. Have the sample or the standard ready to inject in the boat, the boat needs to be in the carrier with the lid closed, prior to clicking the "Start" button. The analyst must wait until the baseline stabilizes after closing the lid.

10.4 Calibration

10.4.1 Click menu command Setup, Calibration, Standards. Then click menu command File, Open and select the boat calibration curve. Click "OK".

10.4.2 Click Run, Sample Setup. Change sample type to TOC Standard. Select Aux click on OK. Then Select 0.00 (DI H2O) and click on Exit. Set number of repeats to 1 and verify that the Method ID is Boat Sampler. Click Save/Use.

10.4.3 Click Start. Enter sample weight and follow the prompts to inject the boat.

10.4.4 Repeat steps 2 and 3 for the 500, 1000 and 2000 standards. The only exception is to highlight the appropriate standard for each calibration point.

10.4.5 When four standards have been read click on menu command Results, Calibration. Select "Boat Curve" for the calibration curve ID. Locate and select the four readings just performed, all others should not be selected. Click "Recalc" button. This will create a four-point calibration curve. The curve will be 1st order linear. The r-value must be greater than 0.995, if not, recalibrate.

11.0 **PROCEDURE:**

11.1 **Run Types**
There are three different ways to run TOCs: SW846 9060, SW846 M9060 and EPA 415.1.

11.1.1 When referencing SW846 9060, quadruplicate analysis is required for all samples. Each sample will be composed of 4 individual injections. Report all four individual injection readings and the average of the four readings.

11.1.2 If the client desires to have SW846 9060 cited, but does not want quadruplicate analyses performed, the modified procedure for analysis will be followed: two reps will be performed with the results averaged, the average of two injections is reported with a citation of SW846 M9060. To run this on the Apollo 9000, you must set the continuing calibration checks to 1 and all of the other reps to 2. This is used for soil matrix only.

11.1.3 When referencing EPA 415.1, the instrument will run 3 injections of the sample. The first injection reading that is within 10% RPD of the next injection reading is reported. If the first two injection readings are at or below the EQL, precision is NOT calculated and the first injection reading is reported. If no injection reading is within 10% RPD of the next injection reading and the injection readings are above the EQL, the sample must be rerun. This is used for water matrix only.

11.1.4 The following is true for <u>all</u> run types. No individual injections can be used if the concentration exceeds the highest standard in the curve. The sample must be diluted for waters or less sample weight taken for soils and rerun.

Water Sample Analysis

11.2 Prepare water samples as follows:
- 11.2.1 Shake sample vigorously to suspend sediment.
- 11.2.2 Pour 20 mls into a clean 40 mL vial and place in autosampler.
- 11.2.3 Prepare method blank by pouring 20 mls DI water into clean 40 ml VOA vials. For the Laboratory Control Spike (LCS) add 0.50 ml of 4000-mg/L stock standard into 20 ml of DI water and pour into clean 40 ml VOA vial.
- 11.2.4 Prepare matrix spike / matrix spike duplicate by randomly selecting one sample as the parent. Add 0.5 ml of 4000-mg/L stock solution into 19.5 ml of sample.

11.3 Sample Analysis

11.3.1 Start the TOC Apollo program and click on Run in the menu. Click on Setup in the menu and then select instrument. Change System from Standby to Ready. Select your initials from the list or type them in. Select "With Autosampler" from the drop down combo box and check both "0.8mm Particulate Kit Installed" as well as "Autosampler Sparge Option".

11.3.2 Click menu command Run. Then click "Sample Setup" button. Select a new schedule from the File menu. Fill in information for Sample ID, Method ID, Reps, and Status. Sample type should always be "Sample" even for ICV/ICB and

CCV/CCBs. Be certain that Method ID and Reps reflect the test being performed. Status should be "Ready" for all samples.

11.3.3 Save the schedule using the format DDMMYY. Click Save/Use.

11.3.4 Load the tray corresponding to the schedule. Vials should be 2/3-3/4 full. The space is necessary since sparging will occur inside the vial.

11.3.5 Click Start. Sample analysis takes approximately 1/2 hour per sample. If the run log needs editing after it has been started, you must stop the instrument by clicking the "Stop" button. If you attempt to alter the run log during analysis, the instrument may be off an injection – causing you to rerun.

11.4 Shutdown

11.4.1 If on the final run for the day, click menu command Setup, Instrument and make sure that the options for "Auto Shutdown" and "w/ furnace off" are checked.

11.4.2 Close Apollo 9000 software. Log off computer if no further applications are to be performed.

11.4.3 Turn the carrier gas off. Turn the regulator valve off, although the tank may be left on.

11.4.4 Empty vials. Check and dump waste collection carboy if necessary.

11.4.5 DO NOT turn off the unit. It will remain in a standby setting.

11.5 Data Printout

11.5.1 Select "Samples" from the Results menu. Then "Clear" from the File menu. Followed by "Open Results from Day" also from the File menu. Type the date of the run in the format provided YYYY MM DDD and click OK.

11.5.2 Now select "Print Summary Report" and then select "Print Detailed Report" from the File menu. Exit without saving changes and select "Calibration" from the Results menu. Click on "Print" and then click on "Cancel".

11.5.3 Upon analyzing the data, no injections can be used if they are above the curve. Each sample that has an injection above the curve must be diluted and rerun.

Soil Sample Analysis

11.6 Sample Prep

11.6.1 Weigh 10 g of soil. Add 10% Sulfuric Acid and place in a digestion block at 70°C. After sample does not react with acid (no bubbling), it is filtered and then baked in an oven at 103°C overnight until 100% dry weight is achieved.

11.6.2 The dried sample is then homogenized with a mortar & pestle.

11.7 Sample Analysis

11.7.1 Click menu command Run. Click "Sample Setup" button. Enter the sample ID, Sample type should read, "sample". Choose the number of repeats for the sample and verify that the Method ID is Boat Sampler. Click "Save/Use" button.

11.7.2 Weigh out soil sample in a boat that has already been baked out and cooled. If a sample amount is over what was desired, the entire boat must be emptied and reweighed. The standard weight used is 0.0400 g. A weight of 0.0420g or less is acceptable. Place the boat with soil in the boat analyzer. Click "Start" button. Enter the sample weight into runlog. Follow the prompts to inject the boat.

11.7.3 To perform a MB, inject 40uL of DI H2O into the cool boat. To perform an LCS or LCSD, inject 40uL of the 1000 mg/L standard into the cool boat. To perform a MS or MSD, weigh parent sample and inject 20uL of the 1000 mg/L standard into the boat.

11.7.4 Repeat steps 11.7.1 and 11.7.2 for each sample being analyzed.

11.7.5 While running samples, no injections can be used if they are above the curve. If an injection is above the curve, weigh out a smaller amount of the sample and rerun that injection.

11.7.6 For Quads, if the first injection of a sample is below the EQL, more sample must be weighed out unless the weight exceeds 0.04g. Once the weight of 0.04g has been surpassed, the results will be reported even if they are below the EQL. If the first injection is above the EQL and one or two of the other injections is below the EQL it can be used only if it is within 0.0002g of the first injection. However, if three of the injections are under the EQL, four more injections must be run at a higher weight that satisfies these conditions.

11.7.7 For Modified Quads (two injections), both injections must be above the EQL if <0.04g is weighed.

11.8 Shutdown

11.8.1 Slide boat into oven and switch off the boat analyzer (black switch).

11.8.2 Turn the boat gas and sparge gas off. Turn the carrier gas off if no further analysis of soils is to be performed. Turn the regulator valve off though the tank may be left on.

11.8.3 Remove the tube from the gas sparger tube on the soils unit.

11.8.4 The fan of the soils unit will always be on in order to cool the furnace.

11.9 Data Print Out

11.9.1 Select "Samples" from the Results menu. Then "Clear" from the File menu. Followed by "Open Results from Day" also from the File menu. Type the date of the run in the format provided YYYY MM DDD and click OK.

11.9.2 Now select "Print Summary Report" and then select "Print Detailed Report" from the File menu. Exit without saving changes and select "Calibration" from the Results menu. Click on "Print" and then click on "Cancel".

12.0 **CALCULATIONS:**

12.1 The instrument provides calculated sample results in mg/L. The Apollo 9000 instrument uses the formula Y = mx.

12.1.1 SW846 9060 Calculations

Injection 1:
Soil:

$$\text{Raw Data Value (mg/L)} \times \frac{0.04\ (\text{ml}) \times 1000\ (\text{g})}{\text{Injection weight (g)} \times 1\ (\text{Kg})} \times \frac{1(\text{L})}{1000\ (\text{ml})} = \text{TOC (mg/Kg) (TOC1)}$$

Water:

$$\text{Raw Data Value (mg/L)} \times \frac{0.2\ (\text{ml})}{\text{Injection volume (ml)}} \times \text{Dilution} = \text{TOC (mg/L) (TOC1)}$$

Injection 2:
Soil:

$$\text{Raw Data Value (mg/L)} \times \frac{0.04\ (\text{ml})}{\text{Injection weight (g)}} \times \frac{1000\ (\text{g})}{1\ (\text{Kg})} \times \frac{1\ (\text{L})}{1000\ (\text{ml})} = \text{TOC (mg/Kg) (TOC2)}$$

Water:

$$\text{Raw Data Value (mg/L)} \times \frac{0.2\ (\text{ml})}{\text{Injection volume (ml)}} \times \text{Dilution} = \text{TOC (mg/L) (TOC2)}$$

Injection 3 (Quad only):
Soil:

$$\text{Raw Data Value (mg/L)} \times \frac{0.04\ (\text{ml})}{\text{Injection weight (g)}} \times \frac{1000\ (\text{g})}{1\ (\text{Kg})} \times \frac{1\ (\text{L})}{1000\ (\text{ml})} = \text{TOC (mg/Kg) (TOC3)}$$

Water:

$$\text{Raw Data Value (mg/L)} \times \frac{0.2\ (\text{ml})}{\text{Injection volume (ml)}} \times \text{Dilution} = \text{TOC (mg/L) (TOC3)}$$

Injection 4 (Quad only):
Soil:

$$\text{Raw Data Value (mg/L)} \times \frac{0.04\ (\text{ml})}{\text{Injection weight (g)}} \times \frac{1000\ (\text{g})}{1\ (\text{Kg})} \times \frac{1\ (\text{L})}{1000\ (\text{ml})} = \text{TOC (mg/Kg) (TOC4)}$$

Water:

$$\text{Raw Data Value (mg/L)} \times \frac{0.2\ (\text{ml})}{\text{Injection volume (ml)}} \times \text{Dilution} = \text{TOC (mg/L) (TOC4)}$$

12.1.3 Dry weight correction:

$$\frac{\text{Final result (mg/Kg)}}{\text{Dry solids (in decimal i.e. 0.85)}} = \text{TOC mg/Kg dry weight}$$

Please note that soils are dried to 100% dry weight before analysis - so no dry weight correction is needed. The above formula would be used ONLY if the samples were not dried before analysis.

12.1.4 Average sample result (Quad) $= \frac{(\text{TOC1}) + (\text{TOC2}) + (\text{TOC3}) + (\text{TOC4})}{4(\text{number of injections})}$

12.1.5 Average sample result (modified) = $\frac{(TOC1) + (TOC2)}{2(\text{number of injections})}$

12.2 For samples run in Quadruplicate: each injection is calculated using the appropriate injection equation according to 12.1.1. The average final result is acquired using 12.1.4. The final average result (from 12.1.4) is reported as well as each individual injection's final result.

For Modified Quadruplicate (two injections): Each injection is calculated using 12.1.2. The average of the final results is acquired using 12.1.5. Report the average result only.

12.3 Accuracy:
For EPA 415.1, a matrix spike / matrix spike duplicate is analyzed in each analytical batch of 20 or fewer samples. For SW846 9060, a matrix spike / matrix spike duplicate is analyzed in each batch of 10 ore fewer samples. The accuracy is calculated based on the average and not the individual injections.

MS/MSD calculation

$$\% \text{ Recovery} = \frac{SSR - SR}{SA} \times 100$$

SSR = Spike sample result
SR = Sample result
SA = Spike added

12.4 Precision (for QC samples):
The precision is calculated based on the % recovery of the matrix spike / matrix spike duplicate result.

Relative percent difference (RPD) calculation:

$$\% \text{ RPD} = \frac{|MS-MSD|}{(MS+MSD)/2} \times 100$$

MS = % recovery of matrix spike
MSD =% recovery of matrix spike duplicate

For SW846 9060 or SW846 M9060: precision is only calculated on the final average – not each injection.

12.5 Water precision calculation:

Relative percent difference (RPD)

$$\% \text{ RPD (must be less than 10\%)} = \frac{|\text{Rep. 1} - \text{Rep. 2}|}{(\text{Rep. 1} + \text{Rep. 2})/2} \times 100$$

Rep. 1 = raw amount of first replicate
Rep. 2 = raw amount of second replicate

The instrument will run 3 injections of the sample. The first injection reading that is within 10% RPD of the next injection reading is reported. If the first two injection readings are at or below the EQL, precision is NOT calculated and the first injection reading is reported. If no injection reading is within 10% RPD of the next injection reading and the injection readings are above the EQL, the sample must be rerun.

13.0 **METHOD PERFORMANCE:**

13.1 The method performance is validated through the Method Detection Limit Study, Initial Validations and the Performance Testing Samples taken through this procedure.

13.2 See Table K for EnChem's Initial Demonstration of Capability.

14.0 **POLLUTION PREVENTION:**

14.1 Pollution prevention encompasses any technique or procedure that reduces or eliminates the quantity or toxicity of waste at the point of generation. Laboratory staff should order where possible acceptable non-toxic alternative supplies and prepare only those quantities of reagents or standards that will be used prior to the expiration date. Other appropriate measures to minimize waste generation should be brought to the attention of laboratory management. All laboratory waste shall be handled as directed by the Laboratory Waste Management Plan and Hazardous Waste Contingency Plan.

15.0 **DATA ASSESSMENT AND ACCEPTANCE CRITERIA FOR QUALITY CONTROL MEASURES:**

15.1 At a minimum there are three levels of data review:

15.2 Analyst/Technician verification at the bench top are looking at instrument performance as it relates to initial calibration, calibration verification, and cleanliness.

15.3 Supervisor/Analyst verification after analysis are looking for sample concentration versus linear range of the instrument, typical patterns resulting from the compounds or elements in question, and quality control measure criteria. Data is accepted without qualification, accepted with qualification, or rejected with samples reprocessed.

15.4 Report Reviewer/Project Management personnel look at the presentation of the data on final reports. The reports are verified for holding time compliance, receipt conditions, method citation and reasonableness, which may include field duplicate analysis, analytical comments and qualifications presented by the previous reviews, and comparing results of similar analytical techniques as it relates to the project site information when available.

15.5 A fourth level of review, data validation is determined from a project or program scope of laboratory services and encompasses the generation Quality Control summaries in the media of "Form Generation".

15.6 See Tables L and M for summaries.

16.0 **CORRECTIVE ACTIONS FOR OUT-OF-CONTROL DATA**

16.1 Assessment of Quality Control measures is done to provide a level of confidence in the data generated. The measures provide documentation that the instrument conditions were reliable during the analysis. See Table L for a summary.

17.0 CONTINGENCIES FOR HANDLING OUT-OF-CONTROL OR UNACCEPTABLE DATA

17.1 During analysis, events occur specific to the physical and chemical characteristics of the environmental sample. When possible, with received sample volumes, data generated along with measures that do not meet statistical goals are re-analyzed again to see if the statistical goal can be achieved. When environmental samples do not meet statistical goals, unacceptable data is generated. These events are different from those pertaining to instrument operating conditions and occur when the instruments are operating under ideal conditions.

17.2 See Table L for a summary.

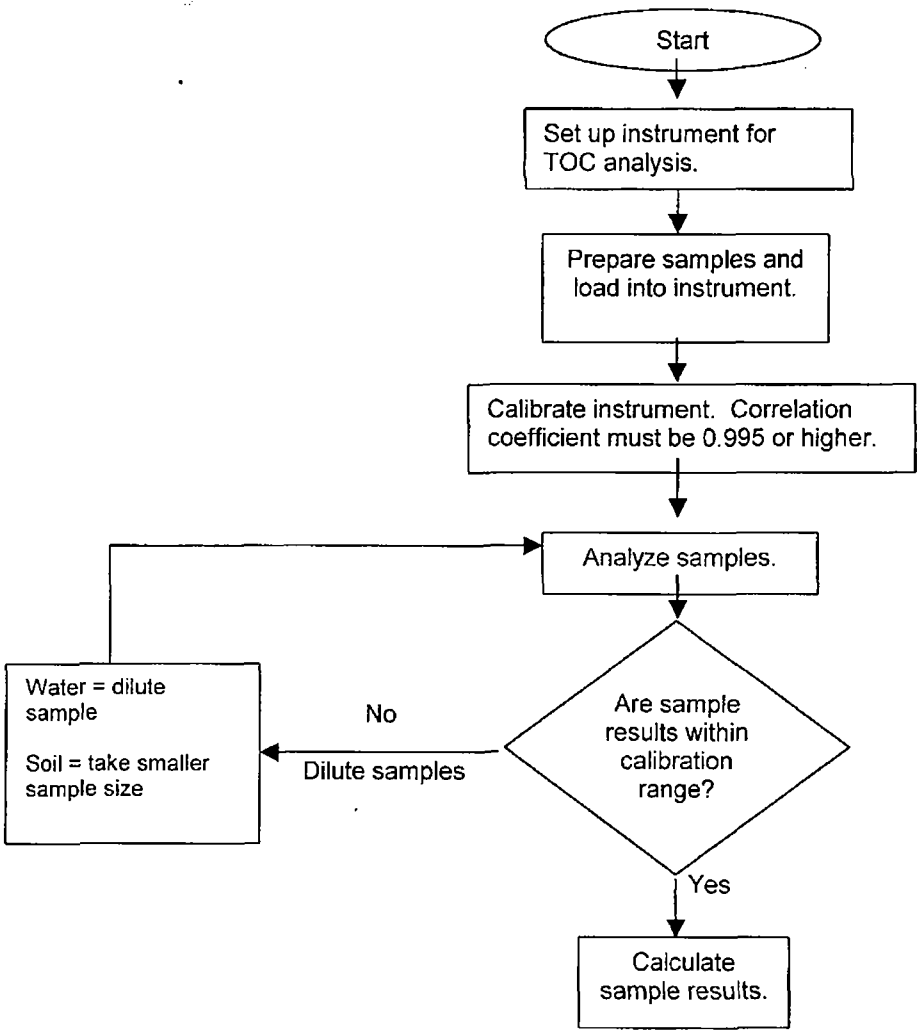
18.0 WASTE MANAGEMENT

18.1 To minimize waste during sample preparation has two benefits. The first benefit is a cost savings to the lab in materials and supplies. The second is a benefit to the environment, as fewer materials need to be disposed.

REFERENCES:

40CFR Part 136
National Institute of Standards and Technology (NIST)
2002 National Environmental Laboratory Accreditation Conference (NELAC) Standards
Effective July 2004
US EPA Quality Assurance Division (QAD)
Apollo 9000 TOC Combustion Analyzer User Manual
Standard Methods for the Examination of Water and Wastes - 5310
EPA SW846 9060
EPA 600 4-79-020, Revised March 1983, Method 415.1

FLOWCHARTS


Start
Set up instrument for TOC analysis.
Prepare samples and load into instrument.
Calibrate instrument. Correlation coefficient must be 0.995 or higher.
Analyze samples.
Are sample results within calibration range?
No
Dilute samples
Water = dilute sample
Soil = take smaller sample size
Yes
Calculate sample results.

VALIDATION DATA:

The laboratory must demonstrate initial proficiency with each combination of sample preparation and determinative methods utilized, by generating data of acceptable accuracy and precision for a reference sample containing the target parameters in a clean matrix. The laboratory must also repeat this demonstration whenever new staff is trained or significant changes in instrumentation are made. Analysts previously trained shall perform a continued demonstration of proficiency annually.

The values from the determinative method are presented as guidance only and are not intended as absolute acceptance criteria. Accuracy of parameters routinely analyzed by En Chem can be found in Initial Demonstration Data Table K. Blind studies are available upon request from the QC Manager.

MANAGEMENT APPROVAL AND REVIEW OF SOPS - POLICY AND DOCUMENTATION

APPROVED BY: _____ 6/16/2004
Alexandria Wolf
Wet Chemistry Supervisor
Date

REVIEWED BY: _____ 6/15/2004
Julie Trivedi
Quality Assurance Officer
Date

APPROVED BY: _____ 6/15/2004
Glen Coder
Laboratory Manager
Date

Periodic Review Record

Review Date					
Initials					

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Table A
REPORTING LIMITS

Compound Name	Aqueous		Solid	
	MDL (µg/L)	EQL (µg/L)	MDL (mg/Kg)	EQL (mg/Kg)
Total Organic Carbon	0.20	1.0	12	500

Table B
REQUIRED SAFETY EQUIPMENT

Safety Apparel Description	Mandatory for Procedure	Optional
Safety Goggles or Glasses	√	
Lab Coat	√	
Gloves	√	
Face Shield		√

Table C
EQUIPMENT*

Equipment	Manufacturer	Serial #
TOC analyzer	Apollo 9000	99174002
Analytical Balance	Mettler	
Pipettors 100 µL	Eppendorf	
Pipettors 500 µL	Eppendorf	
Pipettors 100 µL – 5000 µL	Eppendorf	
Volumetric Flasks	Fisher	
Syringe 40uL	Hamilton	
Syringe 200uL	Hamilton	
TOC Boat Analyzer	Rosemount/Dohrmann	99162007
Apollo detector	California Analytical Instruments	20J12001
Spatula		
Mortar & Pestle	Coors Tek	
Hot Block		

Table D
SUPPLIES*

Supplies
40 ml VOA vials
Aluminum dishes
Digestion Tubes

* Or equivalent

Table E
REAGENTS

Reagent	Purity	Vendor	Directions found in:
Deionized water			
Purified Compressed Air			
Sulfuric Acid	Concentrated	Fisher	Table J2
Phosphoric Acid	85%	Fisher	Table J2

Table F
STANDARDS

Standard	Acronym	Concentration	Direction found in Section:
Potassium hydrogen phthalate (KHP) 2 sources	Stock	Granular	Table J
Calibration Curve Standard 1 Water	Cal. Std 1	400 mg/L	Table J
Calibration Curve Standard 2 Water	Cal. Std 2	300 mg/L	Table J
Calibration Curve Standard 3 Water	Cal. Std 3	150 mg/L	Table J
Calibration Curve Standard 4 Water	Cal. Std 4	50 mg/L	Table J
Calibration Curve Standard 5 Water	Cal. Std 5	10 mg/L	Table J
Calibration Curve Standard 6 Water	Cal. Std 6	2.0 mg/L	Table J
Calibration Curve Standard 7 Water	Cal. Std 7	0.0 mg/L	Table J
Calibration Curve Standard 1 Soil	Cal. Std. 1	2000 mg/L	Table J
Calibration Curve Standard 2 Soil	Cal. Std. 2	1000 mg/L	Table J
Calibration Curve Standard 3 Soil	Cal. Std. 3	500mg/L	Table J
Calibration Curve Standard 4 Soil	Cal. Std. 4	0 mg/Kg	Table J
Initial/Continuing Calibration Verification Standards For Water	ICV/CCV	200mg/L	Table J
Spiking solution For water	MS/MSD LCS/LCSD	100 mg/L 100mg/L	Table J
Initial/Continuing Calibration Verification Standards for Soil	ICV/CCV	1000mg/L	Table J
Spiking solution For soil	MS/MSD LCS/LCSD	500mg/L 1000 mg/L	Table J

Table G
SAMPLE COLLECTION, PRESERVATION, HOLD TIME SHIPMENT AND STORAGE

Matrix	Method	Container(s)	Preservation	Hold Time	Shipment Conditions	Lab Storage Conditions
Aqueous	EPA SW846 9060 415.1	Clean glass containers	H_2SO_4	28 days	4°C	Walk-in cooler 4°C
Soil	EPA SW846 9060 EPA SW846 M9060	Clean glass containers	None	28 days	4°C	Walk-in cooler 4°C

Table H
QUALITY CONTROL

Quality Control Measure	Method SW846 9060 SW846 M9060	Method EPA 415.1
Method Blank	One per batch of samples, up to 20 environmental samples, whichever is more frequent.	One per batch of samples, up to 20 environmental samples, whichever is more frequent.
Laboratory Control Spike (LCS)	One per batch of samples, up to 20 environmental samples, whichever is more frequent. A LCSD is performed if insufficient volume for MS/MSD.	One per batch of samples, up to 20 environmental samples, whichever is more frequent. A LCSD is performed if insufficient volume for MS/MSD.
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	One per batch of samples, up to 10 environmental samples, whichever is more frequent.	One per batch of samples, up to 20 environmental samples, whichever is more frequent.
Initial Calibration	Minimum of 3 standards. A calibration curve is analyzed if the ICV/ICB are outside the control limits.	Minimum of 3 standards. A calibration curve is analyzed if the ICV/ICB are outside the control limits.
Calibration Verification (ICV/CCV)	ICV – Analyzed after initial curve or the beginning of the run. CCV - Analyzed after 10 samples.	ICV – Analyzed after initial curve or the beginning of the run. CCV - Analyzed after 10 samples.
Calibration Blank (ICB/CCB)	ICB - Analyzed after ICV. CCV – Analyzed after every CCV.	ICB – Analyzed after ICV CCB - Analyzed after CCV

Table I
CALIBRATION AND STANDARDIZATION

Analytical Method Acceptance Criteria⇨ Calibration Measure ⇩	EPA SW846 9060 EPA SW846 M9060 EPA 415.1 Frequency	Acceptance Criteria
Laboratory Control Spike and Duplicate	One per batch of samples, up to 20 environmental samples, whichever is more frequent. The LCSD is analyzed if needed.	Project Specific or In-house limits. See Table K1
Matrix Spike / Matrix Spike Duplicate	One per batch of samples, up to 20 environmental samples, whichever is more frequent. The LCSD is analyzed if needed.	Project Specific or In house limits. See Table K2
Method Blank	One per batch of samples, up to 20 environmental samples, whichever is more frequent.	Project Specific or Less than the EQL
Initial Calibration	Before analysis of samples	Correlation coefficient must be greater than 0.995.
Initial Calibration Verification (ICV)	After initial calibration	90 – 110% of true value
Initial Calibration Blank	After ICV	±EQL or Project specific
Continuing Calibration Verification	After 10 samples	90 – 110 % of true value
Continuing Calibration Blank	After CCV	±EQL or Project specific

Table J
PREPARATION OF STANDARDS

Standard	Acronym	Concentration of Intermediate	Directions	Final Volume
Potassium hydrogen phthalate (KHP) 2 sources	Stock	Granular	Dissolve 850 mg of KHP into ~50 mls DI water. Dilute to volume. Shelf life = 1 month.	100 ml
Calibration Curve Standard 1 – water	Cal. Std 1 – 400 mg/L	4000 mg/L	Pipet 10 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month	100 ml
Calibration Curve Standard 2 – water	Cal. Std 2 – 300 mg/L	4000 mg/L	Pipet 7.5 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month.	100 ml
Calibration Curve Standard 3 – water	Cal. Std 3 – 150 mg/L	4000 mg/L	Pipet 3.75 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month.	100 ml
Calibration Curve Standard 4 – water	Cal. Std 4 – 50 mg/L	4000 mg/L	Pipet 1.25 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month.	100 ml
Calibration Curve Standard 5 – water	Cal. Std 5 – 10 mg/L	4000 mg/L	Pipet 0.25 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month	100 ml
Calibration Curve Standard 6 – water	Cal. Std 6 – 1 mg/L	4000 mg/L	Pipet 0.05 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month	100 ml
Calibration Curve Standard 7 – water	Cal. Std 7 – 0 mg/L		Use DI water.	100 ml
Calibration Curve Standard 1 – soil	Cal. Std. – 2000 mg/Kg	4000 mg/L	Pipet 5 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month	10 ml
Calibration Curve Standard 2 – soil	Cal. Std. – 1000 mg/Kg	4000 mg/L	Pipet 2.5 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month	10 ml
Calibration Curve Standard 3 – soil	Cal. Std. – 500 mg/Kg	4000 mg/L	Pipet 1.25 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month	10 ml
Calibration Curve Standard 4 - soil	Cal. Std 4 – 0 mg/Kg		Use DI water.	10 ml
Initial/Continuing Calibration Verification Standards for Water	ICV/CCV – 200 mg/L	4000 mg/L from second source	Pipet 5 ml of stock solution into flask. Dilute to volume. Shelf life = 1 month.	100 ml
Spiking solution For water	MS/MSD 100 mg/L LCS/LCSD 100 mg/L	4000 mg/L from second source	Pipet 0.5 ml of stock solution into vial. Add 20 mL of sample (for MS/MSD) or 20mL DI for LCS/LCSD.	20 ml
Initial/Continuing Calibration Verification Standard for Soil	ICV/CCV – 1000 mg/L	4000 mg/L from second source	Pipet 2.5 mL of stock solution into flask. Dilute to volume. Shelf life = 1 month.	10 ml
Spiking solution For soil	LCS/LCSD 1000 mg/L MS/MSD 500 mg/L	1000 mg/L from ICV/CCV – second source	Inject 40 uL into soil boat for LCS. Inject 20 uL into soil boat containing parent sample for MS/MSD	0.04 ml

Table J2
PREPARATION OF REAGENTS

Reagent	Use	Directions	Final Volume
Phosphoric Acid	For waters	Pipet 50 ml phosphoric acid into ~100 ml. Dilute to volume. Shelf life = 1 year.	200 ml
Sulfuric Acid - 10%	Preparation of soil samples	Pipet 200 ml concentrated H2SO4 into ~1000ml. Dilute to volume. Shelf life = 1 year	2000 ml

Table K
EnChem Initial Demonstration of Capability

Parameter	Conc	IDC-1	IDC-2	IDC-3	IDC-4	Average	% Recovery	SD	RSD
Total Organic Carbon – Water (mg/L)	10	10.8	10.3	9.8	10.9	10.3	103	0.493	4.715
Total Organic Carbon – Soil (mg/Kg)	500	442.3	458.4	442.5	445.4	447.2	89.4	7.638	1.708

Table K1
Laboratory Control Spike Accuracy & Precision

Preparation Method ⇨EPA SW846 9060 EPA SW846 M9060 EPA 415.1			
Laboratory Control Spike Recovery / Duplicate Analysis Parameters ⇩	LCL	UCL	RPD
Total Organic Carbon – Water	80	120	20
Total Organic Carbon – Soil	86	114	20

Table K2
Matrix Spike / Matrix Spike Duplicate Accuracy & Precision Criteria

Preparation Method ⇨EPA SW846 9060 EPA SW846 M9060 EPA 415.1			
Control Spike Recovery / Duplicate Analysis Parameters ⇩	LCL	UCL	RPD
Total Organic Carbon – Water	80	120	20
Total Organic Carbon – Soil	62	143	27

Table L
TECHNICIAN/ANALYST/SUPERVISOR DATA ASSESSMENT

Data Assessment Measure	Corrective Action If acceptance criteria are not met ⇒
Method Blank	1
Accuracy & Precision Matrix Spike	2
Accuracy & Precision Laboratory Control Spikes	3
Initial Calibration	4
Initial / Continuing Calibration Verification	5
Initial / Continuing Calibration Blank	6

1. In the absence of project specific requirements, sample detects less than 20 times the method blank contamination level is reported with the "A" data qualifier. Sample detects greater than 20 times the method blank contamination are reported without qualification.

2. In the absence of project specific requirements, in-house generated limits will be used. If samples are outside the control limits flag the parent sample with the "N" data qualifier for accuracy outliers and the "*" data qualifier for precision outliers. Generate a Non-Conformance Memo. The accuracy criteria is not evaluated if the concentration in the parent sample is greater than 4X the amount in the spike.

3. If sample volume does not allow re-analysis the entire prep/analytical batch of samples shall be flagged with the "&" data qualifier for accuracy outliers and the "*" data qualifier for precision outliers to reflect the deficiencies. Generate a Non-Conformance Memo.

4. If correlation coefficient is less than 0.995, perform maintenance and re-calibrate.

5. If the ICV or CCV does not pass the acceptance criteria the check standard can be re-analyzed one time. If the standard does not pass the second time, perform maintenance and re-calibrate. Samples associated to QC that is outside the control limits must be re-analyzed.

6. If the ICB or CCB does not pass the acceptance criteria the check standard can be re-analyzed one time. If the standard does not pass the second time, perform maintenance and re-calibrate. Samples associated to QC that is outside the control limits must be re-analyzed. Samples that are 10X greater than the concentration in the blank do not have to be reanalyzed.

Table M
REPORT REVIEWER/PROJECT MANAGEMENT DATA ASSESSMENT

Data Assessment Measure ⇩	Method Citation If these conditions are not achieved ⇨
Holding Time Compliance	1
Sample Receipt Conditions and Preservation	2
Method Citation	3
Reasonableness: Field Duplicate	4
Reasonableness: Analytical Comments Qualifications	5

1. Flag results with an H data qualifier. The days past hold are addressed in the report. Hold time issues will be addressed in the case narrative for Level III and IV.

2. In prose describe the receipt conditions as they relate to the acceptance criteria list in Table G.

3. Compare to regulatory program in QAPjP or Chain of Custody.

4. Are duplicates within 40% agreement? If not, internally flag for review.

5. Do related suites of tests agree or are they reasonable?

TABLE N
DATA QUALIFIERS

Flag	Applies To	Explanation
A	Inorganic	Analyte is detected in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample
B	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
B	Organic	Analyte is present in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample
C	All	Elevated detection limit.
D	All	Analyte value from diluted analysis or surrogate result not applicable due to sample dilution.
E	Inorganic	Estimated concentration due to matrix interferences. During the metals analysis the serial dilution failed to meet the established control limits of 0-10%. The sample concentration is greater than 50 times the IDL for analysis done on the ICP or 100 time
E	Organic	Analyte concentration exceeds calibration range.
F	Inorganic	Due to potential interferences for this analysis by Inductively Coupled Plasma techniques (SW-846 Method 6010), this analyte has been confirmed by and reported from an alternate method.
F	Organic	Surrogate results outside control criteria.
H	All	Preservation, extraction or analysis performed past holding time.
HF	Inorganic	This test is considered a field parameter, and the recommended holding time is 15 minutes from collection. The analysis was performed in the laboratory beyond the recommended holding time.
J	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
J	Organic	Concentration detected is greater than the method detection limit but less than the reporting limit.
K	Inorganic	Sample received unpreserved. Sample was either preserved at the time of receipt or at the time of sample preparation.
K	Organic	Detection limit may be elevated due to the presence of an unrequested analyte.
L	All	Elevated detection limit due to low sample volume.
M	Organic	Sample pH was greater than 2
N	All	Spiked sample recovery not within control limits.
O	Organic	Sample received overweight.
P	Organic	The relative percent difference between the two columns for detected concentrations was greater than 40%.
Q	All	The analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
S	Organic	The relative percent difference between quantitation and confirmation columns exceeds internal quality control criteria. Because the result is unconfirmed, it has been reported as a non-detect with an elevated detection limit.
U	All	The analyte was not detected at or above the reporting limit.
V	All	Sample received with headspace.
W	All	A second aliquot of sample was analyzed from a container with headspace.

X	All	See Sample Narrative.
&	All	Laboratory Control Spike recovery not within control limits.
*	All	Precision not within control limits.
<	All	The analyte was not detected at or above the reporting limit.
1	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses passed QC based on precision criteria.
2	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses failed QC based on precision criteria.
3	Inorganic	BOD result is estimated due to the BOD blank exceeding the allowable oxygen depletion.
4	Inorganic	BOD duplicate precision not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
5	Inorganic	BOD result is estimated due to insufficient oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
6	Inorganic	BOD laboratory control sample not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
7	Inorganic	BOD result is estimated due to complete oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.

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STANDARD OPERATING PROCEDURE

The Determination of Mercury by Cold Vapor Atomic Absorption Spectroscopy

Reference Methods: EPA SW-846 Methods 7470A and 7471A

SOP NUMBER:	KM-M-010-Rev.0
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	MET-30 Revision 8, MET-31 Revision 9

APPROVAL

Glen A. Coder — 2/7/05
Glen Coder, Assistant General Manager — Date

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Bruce Warden, General Manager — Date

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1. Purpose

1.1 The purpose of this Standard Operating Procedure (SOP) is to describe the determination of mercury in water, soil/solid samples, and biological tissue.

2. Scope and Application

2.1. This method is applicable to water samples (including drinking water, surface water, and domestic and industrial wastewaters), solid samples (including soils, sediments, sludges, and solid wastes), TCLP leachates, and biological tissue samples.

2.2. This procedure is restricted to use by, or under the supervision of, analysts experienced in the digestion of samples for metals analysis and analysis of digestates by atomic absorption spectrometry. Each analyst must demonstrate the capability to generate acceptable results with this method to be considered qualified to report sample results.

3. Summary of Methods

3.1. Cold vapor atomic absorption utilizes the volatile property of elemental mercury at the 253.7 nm wavelength. To release mercury from organic complexes, the sample is digested with oxidizing reagents and acids in a hot block digester. After digestion, the oxidizing reagents are neutralized. Stannous chloride is added to reduce ionic mercury to the ground state. The Flow Injection Analysis System sweeps the volatile elemental mercury out of the sample and into the cell of an atomic adsorption spectrophotometer. The absorbance signal is proportional to the amount of mercury in the sample.

4. Interferences

4.1. Biota samples can contain diverse matrix types, each of which may present analytical challenges. Spiked samples and Laboratory Control Samples are important for determining digestion efficiency.

4.2 Potassium permanganate is added to eliminate possible interference from sulfide. Concentrations as high as 20 mg/L of sulfide, as NaS, do not interfere with recovery of added inorganic Mercury from D.I. water.

4.3 Copper has also been reported to interfere; however, copper concentrations as high as 10mg/L had no effect on recovery of Mercury from spiked samples.

4.4 Samples high in chlorides require up to 7.5 mls of additional potassium permanganate. During the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation at 253.7 nm. Care must therefore be taken to ensure that free chlorine is absent before the Mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine hydrochloride reagent.

4.5 Certain volatile organic materials that absorb at this wavelength may also interfere. A preliminary run without reagents would determine if this type of interference is present.

5. Safety

5.1. **Standards and Reagents** - The toxicity and carcinogenicity of standards and reagents used in this method have not been fully defined. Each chemical compound should be treated as a potential health hazard. Reduce exposure by the use of gloves, lab coats and safety glasses. Material Safety Data Sheets (MSDSs) are on file in the laboratory and available to all personnel.

5.2. **Special care should be taken when handling the high concentration acids and oxidizing reagents used for sample digestion. All digestions must be conducted in a properly functioning fume hood.**

5.3. **Samples** - Take precautions when handling samples. Samples should always be treated as potentially hazardous "unknowns". The use of personal protective equipment (gloves, lab coats and safety glasses) is required when handling samples.

5.3.1 Extreme caution must be used when preparing rodents for digestion. The samples must undergo a special procedure to destroy any Hantavirus, which may be present. Refer to the most recent version of SOP KM-L-002 for details.

6. Definitions

6.1. Definitions of terms found in this SOP can also be found in the Pace Quality Manual. When definitions are not consistent with NELAC defined terms, an explanation will be provided in this SOP or the Pace Analytical Services' Quality Manual Glossary, Section 12.0.

6.2 **Fish Control Blank (Matrix Blank)** - A sample of a matrix that is used for the control spike. The fish blank will either be catfish or tilapia which ever is available at the time of analysis. The fish blank must be "farm-raised" to minimize background mercury levels. The concentration in the fish blank will be subtracted from the concentration of the laboratory control spike. This is done because the fish blank is known to have some contamination. This SOP will reference catfish blank for ease. Note: For plant material analysis, alfalfa will be used as the control blank matrix.

6.3 **Reagent Grade** – Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents, which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

6.4 **Standardized Reference Material (SRM)** – A certified reference material produce by the U.S. National Institute of Standards and Technology or other

equivalent organization and characterized for absolute content, independent of analytical method. A SRM is analyzed with each analytical batch of biota samples.

7. Responsibilities and Distribution

7.1. **Analyst** – Any analyst using this procedure is responsible for reading, understanding, and following this SOP. Any deviation from this SOP must be reported to the appropriate supervisor. The analyst must make their recommendations for changing the SOP to their supervisor or the QM in writing.

7.2. **Inorganic Supervisor** – The supervisor must ensure that all analysts are properly trained and qualified to use this procedure. The supervisor is also responsible to ensure that the SOP is followed. The supervisor is responsible for reviewing the SOP and communicating recommended changes to the QM.

7.3. **Quality Manager (QM)** – The QM is responsible for monitoring the implementation of the SOPs. The QM shall participate in the revision of the SOP and make sure it is current. The QM shall review and approve all SOPs.

7.4. **Assistant General Manager** – The Assistant General Manager has overall responsibility for ensuring that SOPs are prepared and implemented for all activities appropriate to the region. The Assistant General Manager shall review and approve all SOPs.

7.5. **Distribution** – The official version of this SOP is the signed hardcopy version found in the laboratory. A copy of the SOP shall be kept in the department for reference.

7.6. **Revision** – This SOP shall be reviewed every two years at a minimum. Independent of the minimum review frequency, revisions shall be incorporated as needed if procedures or methods change.

8. Sample Collection, Preservation, and Handling

8.1. Biota Samples

8.1.1. Biota samples can be collected in clean plastic or glass containers or plastic baggies.

8.1.2. Biota samples are kept frozen until time of preparation to preserve integrity. Hold time is 28 days from removal from freezer.

8.2. Soil Samples

8.2.1. Soil and waste samples should be collected in clean wide-mouth glass containers to facilitate obtaining representative aliquots for measurement.

8.2.2. Samples should be stored at 4±2°C and analyzed as soon as possible to minimize microbiological decomposition of organic solids. Samples must be analyzed within 28 days of collection.

8.3 Water samples

8.3.1 Water samples may be collected in plastic or glass containers and must be preserved with HNO_3 to pH <2 and stored at room temp.

8.3.2 Samples must be analyzed within 28 days of collection.

9. Equipment and Supplies

9.1. Heating Block – Operated at 95 ± 5°C. Heating block should be Environmental Express "Hot Block", or equivalent.

9.2. Digestion Vials – Pre-cleaned 68- mL screw cap vials, Environmental Express (SC475), or equivalent.

9.3. Analytical Balance – Capable of weighing to 0.01g.

9.4. Volumetric Flasks – Assorted, Class A

9.5. Graduated Cylinder – 50-mL

9.6. Mechanical Pipettes – Assorted adjustable air-displacement pipettes with disposable tips (Eppendorf or equivalent).

9.7. pH Strips

9.8. CVAA-FIMS

9.9. Inert Sparging and Carrier Gas - Argon

9.10. Autosampler vials

9.11. Autosampler Pump Tubing

9.12. Specimen Cups

9.13. DOLT-3

9.14. Analytical Balance – Capable of weighing to 0.0001g.

10. Reagents and Standards

10.1. Trace Metals Water

10.2. Nitric Acid (HNO_3) – Trace metals grade

10.3. Hydrochloric Acid (HCl) – Trace metals grade

10.4. Sulfuric Acid (H_2SO_4) – Trace metals grade

10.5. Potassium Permanganate ($KMnO_4$) solution (5%) – Dissolve 50.0 g of $KMnO_4$ into ~800 mL of trace metals water. Dilute to 1000 mL. Prepare fresh each month.

10.6 Potassium Persulfate Solution ($K_2S_2O_8$) solution (5%) – Dissolve 50.0 g of $K_2S_2O_8$ into ~800 mL of trace metals water. Dilute to 1000 mL. Warm to dissolve. Prepare fresh each month.

10.7 Hydroxylamine Hydrochloride ($NH_2OH•HCl$) Solution (12%) – Dissolve 120 g NaCl and 120g $NH_2OH•HCL$ in ~800 mL of trace metals water. Dilute to 1000 mL. Prepare fresh each month.

10.8 Stannous Chloride Solution ($SnCl_2$) - Dissolve 11.0 g of SnCl in ~ 800 mL of trace metals water. Add 30 mL of HCL. Dilute to 1000 mL. Prepare fresh every other day.

10.9 Analytical Standards – Standard solutions are required calibration, calibration checks, and sample spiking solutions. The following describes the contents of each type of solution. The commercial sources for stock solutions, recipes for preparing dilutions and working standards, and concentrations in standard solutions are presented in Table 1, Table 2, and Table 3.

Table 1
Stock Standards

Standard	Concentration	Vendor	Catalog#
Hg Calibration Stock	1000µg/mL	Inorganic Ventures, Inc.	CGHG1-1
ICV Calibration Stock	1000µg/mL	High-Purity Standards	100033-1

Standards are used until they expire based on the manufacturer's expiration date.

Table 2
Intermediate and Calibration Standards
Waters

Standard	Stock Standard	Conc.	Amount Used	Amount of conc. HNO_3 used	Final Volume (with trace metals water)	Final Conc.
Hg ICV Stock	-	1000µg/mL	-	-	-	1000 µg/mL
Hg Calibration Intermediate	Hg Calibration Stock	1000µg/mL	10 µL	2.0 mL	100 mL	100 ppb
Hg ICV Intermediate	Hg ICV Stock	1000 µg/ml	10 µL	2.0 mL	100 mL	100 ppb
Hg Cal. 1	-	-	-	-	20 mL	0.0 ppb
Hg Cal. 2	Hg Cal. Intermediate	100 ppb	40 µL	-	20 mL	0.2 ppb
Hg Cal. 3	Hg Cal. Intermediate	100 ppb	200 µL	-	20 mL	1.0 ppb
Hg Cal. 4	Hg Cal. Intermediate	100 ppb	500 µL	-	20 mL	2.5 ppb
Hg Cal. 5	Hg Cal. Intermediate	100 ppb	1000 µL	-	20 mL	5.0 ppb
Hg Cal. 6	Hg Cal. Intermediate	100 ppb	2000 µL	-	20 mL	10.0 ppb
Hg ICV	Hg ICV Intermediate	100 ppb	800 µL	-	20 mL	4.0 ppb
Hg CCV	Hg ICV Intermediate	100 ppb	1000 µL	-	20 mL	5.0 ppb
Hg ICB/CCB	-	-	-	-	20 mL	0.0 ppb

All intermediate dilution solutions must be prepared as needed, or at least every 7 days. Working solutions must be prepared fresh daily. Solutions may be stored at room temperature.

Table 3
Intermediate and Calibration Standards
Soils/Biota

Standard	Stock Standard	Conc.	Amount Used	Amount of conc. HNO_3 used	Final Volume (with trace metals water)	Final Conc.
Hg ICV Stock	-	1000µg/mL	-	-	-	1000 µg/mL
Hg Calibration Intermediate	Hg Calibration Stock	1000µg/mL	10 µL	2.0 mL	100 mL	100 ppb
Hg ICV Intermediate	Hg ICV Stock	1000 µg/ml	10 µL	2.0 mL	100 mL	100 ppb
Hg Cal. 1	-	-	-	-	30 mL	0.0 ppb
Hg Cal. 2	Hg Cal. Intermediate	100 ppb	60 µL	-	30 mL	0.2 ppb
Hg Cal. 3	Hg Cal. Intermediate	100 ppb	300 µL	-	30 mL	1.0 ppb
Hg Cal. 4	Hg Cal. Intermediate	100 ppb	750 µL	-	30 mL	2.5 ppb
Hg Cal. 5	Hg Cal. Intermediate	100 ppb	1500 µL	-	30 mL	5.0 ppb
Hg Cal. 6	Hg Cal. Intermediate	100 ppb	3000 µL	-	30 mL	10.0 ppb
Hg ICV	Hg ICV Intermediate	100 ppb	1200 µL	-	30 mL	4.0 ppb
Hg CCV	Hg ICV Intermediate	100 ppb	1500 µL	-	30 mL	5.0 ppb
Hg ICB/CCB	-	-	-	-	30 mL	0.0 ppb

All intermediate dilution solutions must be prepared as needed, or at least every 7 days. Working solutions must be prepared fresh daily. Solutions may be stored at room temperature.

11. Calibration

11.1 A digested calibration curve is made up every time there are samples prepared. The curve is associated to the sample batch it is prepped with. Calibration requires analysis of a calibration blank and at least five levels of calibration solutions. The lowest calibration concentration is the Pace Reporting Limit.

11.2 The resultant correlation coefficient must be greater than 0.995. If this does not occur, then the instrument must be recalibrated and or the calibration curve and the associated samples must be re-prepped.

11.3 The calibration curve must pass an Initial Calibration Verification (ICV) that is analyzed after the calibration standards and before any samples. The ICV concentration is near the midpoint of the calibration curve and is made from a source other than the one used to make the calibration standards.

11.4 Every ten samples or less must be bracketed by Continuing Calibration Verifications (CCV). The CCV concentration is near the midpoint of the calibration curve.

11.5 The ICV and CCV limits are +/- 10% of their expected values. If one fails, then the instrument must be re-calibrated and any samples after the failure or not bracketed by an acceptable CCV, must be reanalyzed.

11.6 An acceptable Initial Calibration Blank (ICB), must be analyzed after the ICV.

11.7 Continuing Calibration Blanks (CCB) are analyzed after the CCVs.

11.8 The control limit for the ICB and CCB is less than the Pace Reporting Limit. If one fails, then the instrument must be re-calibrated and any samples, after the failure or not bracketed by an acceptable CCB, must be reanalyzed.

12. Procedure

12.1. Sample Preparation

12.1.1. Water samples

12.1.1.1 Verify preservation in the samples by checking their pH with a test strip. Record on prep log that the pH was checked and is correct.

12.1.1.2 Prior to analysis the samples and the calibration curve must be digested.

12.1.1.3 Turn on the heating block or water bath and set the temperature to maintain a sample temperature of 95±5°C. Before placing samples in the block or bath to digest, verify that the sample well temperature is correct and adjust as required. Record the temperature in the sample logbook. Verify that the hood is functioning.

12.1.1.4 Add 20 mL of trace metals water and the appropriate amounts (as shown in Table 2) of Hg Calibration Intermediate and Hg ICV Intermediate to digestion vials for the curve, ICV, CCV, ICB, and CCB.

12.1.1.5 Add 20 mL of trace metals water to a digestion vial for the Method Blank.

12.1.1.6 Add 20 mL of trace metals water and 1.0 mL of Hg ICV Intermediate to two digestion vials for the Laboratory Control Spike and Laboratory Control Spike Duplicate. Only prep LCSD if requested by client or there is not enough sample to run an MS/MSD.

12.1.1.7 Add 20 mL of each well-mixed sample to digestion vials.

12.1.1.8 To prepare a Matrix Spike and Matrix Spike Duplicate, a sample with sufficient volume is chosen at random. An additional 20 mL of this sample along with 1.0 mL of Hg ICV Intermediate is added to two digestion vials.

12.1.1.9 To each digestion vial add 0.5 mL of concentrated nitric acid.

12.1.1.10 To each digestion vial add 1.0 mL of concentrated sulfuric acid.

12.1.1.11 Swirl the digestion vials gently.

12.1.1.12 Add 3 mL of 5% $KMnO_4$ and let stand for 15 minutes. If a sample does not maintain a purple or brown color, an additional 3 mL of $KMnO_4$ solution is added to all samples, QC, and standards. **Note: If the sample still does not maintain color, discard applicable samples and dilute the samples prior to digestion.**

12.1.1.13 Add 1.6 mL of 5% Persulfate solution. Place lid or cap on tube so as to allow pressure to vent but minimizing evaporation.

12.1.1.14 Digest samples for 2 hours at 95±5°C.

12.1.1.15 Remove samples and let cool to room temperature.

12.1.1.16 Add 1 mL of 12% sodium chloride/hydroxide solution.

12.1.1.17 Samples are now ready for analysis.

12.1.2. **Soil/Solid/Biota Samples**

12.1.2.1 Prior to analysis the samples and calibration curve must be digested.

12.1.2.2 Turn on the heating block or water bath and set the temperature to maintain a sample temperature of 95±5°C. Before placing samples in the block or bath to digest, verify that the sample well temperature is correct and adjust as required. Record the temperature in the sample logbook. Verify that the hood is functioning.

12.1.2.3 Add 30 mL of 3% HNO_3 and the appropriate amounts (as shown in Table 2) of Hg Calibration Intermediate and Hg ICV Intermediate to digestion vials for the curve, ICV, CCV, ICB, and CCB.

12.1.2.4 Prepare one Method Blank by leaving one digestion vial blank. For biota analysis, a fish control blank consisting of catfish or tilapia is also prepared by weighing 0.6 g of homogenized fish control blank (either catfish or tilapia) into a digestion vial.

12.1.2.5 Prepare the Laboratory Control Spike and Laboratory Control Spike Duplicate (LCS/LCSD) for soils and wastes by adding 1.5 mL of Hg ICV Intermediate to two digestion vials. Prepare the LCS/LCSD for biota samples by weighing 0.6 g of homogenized fish control blank (either catfish or tilapia) into two digestion vials. Add 1.5 mL of Hg ICV Intermediate to each vial. Only prep LCSD if requested by client or there is not enough sample to run an MS/MSD.

12.1.2.6 For biota samples weigh approximately 0.05 g of Standard Reference Material on an analytical balance (must read to at least 4 places past the decimal) into a labeled digestion vial.

12.1.2.7 Weigh 0.6 g of homogenized sample into a labeled digestion vial. Record the weight to the nearest 0.01 g in the digestion logbook. For samples with high liquid content, a larger sample size may be used, as long as the digestion is complete.

12.1.2.8 To prepare a Matrix Spike and Matrix Spike Duplicate, a sample with sufficient volume is chosen at random. Weigh 2 additional 0.6 g aliquots into digestion vials. Add 1.5 mL of Hg ICV Intermediate to each vial.

12.1.2.9 Add 30 mL of 3% HNO_3 solution to all QC and samples.

12.1.2.10 To each digestion vial add 0.5 mL of concentrated nitric acid.

12.1.2.11 To each digestion vial add 2.0 mL of concentrated hydrochloric acid.

12.1.2.12 Swirl cups to gently mix.

12.1.2.13 Place in hot block for 10 minutes.

12.1.2.14 Add 3 mL of 5% $KMnO_4$ and let stand for 15 minutes. If a sample does not maintain a purple or brown color, an additional 3 mL of $KMnO_4$ solution is added to all samples, QC, and standards. **Note: If the sample still does not maintain color, discard set and dilute the sample prior to digestion.** For Biota samples, add 6ml of KMnO4 to start with.

12.1.2.15Digest samples for 30 minutes at 95±5°C.

12.1.2.16Remove samples and let cool to room temperature.

12.1.2.17Add 3 mL of 12% hydroxylamine hydrochloride solution.

12.1.2.18Samples are now ready for analysis.

12.2. **Basic System Operation – Analytical**

This portion of the SOP is designed to allow the user to set up and run a method, print a sample report, then shut down using the more basic software functions. For a more detailed explanation of the many other options, the user should refer to the Reference Manual.

12.2.1. Turn on the carrier argon gas supply.

12.2.2. Switch on the FIMS 100.

12.2.3. Switch on the computer and enter network password and click on Start.

12.2.4. Click on the AA WinLab Analyst. To use previously defined workspace click "wkspace" icon, otherwise click "Auto" icon.

12.2.5 To select previously defined method:
Under File name highlight: AUTO.fms and click on OK.
Four windows will automatically open:
1. Results
2. Examine Peak
3. Examine Calibration
4. Automated Analysis, within this window double-click on method entry field to display the Methods. Highlight HgtestRun or HG-MSA and click on OK.

12.2.6 Under "Sample Information File" click on Browse and choose **hgidfile.sif** file. A sample information file is created with the Sample Information Editor window.

12.2.7 Enter sample information starting with Autosample Location #10. Enter the LIMS ID numbers under sample ID columns.

12.2.8 Column Fill, in the Edit menu, allows you to clear one or more entries, or make entries in increments. Edit also allows you to delete or insert lines. The sample information Parameter File supplies the computer with all the information needed to convert the concentration of the analyte in the sample solution (solution concentration or result) to the corrected concentration (final result).

12.2.9 In the menu click on Print and sample information to get a copy of the sample information you just entered to check for errors.

12.2.10 Save the completed file by using Save As in the File menu.

12.2.11 Close the window by clicking on the X in the upper right-hand corner.

NOTE: Only sample information should be entered in this file. Information on blanks, standards and QC samples is entered in the QC page of Method Editor.

Under the QC page you set up the QC sample ID, i.e. ICV's and CCV's and the autosampler location. Set the QC concentration and the control limits.

On the Schedule Timing page set up when the QC will be analyzed, i.e. after calibration, after 10 samples, and at the end. IF re-calibration occurs the QC must be analyzed at the same frequency.

Under the Actions Calib. And Periodic page, specify what to do if calibration QC fails, for example recalibrate, recalibrate and rerun, or stop.

On the Actions: End and Retry page, specify what QC to run at the end of a run and corrective action if QC fails.

Under the Options page, set how you want data printed (usually default). It is also possible to specify saving the peaks and add comments about the run.

In the Automated Analysis Window there are 2 pages: Set UP, and Analyze.

12.2.12 Under "Use Autosampler Locations listed Below", type in the numbers or range of numbers to be analyzed.

12.2.13 Select the name of the Results Data Set to save the results. Naming example: HG092800A, denotes the element, month, day and year. A letter is used for describing each run within a day's output.

12.2.14 The Save Data box and Print Log box should already be selected.

12.2.15 Off After Analysis. Pumps should be checked.

12.3. **Starting the Analysis**

12.3.1 Prepare the required reagents: Carrier solution and reducing agent.

Clamp down the tubes by swinging the pressure levers until they lock. Place inlets of each solution in proper container: Yellow/blue in the carrier and red/red in the reductant. Click on the Fias icon to turn on the pump to draw solutions through the tubing. Check on the flow.

12.3.2 Click on the Analyze All button. The system will run the blank and standards specified in the Element Parameter file, then the entire sample

specified in the Sample Info. File. Check the calibration curve by clicking on Calibration icon on the tool bar.

12.3.3 To run the blank and standards only: In order to check the calibration curve before running any samples:

Click on Calibration, the system will run the blank and standards specified in the Element File and complete the calibration curve. To check the calibration curve, click on the Calibration icon on the toolbar.

To continue the run, click on the Auto control window then click on Analyze sample. The system will run the samples specific in the Sample Info. file.

12.3.4 To change or stop the element file that has already started: Click on Analyze. A dialogue box will appear with these options:

Stop immediately

Stop after current replicate

Stop after completing all replicates for current sample

12.3.5 To restart the analysis from the beginning: In the Automated Analysis Control window, click on RESET. Start the analysis as usual.

12.3.6 To continue the analysis where it was interrupted or continue with a specific sample: In the Automated analysis Control window, click on Analyze All or Analyze Samples. A dialog box appear, elect one of the options. Click on OK.

12.3.7 Performing a recalibration: You define the type and frequency of automatic recalibration on the Checks page of the Method.

Stop the analysis.
In the Automated Analysis Control window, click on Reset.

In the Automated Analysis Control window, click on Calibrate.

12.3.8 Analyzing One or More Selected Samples: IN the Automated Analysis Control window, click on Select Location – a dialog box appears. Select the Analyze Samples In Locations option. Enter the autosampler locations of the solutions to analyze in the test box: Enter individual locations or a range of locations. Use comas to separate the locations and ranges, e.g. 10-15,18,20,25-30. Click OK.

12.3.9 Resetting the Autosampler: In the Automated Analysis Control window, click on Reset. Analyze the sample; the system will begin with the first sample in the sample list on the Set Up page of the Automated Analysis Control window.

12.3.10 Raising or Lower Sample Probe: In the Automated Analysis Control window, click on Probe Up/Down. The sample probe moves up or down but remains at the sample autosampler locations.

12.3.11 Rinsing the Sampling Probe and Sampling Tube: In the Automated Analysis Control window, select Location – a dialog box appears. Select "Go to Wash." Click on OK. The sampling probe moves to the wash location. In the FIAS Control window: Make sure the FIAS-valve is in the correct position to rinse the sample channel. Click on the Pump.

12.3.12 The sample pump feeds the rinse fluid from the wash container through the sample channel. Click on Pump again to stop it. Click on Move Probe Up/Down to raise the probe out of the wash container in the automated analysis Control window.

12.4 **System Shutdown**

12.4.1 Place inlets of the carrier and reagent lines in a container of DI water. Rinse the sample, carrier, and reagent tubing with DI water. In the FIAS Control window, click on Valve Fill/Inject a number of times while the pump is running. This ensures that the sample channel and the inside of the FIAS-valve are rinsed effectively.

12.4.2 After adequate time, remove, all the tubes from the rinse containers. Click on Move Probe Up/Down to raise the sampling probe.

12.4.3 Allow the pump to run until all the tubes and the gas/liquid separator are empty. Then click on the Pump button to stop the pump.

12.4.4 Make sure that the FIAS-valve is in the Fill position.

12.4.5 Swing all the pressure levers away from the pump tube magazines.

12.4.6 Turn off the carrier gas supply at the regulator valve.

12.4.7 Exit the AA WinLab application.

12.4.8 Switch off the FIMS spectrometer.

12.4.9 Switch off the computer.

13. Calculations

13.1 **Water Samples** – Since initial sample aliquot and final digestate volumes are the same, the mercury analyzer data system will calculate the concentration directly. No further calculations are necessary unless the sample was diluted.

13.2 **Soil/Solid/Biota Samples -**

Final Result (mg/kg dry weight corrected) =

$$\frac{\text{Raw data result (ug/L) * Final Volume (L) * Dilution Factor}}{\text{Sample weight (g) * Dry weight for soil/solid (decimal form)}}$$

Biota results are reported on an as is/wet weight basis. The dry weight correction in the formula is not applicable.

13.3 **Accuracy-**

$$\text{Spike Percent Recovery} = \frac{\text{Spike Sample Result} - \text{Sample Result}}{\text{Spike Added}} \times 100$$

13.4 **Precision-**

Relative Percent Difference =

$$\frac{\text{Spike Sample Result} - \text{Spike Sample Duplicate Result}}{(\text{Spike Sample Result} + \text{Spike Sample Duplicate Result})/2} \times 100$$

14. Quality Control

14.1 **Calibration Blanks** – Calibration blanks (ICB and CCB) may not contain concentrations in excess of the reporting limit. If blank results are not acceptable, analysis of the batch should be halted. Corrective actions could include preparation of fresh calibration standards and blanks.

14.2 **Calibration Checks**- Calibration checks (ICV and CCV) must agree within 10% of the true value. If the results are unacceptable, re-calibrate the system and then re-analyze the check solution and samples.

14.3 **Laboratory Control Spike** – A Laboratory Control Spike (LCS) must be prepared and analyzed with every sample batch or every 20 samples, whichever is more frequent. A Laboratory Control Spike Duplicate (LCSD) is performed if there is insufficient sample available for a MS/MSD or if requested by the client. The LCS and LCSD must meet the in-house acceptance criteria or all the samples prepared in the batch must be re-prepped and re-analyzed. If insufficient sample remains to re-prep and re-analyze, the "&" (for accuracy) and/or "*" (for precision) data qualifier is given to all associated samples.

14.4 **Method Blank** – A Method Blank (MB) must be prepared and analyzed with every sample batch or every 20 samples, whichever is more frequent. The MB must not contain mercury at a concentration at or above the reporting limit. Any samples digested with an unacceptable method blank must be re-prepped and analyzed unless the sample concentrations are less than the reporting limit or more than 20 times the value found in the method blank.

14.5 **Matrix Spike/ Matrix Spike Duplicate** – A Matrix Spike/Matrix Spike

Duplicate (MS/MSD) must be prepared and analyzed for each group of samples that are similar in matrix at a frequency of 5%. If one or both spike recoveries are outside in-house accuracy acceptance criteria, the parent sample is given the "N" data qualifier. If the RPD is outside in-house precision criteria the parent sample is given the "*" data qualifier.

14. Method Performance

14.1. There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual.

14.2. The analyst must read and understand this procedure with written documentation maintained in his/her training file.

14.3. An initial demonstration of capability (IDC) must be performed per MN-Q-211, *Training Procedures*. A record of the IDC will be maintained in his/her QA file with written authorization from the Laboratory Manager and Quality Manager.

14.4. An annual method detection limit (MDL) study will be completed per ALL-Q-004, *Method Detection Limit Studies*, for this method and whenever there is a major change in personnel or equipment. The results of these studies are retained in the quality assurance office.

14.5. Periodic performance evaluation (PE) samples are analyzed per ALL-Q-010, *PE/PT Program*, to demonstrate continuing competence. All results are stored in the QA office.

15. Pollution Prevention and Waste Management

16.1 The quantity of chemicals purchased is based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes reflect anticipated usage and reagent stability.

16.2 Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner.

16.3 The laboratory Chemical Hygiene Plan/Health and Safety Plan contains additional information on pollution prevention.

17 References

17.1 SW-846 7470A, Revision 1, September 1994

17.2 SW-846 7471A, Revision 1, September 1994

17.3 PASI Quality Manual, current revision

17.4 National Environmental Laboratory Accreditation Conference (NELAC), July 1998 Standards

18 Tables, Diagrams, Flowcharts, Appendices, etc.

Not Applicable

19 Revisions

Document Number	Reason for Change	Date
KM-M-010-Rev.0	Combined MET-30 Revision 8 and Met-31 Revision 9 into 1 SOP in new format.	February 1, 2005

TITLE: Total Suspended Solids Dried at 103 – 105 °C and Total Volatile Suspended Solids Dried at 550 °C.

MATRICES:

This method is applicable to surface, drinking and saline waters, domestic and industrial wastes, and ground waters.

DETECTION LIMITS:

Reporting Limits are used in the absence of Project or State Specific Required Detection Limits are found in Appendix B Table A.

The method detection limits (MDL) determination is not applicable to this method.

1.0 **SCOPE AND APPLICATION:**

1.1 Methods 160.2 and 160.4 are applicable to drinking, surface, saline water, domestic and industrial wastes.

2.0 **SUMMARY OF THE TEST METHOD:**

2.1 A well-mixed sample is filtered through a glass fiber filter, and the residue retained on the filter is dried to a constant weight at 103-105 °C.

2.2 If Total Volatile Suspended Solids are requested, the residue from the Total Suspended Solids is ignited to constant weight at 550 °C ± 50 °C. The weight lost on ignition is the volatile suspended solid.

3.0 **DEFINITIONS:**

3.1 Definitions of terms used throughout this document are defined in Appendix A.

4.0 **INTERFERENCES:**

4.1 The apparatus, procedure and drying temperature are specified since these variables can affect the results.

4.2 Samples high in dissolved solids may require a sample volume adjustment and careful post-washing.

5.0 **SAFETY:**

5.1 Safety is everyone's business at En Chem, Inc. and everyone is responsible for assisting in reducing unsafe and unhealthy working conditions or potential hazards. The company provides you with a safe place to work, but we need your cooperation to keep it safe. When you see something that does not look safe, or you see someone working in an unsafe manner, mention it to your Supervisor.

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Distribution: 3

5.2 All samples should be treated as hazardous. Safety glasses, gloves, and lab coats are to be worn. The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. However, each chemical compound should be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by a safe technique. A reference file of material safety data sheets should also be made available to all personnel involved in the chemical analysis.

5.3 Required Safety Equipment is listed in Appendix B Table B

6.0 EQUIPMENT AND SUPPLIES:

6.1 See Appendix B Table C and Table D for a summary.

7.0 *REAGENTS AND STANDARDS:*

7.1 See Appendix B Table E and Table F for a summary.

8.0 SAMPLE COLLECTION, PRESERVATION, HOLD TIME, SHIPMENT AND STORAGE:

8.1 Samples must be stored at 4°C and warmed to 20°C before analysis.

8.2 Plastic or glass containers are adequate.

8.3 Hold time is 7 days.

8.4 See *Appendix B Table G for a summary.*

9.0 QUALITY CONTROL:

9.1 The Initial Demonstration determination is not applicable to this method.

9.2 The method detection limits (MDL) determination is not applicable to this method.

9.3 See Appendix B Table A for a summary or Reporting Limits.

10.0 CALIBRATION AND STANDARDIZATION:

10.1 Calibrate the balance using a Class S weight set that includes weights that bracket the range of use.

11.0 PROCEDURE:

11.1 Preparation of glass fiber filter discs

11.1.1 Place pre-weighed filter on filtering apparatus with wrinkled side up. Record the weight of the filter on the electronic gravimetric bench sheet.

11.1.2 Apply vacuum and wash three times with 20 mL deionized (D.I.) water.

11.1.3. Continue the vacuum to ensure all traces of water have passed through the filter.

11.2 Selection of Sample Volume:

11.2.1 Usually 100 mL of sample will be filtered. If the weight of the captured residue is less than 1.0 mg, the volume of sample filtered must be increased to provide at least 1.0 mg of residue.

11.2.2 If the filter clogs or the filtration time exceeds 10 minutes during filtration of the initial 100 mL sample volume, a smaller sample volume may be used. The sample volume should be decreased to a volume that will pass through the filter within a 10-minute timeframe.

11.2.3 For samples from South Carolina: Sufficient sample volume (up to 1 Liter) must be filtered to obtain a dried residue of 10-200 mg or filter the sample for 10 minutes if clogging of the filter occurs.

11.3. Sample Analysis:

11.3.1 Use a graduated cylinder and measure out the volume of well-mixed sample to be filtered.

11.3.2 Draw the volume through the filter with vacuum. Wash three times with 10-15 mL aliquots of D.I. water. Rinse solids from the cylinder and the filter apparatus sides onto the filter. Record volume of sample filtered on the electronic gravimetric bench sheet.

11.3.3. Release the vacuum. Place the filter in a labeled aluminum dish. Put the filter and aluminum dish in drying oven at 103-105 °C for a MINIMUM of 2 hours to insure constant weight.

11.3.4 Cool in a desiccator and weigh the filter. Record the final weight on the electronic gravimetric bench sheet. Consecutive final weighings must be conducted until a weight change between final weighings of < 0.5 mg is obtained. Wait at least 60 minutes between final weighings. Place the filter back in the aluminum dish and store in the desiccator between weighings.

11.3.5 Volatile suspended solids are to be analyzed:

11.3.5.1 Place aluminum dish and filter in muffle furnace at 550°C for 15 minutes.

11.3.5.2 Cool in desiccator and weigh filter as before. Record the final weight on the electronic gravimetric bench sheet. Consecutive final weighings must be conducted until a weight change between final weighings of < 0.5 mg is obtained. Wait at least 30 minutes between final weighings. Place filter back in the aluminum dish and store in the desiccator between weighings.

12.0 CALCULATIONS:

12.1 Total Suspended Solids

Example:

Volume, (mL)	100
Final Weight (g)	1.4275
-Initial Weight (g)	1.4180
Suspended Solids, SS (g)	0.0095

$$\text{TSS, mg/L} = \frac{\text{SS (g)} \times 10^6}{\text{Volume, mL}} = 95 \text{ mg/L}$$

12.2 Volatile Suspended Solids

Final Weight (g)	1.4275
-Ignited Weight (g)	1.4188
Volatile Solids, VSS (g)	0.0087

$$\text{mg/L} = \frac{\text{VSS} \times 10^6}{\text{Volume, mL}} = 87$$

$$\% \text{ Volatile} = \frac{\text{VSS (mg/L)} \times 100}{\text{SS (mg/L)}} = 92$$

13.0 METHOD PERFORMANCE:

13.1 The method performance is validated through Performance Testing Samples taken through this procedure.

13.2 See Appendix B Table H for a summary

14.0 **POLLUTION PREVENTION:**

14.1 Pollution prevention encompasses any technique or procedure that reduces or eliminates the quantity or toxicity of waste at the point of generation. Laboratory staff should order where possible acceptable non-toxic alternative supplies and prepare only those quantities of reagents or standards that will be used prior to the expiration date. Other appropriate measures to minimize waste generation should be brought to the attention of laboratory management. All laboratory waste shall be handled as directed by the Laboratory Waste Management Plan and Hazardous Waste Contingency Plan.

15.0 **DATA ASSESSMENT AND ACCEPTANCE CRITERIA FOR QUALITY CONTROL MEASURES:**

15.1 At a minimum there are three levels of data review:

15.2 Analyst/Technician verification at the bench top are looking at instrument performance as it relates to initial calibration, calibration verification, cleanliness.

15.3 Supervisor/Analyst verification after analysis are looking for sample concentration versus linear range of the instrument, typical patterns resulting from the compounds or elements in question, and quality control measure criteria. Data is accepted without qualification, accepted with qualification, or rejected with samples reprocessed.

15.4 Report Reviewer/Project Management personnel look at the presentation of the data on final reports. The reports are verified for holding time compliance, receipt conditions, method citation and reasonableness, which may include field duplicate analysis, analytical comments and qualifications presented by the previous reviews, and comparing results of similar analytical techniques as it relates to the project site information when available.

15.5 A fourth level of review, data validation is determined from a project or program scope of laboratory services and encompasses the generation Quality Control summaries in the media of "Form Generation",

15.6 See Table L for a summary.

16.0 **CORRECTIVE ACTIONS FOR OUT-OF-CONTROL DATA**

16.1 Assessment of Quality Control measures is done to provide a level of confidence in the data generated. The measures provide documentation that the instrument conditions were reliable during the analysis. Corrective actions are found in the determinative SOP.

17.0 CONTINGENCIES FOR HANDLING OUT-OF-CONTROL OR UNACCEPTABLE DATA

17.1 During analysis, events occur specific to the physical and chemical characteristics of the environmental sample. When possible, with received sample volumes, data generated along with measures that do not meet statistical goals are re-analyzed again to see if the statistical goal can be achieved. When environmental samples do not meet statistical *unacceptable data is generated. These events are different from those pertaining to* instrument operating conditions. These events occur when the instruments are operating under ideal conditions.

17.2 See Table M for a summary.

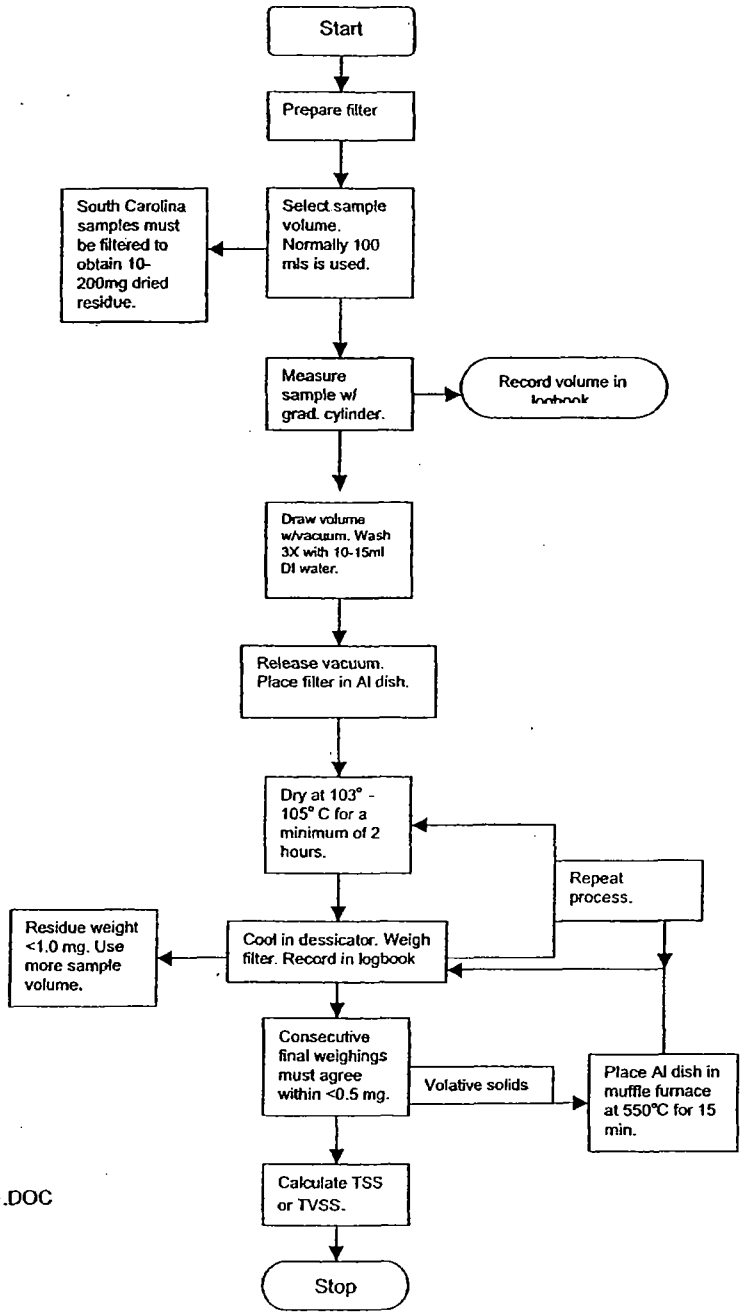
18.0 WASTE MANAGEMENT

18.1 To minimize waste during sample preparation has two benefits. The first benefit is a cost savings to the lab in materials and supplies. The second is a benefit to the environment as fewer materials need to be disposed.

REFERENCES:

EPA 600/4-79
40CFR Part 136
American Society for Quality Control (ASQC), Definitions of Environmental Quality Assurance Terms, 1996
American National Standards Institute (ANSI), Style Manual for Preparation of Proposed American National Standards, Eighth Edition, March 1991
ANSI/ASQC E4, 1994
ANSI N42.23-1995, Measurement and Associated Instrument Quality Assurance for
National Institute of Standards and Technology (NIST)
National Environmental Laboratory Accreditation Conference (NELAC), July 1998 Standards
Random House College Dictionary
US EPA Quality Assurance Division (QAD)
Webster's New World Dictionary of the American Language

FLOWCHARTS


Start
Prepare filter
Select sample volume. Normally 100 mls is used.
South Carolina samples must be filtered to obtain 10-200mg dried residue.
Measure sample w/ grad. cylinder.
Record volume in logbook
Draw volume w/vacuum. Wash 3X with 10-15ml DI water.
Release vacuum. Place filter in Al dish.
Dry at 103° - 105° C for a minimum of 2 hours.
Repeat process.
Residue weight <1.0 mg. Use more sample volume.
Cool in dessicator. Weigh filter. Record in logbook
Consecutive final weighings must agree within <0.5 mg.
Volative solids
Place Al dish in muffle furnace at 550°C for 15 min.
Calculate TSS or TVSS.
Stop

VALIDATION DATA:

The laboratory must demonstrate initial proficiency with each combination of sample preparation and determinative methods utilized, by generating data of acceptable accuracy and precision for a reference sample containing the target parameters in a clean matrix. The laboratory must also repeat this demonstration whenever new staff are trained or significant changes in instrumentation are made. Analysts previously trained shall perform a continued demonstration of proficiency annually by performing "Yearly *Demonstration of Capability*" (YDC).

The values from the determinative method are presented as guidance only and are not intended as absolute acceptance criteria. Accuracy of parameters routinely analyzed by En Chem can be found in Appendix B Initial Demonstration Data Table H. Blind studies are available upon request from the QC Manager.

MANAGEMENT APPROVAL AND REVIEW OF SOPS - POLICY AND DOCUMENTATION

REVIEWED BY: _____ 12/24/02
Section Supervisor — Date

REVIEWED BY: M Sulka 23 DEC 02
Quality Assurance Officer — Date

APPROVED BY: _____ 12/23/02
Laboratory Manager — Date

Periodic Review Record

Review Date					
Initials					

APPENDICES

Appendix A	**DEFINITIONS**
Appendix B	**TABLES**

Appendix A

Acceptance Criteria: *specified limits placed on characteristics of an item, process, or service* defined in requirement documents. (ASQC)
Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)
Analytical Detection Limit: the smallest amount of an analyte that can be distinguished in a sample by a given measurement procedure throughout a given (e.g., 0.95) confidence interval. (applicable only to radiochemistry)
Analyst: the designated individual who performs the "hands-on" analytical methods and *associated techniques and who is the one responsible for applying required laboratory practices* and other pertinent quality controls to meet the required level of quality. (NELAC)
Assessment Criteria: the measures established by NELAC and applied in establishing the extent to which an applicant is in conformance with NELAC requirements. (NELAC)
Batch: a group of 20 or fewer samples that have quality control associated with them
Data Reduction: the process of *transforming raw data by arithmetic or statistical calculations,* standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)
Deficiency: an unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)
Demonstration of Capability: a procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)
Detection Limit: the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated degree of confidence.
Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)
Duplicate Analyses: the analyses or measurements of the variable of interest performed *identically on two sub-samples of the same sample. The results from duplicate analyses are* used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)
Equipment Blank: a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)
estimate of Target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS)
Matrix Spike Duplicate (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)
May: *denotes permitted action, but not required action.* (NELAC)
Method Blank: a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical *results for sample analyses.* (NELAC)
Method Detection Limit: the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Must: denotes a requirement that must be met. (Random House College Dictionary)
National Institute of Standards and Technology (NIST): an agency of the US Department of Commerce's Technology Administration that is working with EPA, States, NELAC, and other public and commercial entities to establish a system under which private sector companies and interested States can be accredited by NIST to provide NIST-traceable proficiency testing (PT) to those laboratories testing drinking water and wastewater. (NIST)
Negative Control: measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)
(items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ASQC E-41994)
Quantitation Limits: the maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)
Range: the difference between the minimum and the maximum of a set of values. (EPA-QAD)
Raw Data: any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)
Reagent Blank (method blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)
Record Retention: The systematic collection, indexing and storing of documented information under secure conditions. (EPA-QAD)
Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)
Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)
Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.08)
Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)
Requirement:. denotes a mandatory specification; often designated by the term "shall". (NELAC)
Resource Conservation and Recovery Act (RCRA): the enabling legislation under 42 USC 321 *et seq.* (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage, and disposal. (NELAC)
Sample Duplicate: two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)
Selectivity: (Analytical chemistry) the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)
Sensitivity: the capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)
Should: denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)
Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)
Standard: the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)
Standard Operating Procedures (SOPs): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)
Standardized Reference Material (SRM): a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)
Supervisor (however named): the individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)
Surrogate: a substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)
Systems Audit (also Technical Systems Audit): a thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)
Test: a technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)
Test Method: an adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)
Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g. +/- 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g. +/- 3 sigma) (applies to radiobioassay laboratories). (ANSI)
Toxic Substances Control Act (TSCA): the enabling legislation in 15 USC 2601 *et seq.*, (1976), that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)
Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)
United States Environmental Protection Agency (EPA): the federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends. (US-EPA)
Validation: the process of substantiating specified performance criteria. (EPA-QAD)
Verification: confirmation by examination and provision of evidence that specified

requirements have been met. (NELAC)NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: a well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented.

Appendix B

Tables

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Table A

REPORTING LIMITS

COMPOUND NAME	AQUEOUS (mg/L)	
	MDL	EQL*
Total Suspended Solids	–	1.0
Total Volatile Suspended Solids	–	1.0

* Based on 1.0 litre through a filter

Table B

REQUIRED SAFETY EQUIPMENT

Item	Safety Apparel Description	Mandatory for Procedure	Optional
1	Safety Goggles or Glasses	✓	
2	Lab Coat	✓	
3	Gloves	✓	
4	Face Shield		✓

Table C

EQUIPMENT

Equipment	Manufacturer	Model(s)	Serial #	Date In Service
Filter holder – 35 mm filtration diameter	Gelman			10/2002
Marathon pump 1/3 HP, 1725 rpm	Gast			10/2002
Drying Oven	VMR	130U		10/2002
Muffle Furnance	Lindberg	51714	927000	10/2002
Analytical balance – 0.1 mg capability	OHAUS	Analytical Plus	1113242960	7/1996
Nanopure DI System	Barnstead-Thernoline	D 8961 – Infinity	89699120089	2/2000

Table D

SUPPLIES

Supplies	Manufacturer	Vendor	Catalog #
Filters: 934-AH glass microfibre, 4.25 diameter	Environmental Express	Fisher	F93447MM
Tweezers	Generic	Purchased at Target	
Filtering Flask	Pyrex	VWR	
Crucible tongs		—	—
Dessicator	Dry Keeper	—	—
Indicating Drierite	Hammend	Fisher	23005

Table E

REAGENTS

Reagent	Conc.	Purity	Manufacturer	Vendor	Catalog #
Deionized water		Nanopure	—	—	—

Table F

STANDARDS

Standard	Acronym	Concentration	Direction Found in Section:	Aliquot
Reference Solution	LCS/LCSD	As per lot	Table J	LCS/LCSD

Table G

SAMPLE COLLECTION, PRESERVATION, HOLD TIME, SHIPMENT AND STORAGE

Matrix	Prep Method	Container(s)	Preservation Hold Time	Shipment Conditions	Lab Storage Conditions
Aqueous	160.2 160.4	Clean glass / plastic containers – 1 L	None 7 days	On ice 4+/- 2° Celsius	4 ± 2°C

Table H

QUALITY CONTROL

Preparation Method⇨ Quality Control Measure ⇩	EPA 160.2
Method Blank	1 per batch, up to 10 samples
Laboratory Control Spike / Duplicate (LCS/LCSD)	1 per batch, up to 10 samples
Duplicates	1 per batch, up to 10 samples

Table I

CALIBRATION AND STANDARDIZATION

Analytical Method Acceptance Criteria⇨ Calibration Measure ⇩	Frequency	Acceptance Criteria
Laboratory Control Spike and Duplicate	• One pair per batch of samples, up to 10 environmental samples, whichever is more frequent.	• Project specific or • In house limits determined. See Table K for criteria.
Duplicates	• One pair per batch of samples, up to 10 environmental samples, whichever is more frequent. Fortify with all target compounds.	• Project specific or • In house limits determined. See Table K for criteria.
Method Blank	• One per batch, up to 10 samples.	• Project specific or • Less than EQL

Table J

PREPARATION OF INTERMEDIATE STANDARDS

Standard	Acronym	Concentration of Intermediate	Reagents Used	Final Volume
Control Standard	LCS	As per lot	As per lot	—

Table I

En Chem Initial Demonstration of Capability

Element	Symbol	Conc ppb	IDC 1	IDC 2	IDC 3	IDC 4	EPA Criteria	En Chem Criteria

Not applicable to Method

Table K1

Control Spike Recovery

Preparation Method ⇨	160.2			160.4		
Control Spike Recovery / Duplicate Analysis Parameters ⇩	LCL	UCL	RPD	LCL	UCL	RPD
Total Suspended Solids	80	120	20	80	120	20
Total Volatile Suspended Solids	80	120	20	80	120	20

Calculated percentage from true value as per lot

Table K1

Precision Control Limits

Preparation Method ⇨	160.2			160.4		
Duplicate Analysis Parameters ⇩	LCL	UCL	RPD	LCL	UCL	RPD
Total Suspended Solids	-	-	10	-	-	10
Total Volatile Suspended Solids	-	-	10	-	-	10

Table L

ANALYST/TECHNICIAN DATA ASSESSMENT

Analytical Method Acceptance Criteria⇨ Data Assessment Measure ⇩	Method Citation EPA If these conditions are not achieved -	Method Citation SM If these conditions are not achieved -
Method Blank	• 1	• 1
Accuracy & Precision Laboratory Control Spikes	• 2	• 2
Duplicate Analysis	• 3	• 3

1. In the absence of project specific requirements, sample detects less than 20 times the method blank contamination level are re-analyzed. If re-analysis is not possible the samples

are reported with the "A" data qualifier. Sample detects greater than 20 times the contamination of the method blanks are reported without further qualification or re-analysis. Generate on Non-Conformance Memo.

2. In the absence of project specific requirements, check to be sure that there are no errors in the calculations. If errors are found, recalculate the data accordingly. Re analyze sample if volume allows. If re-analysis is not possible all samples in the batch are reported with the "*" data qualifier. Generate on Non-Conformance Memo.

3. In the absence of project specific requirements, check to be sure that there are no errors in the calculations. If errors are found, recalculate the data accordingly. Re-analyze sample if volume allows. If re-analysis is not possible the samples are reported and the parent sample is flagged with the "*" data qualifier.

Table M
ANALYST/SUPERVISOR DATA ASSESSMENT

Analytical Method Acceptance Criteria> Data Assessment Measure @	Method Citation EPA If these conditions are not achieved	Method Citation SM If these conditions are not achieved
Method Blank	• 1	• 1
Accuracy & Precision Laboratory Control Spikes	• 2	• 2
Duplicate Analysis Precision	• 3	• 3

1. In the absence of project specific requirements, samples with detects less than 20 times the method blank contamination level are re-analyzed. If re-analysis is not possible the samples are reported with the "A" data qualifier. Sample detects greater than 20 times the contamination of the method blanks are reported without further qualification or re-analysis. Generate on Non-Conformance Memo.

2. In the absence of project specific requirements, check to be sure that there are no errors in the calculations. If errors are found, recalculate the data accordingly. Re-analyze sample if volume allows. If re-analysis is not possible all samples in the batch are reported with the "&" (recovery) and "*" (precision) data qualifiers. Generate on Non-Conformance Memo.

3. In the absence of project specific requirements, check to be sure that there are no errors in the calculations. If errors are found, recalculate the data accordingly. Re-analyze sample if volume allows. If re-analysis is not possible the samples are reported and the parent sample is flagged with the "*" data qualifier.

Table N
REPORT REVIEWER/PROJECT MANAGEMENT DATA ASSESSMENT

Analytical Method Acceptance Criteria ⇨ Data Assessment Measure ⇩	Method Citation EPA if these conditions are not achieved =
Holding Time Compliance	• 1
Sample Receipt Conditions and Preservation	• 2
Method Citation	• 3
Reasonableness: Field Duplicate	• 4
Reasonableness: Analytical Comments Qualifications	• 5

1. Flag results with an H and the number of days past hold in parenthesis e.g. H(5) for level I and II packages. For Level III and IV data packages the hold time is address in the case narrative.
2. In prose describe the receipt conditions as they relate to the acceptance criteria list in Table G
3. Compare to regulatory program in QAPjP or Chain of Custody.
4. Are duplicates within allowable limits? If not, internally flag for review.
5. *Do related suites of tests agree or are reasonable.*

Table O
CORRECTIVE ACTIONS

Analytical Method Acceptance Criteria⇨ Quality Control Measure ⇩	Method Citation EPA If these conditions are not achieved ⇨	Corrective Action (Key below)	Method Citation SM If these conditions are not achieved ⇨	Corrective Action (Key below)
Method Blank		• 1		• 1
Duplicate		• 2		• 2
LCS – Accuracy / precision		• 3		• 3

1. Samples with detects less than 20X the concentration in the method blank contamination are re-analyzed. If re-analysis is not possible then the data is qualified with the "A" data qualifier. Samples with detects greater than 20X the concentration in the method blank contamination are reported without qualification.

2. If precision criteria are not met the samples are re-analyzed. If re-analysis is not possible then the data is reported. The parent and duplicate analysis is flagged with the "*" data qualifier.

3. Samples are re-analyzed if the control spikes do not meet acceptance criteria. If re-analysis is not possible the samples are reported and the data is qualified. The "&" data qualifier is used to flag for accuracy failure. The "*" data qualifier is use to flag for "precison" criteria.

Table P
CONTINGENCIES FOR HANDLING OUT-OF-CONTROL OR UNACCEPTABLE DATA

Analytical Method Acceptance Criteria⇨ Quality Control Measure ⇩	Method Citation EPA If these conditions are not achieved ⇨	Corrective Action (Key below)	Method Citation EPA If these conditions are not achieved ⇨	Corrective Action (Key below)
Duplicate	•	• 1	•	• 1

1. Samples are re-analyzed. If re-analysis is not possible then the samples are flagged with the "*" data qualifier.

Table Q
DATA QUALIFIERS

As per Tables above.

Pace Analytical™
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EnChem,
A Division of Pace Analytical Services, Inc.
1090 Kennedy Avenue
Kimberly, WI 54136

Phone: 920 469 2436
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STANDARD OPERATING PROCEDURE

Analysis of Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Reference Methods: SW-846 Method 8082

SOP NUMBER:	KM-O-002-Rev.0
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	SVO-52 Revision 3

APPROVAL

Glen Coder, Assistant General Manager — Date: 2/11/05

Bruce Warden, General Manager — Date: 2/11/05

Julie Trivedi, Quality Manager — Date: 2/10/05

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1. Purpose

1.1 This Standard Operating Procedure (SOP) is to determine the concentration of PCBs in water, soil, sediment, waste, and biological samples in accordance with SW846 Method 8082.

2. Scope and Application

2.1 This method is used to determine the concentration of PCBs in extracts prepared from water, soil, sediment, waste, and biological samples. A list of the Aroclors routinely analyzed, their CAS numbers and Pace Reporting Levels (PRLs) are shown in Section 17, Table A. PRLs are subject to change based on current analytical system performance and actual sample matrices.

2.2 This procedure is restricted to use by, or under the supervision of, analysts experienced in the use of gas chromatograph/electron capture detection (GC/ECD) systems and interpretation of complex chromatograms. Each analyst must demonstrate the capability to generate acceptable results with this method to be considered qualified to report sample results

3. Summary of Method

3.1 Sample extracts are prepared for analysis by the appropriate sample preparation method. The procedures for extract preparation are described in separate SOPs. A volume of sample extract is injected into a GC and compounds in the effluent are detected by an ECD based on an operating program set up to achieve optimum separation and quantitation of target analytes.

3.2 Retention time windows, in combination with characteristic elution patterns from a dual-column analysis, are used in the identification of PCBs as Aroclors.

3.3 PCBs are quantified as Aroclor mixtures by comparison of their ECD response on a single column with a calibration curve(s) constructed from the response(s) of authentic standards.

3.4 Results are reported in parts per billion (µg/kg or µg/L). Soil and sediment sample results are corrected for moisture and reported on a dry weight basis. Biological results are reported based on wet weight, or "as is" basis.

4. Interferences

4.1 Method interferences may be caused by contaminants (primarily phthalate esters) in solvents, reagents, glassware and other sample processing hardware that leads to discrete artifacts and/or elevated baselines. Phthalate esters are common contaminants that result from contact with flexible plastics. Contact with common plastics or rubber products must be avoided. Lab ware should be constructed of glass, stainless steel, or PTFE, must be thoroughly cleaned and dried prior to use, and should be rinsed with the appropriate solvent immediately before use.

4.2 Elemental sulfur is a common environmental contaminant in many soil, sediment and leachate samples, producing a broad peak that will confound analysis of early eluting analytes. Sulfur may be removed from extracts by treatment with elemental mercury, copper powder, or similar procedure described in a separate SOP.

4.3 Waxes, lipids, and other similar high molecular weight materials may be co-extracted from samples typically resulting in baseline elevation during GC analysis. These interferences may be removed by sulfuric acid clean up and/or column chromatography cleanup using Florisil or gel permeation chromatography (GPC), all of which are described in separate SOPs. Other halogenated pesticides and similar industrial chemicals, which can interfere with analytes of interest, may be removed by these procedures as well.

4.4 All solvents, reagents, glassware, and sample processing hardware must be routinely demonstrated to be free from interferences under the conditions of the analysis by monitoring method blanks and taking corrective action as required.

5. Safety

5.1 The toxicity, or carcinogenicity, of many chemicals used in this method has not been precisely defined; each chemical should be treated as a potential health hazard, and exposure to these chemicals should be minimized. Each analyst is responsible for maintaining awareness of OSHA regulations regarding safe handling of chemicals used in this method. Reduce exposure by the use of gloves, lab coats and safety glasses. Material Safety Data Sheets (MSDSs) are on file in the laboratory and available to all personnel.

5.2 Take precautions when handling samples. Samples should always be treated as potentially hazardous. The use of personal protective equipment (gloves, lab coats and safety glasses) is required when handling samples.

5.3 PCBs have been tentatively classified as known or suspected human or mammalian carcinogens. Primary standards of these toxic compounds should be prepared in a hood.

6. Definitions

6.1 All applicable definitions can be found in Section 10.0 of the PASI Quality Manual.

6.2 **Extract** – A solution of contaminants extracted and concentrated from a sample.

7. Responsibilities and Distribution

7.1 **Analyst** – Any analyst using this procedure is responsible for reading, understanding and following this SOP. Any deviation from this SOP must be reported to the appropriate Supervisor. The analyst must make their recommendations for changing the SOP to their supervisor or the QM in writing.

7.2 **Assistant General Manager** – The Assistant General Manager must ensure that all analysts are properly trained and qualified to use this procedure. The Assistant General Manager is also responsible to ensure that the SOP is followed. The Assistant General Manager is responsible for reviewing the SOP and communicating recommended changes to the QM.

7.3 **Quality Manager (QM)** – The QM is responsible for monitoring the implementation of the SOPs and the associated good laboratory practice. The QM will participate in the revision of the SOP and make sure it is current. The QM will review and approve all SOPs.

7.4 **Laboratory General Manager** – The Laboratory General Manager has overall responsibility for ensuring that SOPs are prepared and implemented for all activities appropriate to the region. The General Manager will review and approve all SOPs.

7.5 **Distribution** – The official version of this SOP is the signed hardcopy version found in the laboratory. A copy of the SOP shall be kept in the appropriate department for reference.

7.6 **Revision** – This SOP will be reviewed every two years at a minimum. It will also be revised as needed if procedures or methods change.

8. Sample Collection, Preservation and Handling

8.1 **General Procedures** – Procedures for sample collection, preservation, and handling are described in the separate sample preparation SOPs.

8.2 **Holding Times**

8.2.1 **Water Samples** – Samples must be extracted within 7 days of collection.

8.2.2 **Soil, Solid, and Other Waste Samples** – Samples must be extracted within 14 days of collection.

8.2.3 **Biological Samples** – Samples remain frozen for up to one year or longer per client request prior to extraction; typical extraction hold times do not apply.

8.2.4 **Extracts** – Extracts must be analyzed within 40 days of preparation.

8.3 **Sample Storage** – Store all samples and extracts in the dark at 4 ± 2°C. Biological samples must be stored at or below 0°C until extracted.

9. Reagents and Standards

9.1 **Solvents** – Hexane and acetone, pesticide grade (Section 17, Table B). All solvents are stored at room temperature and environmental conditions.

9.2 **Analytical Standards** – Prepared from stock standard solutions and are required for initial calibration and continuing calibration checks (Section 17, Table C). The following describes the contents of each type of solution:

9.2.1 **Calibration and Calibration Check Standards** – Five concentration levels of calibration solutions are prepared containing equal amounts of Aroclors 1016 and 1260 (combined in the same solution named AR1660 throughout this document), as well as the surrogates decachlorobiphenyl (DCB) and 2,4,5,6-tetrachloro-m-xylene (TMX). A single point calibration standard is required for the other Aroclor mixtures preferably at the mid-point level of the AR1016/1260 curve. A calibration check solution (ICV) is also prepared at the mid-level concentration of AR1016/1260 from second source materials.

9.2.2 **Surrogate Standard Spiking Solution** – contains decachlorobiphenyl (DCB) and 2,4,5,6-tetrachloro-m-xylene (TMX) and is spiked into all samples prior to extraction.

9.2.3 **Matrix Spiking Solutions** – contain an Aroclor mixture that is spiked into all appropriate QC samples (LCS, MS, and MSD) prior to extraction. The Aroclor(s) spiked and/or spike amounts may be adjusted when prior knowledge of the type or concentration of Aroclor(s) present in the sample matrix is known, or to comply with project requirements.

9.3 **Preparation of Analytical Standard Solutions** – Standards are prepared from commercially available stock solutions. The sources of the stock solutions, recipes for preparing dilutions and working standards, and concentrations in all solutions are shown in Section 17, Table D. All standards are prepared in hexane and stored in amber vials with PTFE-lined screw caps at 4 °C or colder.

9.4 **Stability of Analytical Standards** – Stock solutions of Aroclor mixtures must be replaced within 1 year of preparation. All dilutions and working standard solutions must be replaced within 6 months of preparation or sooner if the standards show signs of degradation. As each standard from the vendor is opened, record all pertinent information in the stock standard logbook. Record all standard preparations in the working standard logbook

10. Equipment and Supplies

10.1 **Instrumentation**

10.1.1 **GC** – Hewlett Packard (HP) 5890 equipped with dual ECDs or HP 6890 equipped with dual μECDs.

10.1.2 **GC Autosampler** – HP 7673A (5890) or HP 7863 (6890).

10.1.3 **GC Columns** – Two of the following capillary columns may be used:

10.3.1.1 RTX CLPesticides I, 30m x 0.32mm I.D. (Restek)

10.3.1.2 RTX CLPesticides II, 30m x 0.32mm I.D. (Restek)

10.3.1.3 DB-1701, 30m x 0.32mm I.D. (J&W Scientific)

10.3.1.4 DB-5, 30m x 0.32mm I.D. (J&W Scientific)

10.1.4 **Data Processor** – TurboChrom IV or HP ChemStation.

10.1.5 **Printer** – HP LaserJet 5Si or equivalent.

10.2 **Glassware and Materials**

10.2.1 **Gastight Syringes** – any size ranging from 10µL to 1000µL (Hamilton series 1000 or equivalent)

10.2.2 **Autosampler Vials** – 1.8mL with crimp caps

11. Calibration

11.1 **Initial Calibration (ICAL)**

11.1.1 **Analysis of Standards**

11.1.1.1 The initial calibration includes analysis of a five-point calibration curve of AR1660 at concentrations of 0.1, 0.3, 0.5, 0.8, and 1.0µg/mL, which includes TMX and DCB at concentrations of 0.01, 0.02, 0.05, 0.1, and 0.15µg/mL respectively. Inject a single point standard of Aroclors 1221, 1232, 1242, 1248, and 1254 at 0.5µg/mL.

11.1.1.2 Other calibration ranges may be substituted to meet expected concentrations of samples to be analyzed. If historical data indicates a specific aroclor is present, a five point initial calibration may be performed for the Aroclor of concern instead of using the AR1660 mixture.

11.1.1.3 A minimum of five (preferably seven) peaks must be selected for each Aroclor. The peaks chosen for quantitation should be at least 25% of the height of the largest peak in each Aroclor and should have minimal co-elution with the peaks of other Aroclors.

11.1.2 **Retention Time (RT)** – Retention time windows are used for compound identifications in samples. The RT for all components in all standards must be within the windows specified for both columns.

11.2.1.1 Make at least three injections of all analytes of interest over a 72-hour period.

11.2.1.2 Record the retention time for each selected peak for each Aroclor mixture, to three decimal places. Calculate the mean and standard deviation for each peak.

11.2.1.3 The width of the retention time window is defined as ± 3 standard deviations of the mean established. The minimum retention window will be ± 0.03 minutes.

11.2.1.4 Establish the center of the RT window for each Aroclor mixture and surrogate using the absolute RT from the calibration verification standard at the beginning of the analytical shift. Optionally, the Initial Calibration RT windows may continue to be used as long as method criteria are met. For samples run during the same shift as an initial calibration, use the RT of the mid-point standard in the Initial calibration as the center of the RT window.

11.1.3 **Response Factors (RF)** – Individually tabulate the area responses for each of the five or more peaks selected for each Aroclor versus concentration of the five-point calibration standards for each GC column. Calculate RF for each peak using the following equation:

$$RF = \frac{A_x}{C_x}$$

Where:
A_x = Total area of analyte response.
C_x = Concentration of the analyte in the solution (µg/mL).

11.1.4 **Acceptance Criteria** – The percent relative standard deviation (%RSD) of the five calibration factors for each peak of each Aroclor, (1016 and 1260) along with the surrogates must be ≤20%. If this is the case, linearity can be assumed, and the average RF can be used for quantitation. If the %RSD is >20%, a linear calibration curve may be used if the correlation coefficient is ≥0.99. **The results for both columns must meet calibration acceptance criteria.**

11.2 **Calibration Verification**

11.2.1 **Initial Calibration Verification (ICV)** – In order to consider the initial calibration acceptable, an ICV standard must be analyzed. The ICV standard must be from a second source stock and meet the same criteria as the continuing calibration verification standard before the initial calibration may be considered valid.

11.2.2 **Continuing Calibration Verification (CCV)** – A midpoint calibration check standard must be injected at the beginning and end of each 12-hour analysis period, and at intervals of not less than once every 20 samples, for calibration verification. If the response factor (area/concentration) of the check standard deviates by more than 15% from the initial average response factor, the calibration is considered out of control and analysis must be stopped.

11.2.3 **Acceptance Criteria** – The percent difference (%D) is determined for every analyte and must be within ±15% of the calibration curve. Calculate %D for each peak using the following equation:

$$\%D = \left(\frac{R_1 - R_2}{R_1}\right) X 100$$

Where:
R_1 = Mean Response factor from the ICAL
R_2 = RF calculated from the CCV

11.3.2.1 First determine whether the average %D for all of the peaks for each specific Aroclor with a five-point calibration is ≤15%. Each individual Aroclor must be evaluated separately. For example, the average %D for all of the peaks used for quantitation of AR1016 must be ≤15%. If the Aroclors themselves are acceptable, evaluate the %RSD for each surrogate. If the %D is ≤15% for each individual surrogate, the continuing meets the acceptance criteria.

11.3.2.2 If either, or both surrogates exceed 15%D, calculate the overall average %D using all of the Aroclor peaks and the surrogates. If the overall average %D is ≤15% using all the Aroclor peaks and surrogates, the continuing meets the acceptance criteria. The surrogate results must be qualified on the final report to indicate the %D criteria was exceeded.

11.3.2.3 If the ending calibration verification standard exceeds 15%D criteria on the high side (i.e., an increase in sensitivity) samples that had no Aroclors detected do not need to be reanalyzed. If the continuing calibration standard criterion is exceeded on the low side (i.e., a drop in sensitivity), all samples analyzed since the last acceptable CCV must be re-analyzed.

11.2.4 **All samples must be bracketed by acceptable calibration verifications on both columns.** Perform corrective action such as injection port or column maintenance. Prior to the analysis of any subsequent samples acceptable calibration verification must be established. In the event that this cannot be achieved, a new initial calibration must be performed.

12. Procedure

12.1 **Sample Preparation** – All sample extracts and standard solutions must be allowed to warm to room temperature before analysis.

12.2 **GC/ECD System Preparation** – Verify instrument parameters as set up for current operating conditions.

12.2.1 **GC Column Conditions**

Carrier Gas	UHP Helium
Flow Rate	3.4 mL/min.
Make-up Gas	UHP Nitrogen
Flow Rate	35.0 mL/min.
Detector Temp.	300°C
Injector Temp.	205°C

Injection	Splitless

12.2.2 **GC Temperature Program**

Initial Temp.	110°C
Initial Time	1.5 min.
Rate 1	20.00°C/min.
Final Temp. 1	140°C
Final Time 1	0.00 min.
Rate 2	11.00°C/min.
Final Temp. 2	280°C
Final Time 2	5.00 min.
Rate 3	20.00°C/min.
Final Temp. 3	300°C
Final Time 3	3.00 min.

12.3 **Batch Sequence** – Generate a sequence to run a batch of samples and the associated quality control samples.

12.3.1 **Initial Calibration** – For example, the batch for initial calibration should include the following:

Series of 2-3 Primes
Solvent Blank (Hexane)
AR1660-1 (0.1µg/mL)
AR1660-2 (0.3µg/mL)
AR1660-3 (0.5µg/mL)
AR1660-4 (0.8µg/mL)
AR1660-5 (1.0µg/mL)
Solvent Blank (Hexane)
AR1660-3 ICV

12.3.2 **Sample Analysis** – For example, the typical batch for analysis of PCBs should include the following:

AR1660-301 CCV (0.5µg/mL)
(20 samples or 12-hour period)
Method Blank
Laboratory Control Spike
Samples
Matrix Spike/Matrix Spike Duplicate
Duplicate Sample(s)
AR1660-302 CCV (0.5µg/mL)

12.4 **Load Autosampler** – Load the autosampler with the appropriate primes, solvent blanks, standards and samples for the batch as it was created.

12.5 **Analyze Samples** – Analyze all standards, quality control samples, and environmental samples.

12.5.1 The method blank and LCS extracted along with the samples should be analyzed on the same instrument as the samples.

12.5.2 If the analyst determines that interferences could be removed by sulfuric acid cleanup and/or sulfur removal, then the analyst will perform the necessary cleanups and re-analyze the samples. The blank and LCS will also undergo the same cleanups and be re-analyzed.

12.6 **Qualitative Analysis of Results**

12.6.1 **Identification**

12.1.6.1 To be identified as an Aroclor, peaks present in a sample extract must fall within the established retention time window for a specific Aroclor. Once the Aroclor pattern has been tentatively identified, compare the responses of 3 to 10 major peaks in the single-point calibration standard for that Aroclor with the peaks observed in the sample extract. Overlay comparison of sample chromatograms with standard chromatograms may be required to clearly identify patterns.

12.1.6.2 Since the chromatograms for many Aroclor mixtures overlap, the presence of multiple mixtures may complicate their quantitation. Also, environmental "weathering" of PCBs may complicate reliable identification and quantitation.

12.6.2 **Confirmation**

12.2.6.1 Confirmation is generally required using a second GC column of dissimilar stationary phase. **When dual-column analysis is performed for confirmation, the same initial and continuing calibration criteria apply to both columns.** If analyte concentrations are sufficient, identifications may be confirmed by GC/MS by analyzing the same extract by SW846 Method 8270.

12.2.6.2 Since Aroclors provide distinct multiple peak patterns which may be identified by an experienced analyst, confirmation on the second column may be based upon pattern recognition.

12.7 **Calculate Results**

12.7.1 The amount of Aroclor is calculated using the individual response factor (single point) for each of the 7 characteristic peaks chosen for quantitation of that specific Aroclor. If Aroclor 1016 and/or 1260 is being quantified use the average response factor from the AR1660 curve. Use the single point response factor from the initial calibration for all other Aroclors. Surrogates are quantified based on the average response factors for TMX and DCB analyzed with the AR1660 curve. A concentration is determined using each of the characteristic peaks and then those 7 concentrations are averaged to determine the on-column concentration of that Aroclor.

12.7.2 If the initial on-column result of a sample extract exceeds the calibration range, the extract must be diluted and re-analyzed. All dilutions should keep the response of the major constituents in the upper half of the linear range of the curve. The GC data system will calculate concentration of each parameter as µg/mL on-column in the extract. Concentrations in samples are then calculated based on sample size, total volume of the final extract, any dilution factor, and any correction factor.

12.2.7.1 **Water and Water-Miscible Waste Samples**

$$\text{Final Concentration } (\mu g/L) = \frac{(C_x)(DF)(U_f)(V_t)}{(V_i)(V_o)}$$

Where:
C_x = On-column concentration in extract (µg/mL).
DF = Dilution factor.
U_f = Correction factor.
V_t = Volume of final extract (µL).
V_i = Volume injected (µL).
V_o = Volume of water sample extracted (mL).

12.2.7.2 **Soil/Solid, Waste and Biological Samples**

$$\text{Final Concentration } (\mu g/Kg) = \frac{(C_x)(DF)(U_f)(V_t)}{(V_i)(W_s)(S)}$$

Where:
C_x = On-column concentration in extract (µg/mL).
DF = Dilution factor.
U_f = Correction factor.
V_t = Volume of final extract (µL).
V_i = Volume injected (µL).
W_s = Weight of sample extracted (g).
S = Percent Solids (biological samples not corrected for percent solids).

12.8 **Quality Control Results** – Calculate recoveries for the surrogates in all samples; spiked analytes in LCS and MS/MSD samples; and Relative Percent Differences (RPD) for duplicate and MS/MSD samples.

13. Quality Control

13.1 Calibration Checks

13.1.1 **ICAL** – If initial calibration criteria are not met, check standards preparation procedure for errors. Prepare new standards as required and re-run the calibration.

13.1.2 **Continuing Calibration Verification** – If the CCV criteria are not met, check system parameters, identify and correct likely causes, and re-run the check. An acceptable check is required to report sample results for the applicable batch.

13.2 **Surrogate Recoveries** – Surrogate compound(s) must be added to all samples, spikes, control samples and method blanks, prior to analysis as indicators of method accuracy. Laboratory-based accuracy limits should be used for acceptance criteria. If these criteria are not met, check system parameters, identify and correct likely causes, and re-run the samples.

13.2.1 If **both** surrogate recoveries fail this criterion, re-extraction of the sample may be necessary. If surrogate recoveries are higher than the acceptance criteria and target compounds are less than the reporting limit, the results may be reported with an appropriate footnote. If recoveries appear out of control due to sample matrix, report the results with an appropriate footnote.

13.2.2 One surrogate is allowed to be outside of the control limits. For instance, if an interfering peak obscures one surrogate, then that one surrogate may be excluded. The surrogate is considered diluted out and not evaluated when the dilution performed brings the theoretical on-column concentration below the concentration of the low standard in the initial calibration curve.

13.3 **Method Blank** –The method blank must not contain analyte responses at or above the reporting limit. If the results are not acceptable, re-analyze the method blank. If the problem persists, conduct maintenance to clean the analytical system. An acceptable method blank is required to report sample results for the applicable batch.

13.3.1 The method blank must meet the surrogate limits. If the blank fails this criterion, all of the associated samples, matrix spikes and laboratory control spikes will be evaluated and a corrective action will be determined.

13.3.2 If the blank contains any analyte of interest above the reporting limit, all of the associated samples, matrix spikes, and laboratory control spikes **must** be re-extracted unless the sample concentration is greater than 20X the amount found in the blank or the analyte is not detected in an associated sample. For Wisconsin projects this criteria will be "Above the LOD".

13.4 **LCS Recoveries** – One LCS must be analyzed with each batch of 20 samples. Laboratory-based accuracy limits should be used to for acceptance criteria. An acceptable LCS is required to report sample results for the applicable batch.

13.4.1 If the laboratory control spike does not meet the recovery criteria, the results of all QC performed with the batch will be evaluated by the analyst. Corrective actions include re-extraction of the samples or reanalysis of the extracts.

13.5 **MS/MSD Recoveries** – One MS should be analyzed with each batch of 20 samples. Laboratory-based accuracy limits should be used to for acceptance criteria.

13.5.1 If a matrix spike recovery fails this criterion, the recovery of the other spiked sample in the MS/MSD pair should be evaluated. If recovery failures are duplicated then the sample matrix is suspected as the problem and the data should be flagged and the failures discussed in the sample narrative.

13.6 **Duplicate and MS/MSD RPDs** – Five percent of all environmental samples should be analyzed in duplicate. A MS/MSD pair is also an acceptable duplicate analysis. If results are not acceptable, check for possible sample preparation problems and re-analyze if needed. Report the results with an appropriate data qualifier.

14. Method Performance

14.1 There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual.

14.1.1 The analyst must read and understand this procedure with written documentation maintained in his/her training file.

14.1.2 An initial demonstration of capability (IDC) must be performed per MN-Q-211, *Training Procedures*. A record of the IDC will be maintained in his/her QA file with written authorization from the Laboratory Manager and Quality Manager.

14.1.3 An annual method detection limit (MDL) study will be completed per ALL-Q-004, *Method Detection Limit Studies*, for this method and whenever there is a major change in personnel or equipment. The results of these studies are retained in the quality assurance office.

14.1.4 Periodic performance evaluation (PE) samples are analyzed per ALL-Q-010, *PE/PT Program*, to demonstrate continuing competence. All results are stored in the QA office.

15. Pollution Prevention and Waste Management

15.1 The quantity of chemicals purchased is based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes reflect anticipated usage and reagent stability.

15.2 Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner.

15.3 The laboratory Chemical Hygiene Plan/Health and Safety Plan contains additional information on pollution prevention.

16. References

16.1 USEPA, SW-846, Method 8082, "Polychlorinated Biphenyls (PCBs) by Gas Chromatography", December 1996.

16.2 USEPA, SW-846, Method 8000B, "Determinative Chromatographic Separations", December 1996.

17. Tables, Diagrams, Flowcharts, Appendices, Addenda etc.

17.1 Table A. Reporting Limits for PCBs.

Aroclor	CAS #	Water PRL (µg/L)	Soil PRL (µg/Kg)	Biota PRL (µg/Kg as is)
AR1016	12674-11-2	1.0	50	50
AR1221	11104-28-2	1.0	50	50
AR1232	11141-16-5	1.0	50	50
AR1242	53469-21-9	1.0	50	50
AR1248	12672-29-6	1.0	50	50
AR1254	11097-69-1	1.0	50	50
AR1260	11096-82-5	1.0	50	50

17.2 Table B. Solvents.

Reagent	Purity	Manufacturer	Vendor	Catalog #
Hexane	NS Grade	Burdick & Jackson	MG Scientific	B&J-217-4
Acetone	Pesticide Grade	Burdick & Jackson	MG Scientific	B&J-010-4

17.3 Table C. Standard Stock Solutions.

17.4

Standard	Concentration	Manufacturer	Catalog #
Pesticide Surrogate Mix	200µg/mL each in Acetone	Restek Corporation or equivalent	32000
Aroclor 1016 Mix	1000µg/mL in Hexane	Restek Corporation or equivalent	32006
Aroclor 1221 Mix	1000µg/mL in Hexane	Restek Corporation or equivalent	32007
Aroclor 1232 Mix	1000µg/mL in Hexane	Restek Corporation or equivalent	32008
Aroclor 1242 Mix	1000µg/mL in Hexane	Restek Corporation or equivalent	32009
Aroclor 1248 Mix	1000µg/mL in Hexane	Restek Corporation or equivalent	32010
Aroclor 1254 Mix	1000µg/mL in Hexane	Restek Corporation or equivalent	32011
Aroclor 1260 Mix	1000µg/mL in Hexane	Restek Corporation or equivalent	32012
Aroclor 1016	1000µg/mL in Isooctane	Supelco or equivalent	4-8097
Aroclor 1260	1000µg/mL in Isooctane	Supelco or equivalent	4-4809

17.5 Table D. Preparation of Analytical Standard Solutions.

Analytical Standard	Standard or Stock Solution Used	Volume of Standard or Stock Used	Final Volume & Solvent Used	Final Concentration	Expiration Date
TMX/DCB Stock Solution	Pesticide Surrogate Mix	1000µL	20mL of Hexane	10µg/mL	1 year from date of preparation
AR1221 Stock Solution	Aroclor 1221 Mix	1000µL	10mL of Hexane	100µg/mL	1 year from date of preparation
AR1232 Stock Solution	Aroclor 1232 Mix	1000µL	10mL of Hexane	100µg/mL	1 year from date of preparation
AR1242 Stock Solution	Aroclor 1242 Mix	1000µL	10mL of Hexane	100µg/mL	1 year from date of preparation
AR1248 Stock Solution	Aroclor 1248 Mix	1000µL	10mL of Hexane	100µg/mL	1 year from date of preparation
AR1254 Stock Solution	Aroclor 1254 Mix	1000µL	10mL of Hexane	100µg/mL	1 year from date of preparation
AR1660 Stock Solution	Aroclor 1016 Mix Aroclor 1260 Mix	1000µL each	10mL of Hexane	100µg/mL each	1 year from date of preparation
AR1660 ICV Stock Solution	Aroclor 1016 Aroclor 1260	1000µL each	10mL of Hexane	100µg/mL each	1 year from date of preparation
AR1221-3 Calibration Standard	AR1221 Stock Solution TMX/DCB Stock Solution	AR1221 500µL TMX/DCB 500µL	100mL of Hexane	AR1221 0.5µg/mL TMX/DCB 0.05µg/mL	6 mo. from date of preparation
AR1232-3 Calibration Standard	AR1232 Stock Solution TMX/DCB Stock Solution	AR1232 500µL TMX/DCB 500µL	100mL of Hexane	AR1232 0.5µg/mL TMX/DCB 0.05µg/mL	6 mo. from date of preparation
AR1242-3 Calibration Standard	AR1242 Stock Solution TMX/DCB Stock Solution	AR1242 500µL TMX/DCB 500µL	100mL of Hexane	AR1242 0.5µg/mL TMX/DCB 0.05µg/mL	6 mo. from date of preparation
AR1248-3 Calibration Standard	AR1248 Stock Solution TMX/DCB Stock Solution	AR1248 500µL TMX/DCB 500µL	100mL of Hexane	AR1248 0.5µg/mL TMX/DCB 0.05µg/mL	6 mo. from date of preparation
AR1254-3 Calibration Standard	AR1254 Stock Solution TMX/DCB Stock Solution	AR1254 500µL TMX/DCB 500µL	100mL of Hexane	AR1254 0.5µg/mL TMX/DCB 0.05µg/mL	6 mo. from date of preparation
AR1660-1 Calibration Standard	AR1660 Stock Solution TMX/DCB Stock Solution	AR1660 100µL TMX/DCB 100µL	100mL of Hexane	AR1660 0.1µg/mL TMX/DCB 0.01µg/mL	6 mo. from date of preparation
AR1660-2 Calibration Standard	AR1660 Stock Solution TMX/DCB Stock Solution	AR1660 300µL TMX/DCB 200µL	100mL of Hexane	AR1660 0.3µg/mL TMX/DCB 0.02µg/mL	6 mo. from date of preparation
AR1660-3 Calibration Standard	AR1660 Stock Solution TMX/DCB Stock Solution	AR1660 1000µL TMX/DCB 1000µL	200mL of Hexane	AR1660 0.5µg/mL TMX/DCB 0.05µg/mL	6 mo. from date of preparation
AR1660-4 Calibration Standard	AR1660 Stock Solution TMX/DCB Stock Solution	AR1660 800µL TMX/DCB 1000µL	100mL of Hexane	AR1660 0.8µg/mL TMX/DCB 0.10µg/mL	6 mo. from date of preparation
AR1660-5 Calibration Standard	AR1660 Stock Solution TMX/DCB Stock Solution	AR1660 1000µL TMX/DCB 1500µL	100mL of Hexane	AR1660 1.0µg/mL TMX/DCB 0.15µg/mL	6 mo from date of preparation
AR1660-3 ICV Calibration Standard	AR1660 ICV Stock Solution TMX/DCB Stock Solution	AR1660 500µL TMX/DCB 500µL	100mL of Hexane	AR1660 0.5µg/mL TMX/DCB 0.05µg/mL	6 mo. from date of preparation

18. Revisions

Revision Number	Reason for Change	Date
	Converted SVO-52 Rev.3 to new format.	
KM-O-002-Rev.0	Added CHP information.	01Feb2005

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SOP No.: KNOX-AD-0001
Revision No.: 5
Revision Date: 4/27/04

STL KNOXVILLE

STANDARD OPERATING PROCEDURE

TITLE: RECORD RETENTION AND DOCUMENT STORAGE

(SUPERSEDES: KNOX-AD-0001, Revision 4)

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1. Purpose

1.1. The purpose of this procedure is to describe the requirements for record retention, transmittal, on-site record storage prior to off-site transfer, off-site storage and retrieval of documents and records at STL Knoxville.

1.2. This procedure applies to all operations, quality and project documents and records either received or produced at STL Knoxville.

2. Responsibilities

Position	Responsibility
Project Assistant (PA)	• To receive, verify receipt of, store and retrieve records and documents.
Project Managers	• To ensure that all client communications (emails, faxes, phone logs, etc.) are added to the project folders in a timely manner.
Laboratory Personnel	• To ensure that all quality, operations, and project records that are received or produced in their respective departments are properly identified and maintained while in use. • To safeguard all records and documents from damage and loss. • To properly identify and maintain all records and documents while in use. • To retain records in compliance with the most current STL Record Retention Schedule.

3. Safety

3.1. Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

3.2. Specific Safety Concerns or Requirements

3.2.1. Normal office dependent safety precautions must be taken in performing this SOP. If personnel are required to perform any portion of the procedure in laboratory areas, appropriate personal protective equipment and precautions must be utilized.

3.2.2. All work must be stopped in the event of a known or potential compromise to the health and safety of a STL associate. The situation must be reported immediately to a laboratory supervisor.

4. Procedure

4.1. The retention period for each record shall be obtained from the STL Knoxville Record Retention Schedule (Appendix II). Table 1 outlines STL's standard record retention time. For raw data and project records, record retention is calculated from the date the project report is mailed. For other records, such as controlled documents, QC or administrative records, the retention time is calculated from the date the record is formally retired.

Table 1: STL Record Retention

Record Type		Archival Requirement
Raw Data	All*	5 Years from project completion
Controlled Documents	All*	5 Years from document retirement date
QC	All*	5 Years from archival
Project	All*	5 Years from project completion
Administrative	Personnel/ Training	7 Years

* Exceptions listed in Table 2.

4.1.1. **Client project records** include general information about the receipt of a particular shipment of samples (hereafter referred to as the **hardcopy lot folder**) and raw data generated during the analysis of the samples (hereafter referred to as the **hardcopy data folder**). Client project records are retained electronically and in hardcopy format.

- The electronic records are in Adobe Acrobat (.pdf) file format. Electronic copies of the client project records are maintained for 10 years.
- Hardcopy lot folders will be stored on-site for five years after the report is mailed, after which, these records will be destroyed.
- Hardcopy data folders will be stored on-site for nine months after the report is mailed, whereupon these records will be destroyed.

4.1.2. Electronic records will be "actively" stored online, on the local area network, for a minimum of four months. The electronic client project records are backed up on two different storage media (CD and tape).

4.1.3. Electronic storage media (CDs and or tapes) will be stored for ten years after the report is mailed.

4.1.4. . Programs with Longer Retention Requirements: Some regulatory programs have longer record retention requirements than STL's standard record retention time of five years. These are detailed in Table 2. STL Knoxville's retention procedure meets these requirements through the electronic retention of project records for ten years.

Table 2: Special Record Retention Requirements

Program	Retention Requirement
Colorado – Drinking Water	10 years
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Louisiana - All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Minnesota – Drinking Water	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
NY Potable Water NYCRR Part 55-2	10 years
Pennsylvania – Drinking Water	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

4.2. Records shall be retained as specified in the retention schedule (or as superseded by a contract requirement).

4.2.1. The project manager (PM) is responsible for documenting, in LIMS, if the client must be notified prior to the data being destroyed. The quote

associated with that data contains the following information concerning whom to contact for authorization prior to destroying the data: Client name, address and phone number.

4.3. Destruction of records will be documented on a Certificate of Record Destruction (see example in Appendix III) or in a database.

4.4. No records will be destroyed when litigation, government investigation or audit is underway (pending or imminent). Records held for litigation or audit may be released only by the organization initiating the hold.

4.5. Electronic Document Storage (effective for all client lots received after June 1, 2003)

NOTE: Electronic versions of client project records and other information are backed up onto electronic storage media (CDs and/or tapes). These media are stored in a manner to protect them from fire, moisture and proximity to strong magnetic fields. Examples include fireproof file cabinets or a fire rated storage facility. Refer to KNOX-IT-0002 current revision, "Electronic Data and Software Backup" for the frequency of electronic backup.

4.5.1. On-site storage of electronic media (CDs, tapes, etc.) is maintained in the STL Knoxville safe, which is a concrete, fireproof enclosure with approximately 226 square feet of storage.

4.5.2. Project management files, EH&S files, and laboratory management files are maintained electronically on STL Knoxville's public drives and/or in hardcopy form in each individual's office. Personnel files are maintained in locked filing cabinets.

4.5.3. Each operating group in the lab (GC, GC/MS, metals, etc.) brings final project sample data up front to the reporting group as defined in SOP KNOX-AD-0004 current revision, "Data Reporting". They must ensure that the original sample data review checklist is located behind the narrative, with a copy placed in the report with the data.

4.5.4. The PA must follow the guidelines found in the reporting SOP, KNOX-AD-0004 to compose the final report document for the client.

4.5.5. After the contents of the hardcopy lot folder are scanned in accordance with SOP KNOX-AD-0004, the hardcopy lot folder is placed on the shelves in either the copy room or the scanning room for four months.

4.5.6. After the contents of the hardcopy data folder are scanned in accordance with SOP KNOX-AD-0004, the hardcopy data folder is placed on the shelves in the reporting room, where it is stored for nine months from the mail date.

4.5.7. The electronic client project records are maintained on the local area network in the \\knxsvr1\scandata\archive\ folder for 4 months.

4.5.8. The electronic folder for a given receipt date and all subfolders and files are copied to a CD-ROM by the designated PA when the 4 month time frame has elapsed. The CD-ROM is closed so that no new records or record changes may be made.

4.5.9. Once the CD-ROM is created, the PA places the hardcopy lot folder on the shelf in the reporting room in front of the hardcopy data folder. These folders are placed in sequential order by lot number.

4.5.10. After the CDs are created, they are checked for corrupt files or damaged CD media. This must be done by either the LAN Analyst/EDD Specialist or the Report Production/EDD Specialist or designee. All final report files on a given CD must be verified to be readable and not corrupted. This may be done by using a file comparison software utility (e.g., Folder Match)

4.5.11. After the CD is verified, the PA deletes all files backed up on the CD from the server.

4.5.12. After 9 months, the hardcopy data folder is removed from the shelf and placed in a recycle bin for destruction (e.g., shredding). The following information is recorded in order to document the removal and destruction of the hardcopy contents of the data folder: Lot number, date removed (i.e., put into a recycle bin), initials of the person who removed the data folder, and pick-up date (i.e., date the recycle bin was picked up for shredding). The vendor responsible for shredding will provide a record of destruction.

4.5.13. The hardcopy lot folder is kept in on-site storage for 5 years after the mail date. After 5 years, the lot folder is removed from on-site storage and destroyed. The contents of the lot folder are listed below:

- Cooler airbills
- Sub-contract lab chain-of-custody forms
- Media request forms/chain-of-custody forms
- Client analysis summary
- Sample Log-in Review checklist

- Lot special instructions
- Correspondence
- Data Review Checklists
- HPLC, Metals, Dioxin standard/raw data reference sheets
- Final invoice/working invoice
- Reporting Review Checklist
- Air bills/delivery documentation
- Sample chain-of-custody forms
- CUR checklist

4.5.14. The CD of the project reports is stored in the safe for a period of ten years. A CD contains all project records for lots received on one day and is labeled with the appropriate date. When it is necessary to use multiple CDs for one day's receipts, the label will contain the date and a notation indicating that it is 1 of 2, 2 of 3, etc. After 10 years, the CD-ROM and tape backup will be removed from on-site storage and destroyed.

4.5.15. Other associated laboratory records not included in the electronic copy of the project report must be maintained as specified in Appendix II. These records may be maintained as either hardcopy original records or as electronic copies of the original records. If the records are maintained as hardcopy records, follow Section 4.6 for archival of hardcopy records.

4.5.16. Access to on-site CD archives is limited to STL Knoxville associates and must be documented with a check-out card system to document who removed the CD and the date the CD was removed. The card is placed in the archive position of the removed CD as a placeholder until the CD is returned.

4.6. Hard copy Document Storage (Effective for all client lots received on or before June 1, 2003)

4.6.1. Records that are ready to be transferred from a laboratory area to off-site storage are placed into a records storage box.

4.6.2. The individual transferring the records must complete a Record Transfer Form (see example in Appendix IV) for each box.

4.6.3. The records storage box will be transferred from the laboratory area to the Project Assistant (PA). The PA will assign an off-site tracking box number and document this number on the Records Transfer form.

4.6.4. An original and at least one copy of the record transfer form are distributed as follows:

- Original - PA
- Copy - placed inside appropriate box
- Copy - retained by originating department (optional)

4.6.5. If the safe is not filled to capacity, then the boxes from the laboratory will be moved to the safe.

4.6.6. When records are to be checked out of the safe or if project lot folders are checked out of the reporting room, the associate shall complete a sign-out card and place it in the space from which the data was removed.

4.6.7. Upon return of each record, the sign-out card is removed.

4.6.8. If it becomes necessary to add additional records to a box that has already been placed in the safe, the following steps are followed:

4.6.8.1. For the addition of a data folder, a modified Record Transfer Form signed by the associate making the addition shall be submitted to the PA.

4.6.8.2. Distribution of the modified form will follow the same procedure as the original distribution. The PA or designee will file the modified Record Transfer Form in the Record Transfer Form Log along with the original Record Transfer Form.

4.6.9. The PA or designee will ensure that the Record Transfer Form (and modified Record Transfer Form, if applicable) is in the box and all records listed on the Record Transfer Form are in the box.

4.6.10. If any records are signed out from the box, the PA or designee will contact the responsible associate to determine the location of the record in question.

4.6.11. The PA or designee will sign and date the original Records Transfer Form (or modified Record Transfer Form, if applicable). The PA or designee will file this form in order by bar code number.

4.6.11.1. The original record transfer forms are kept in the reporting area in a three ring binder. The spine of the binder is labeled with the first through the last barcode number that is stored in the binder.

4.6.12. Records are then shipped to off-site storage.

4.6.13. The off-site storage location in use is a document storage facility located at Security Business Records Management, 1407 Boruff Street, Knoxville, Tennessee 37917.

4.7. The PA or designee shall be contacted for retrieval of records from off-site storage. A Security Business Records Management Request Form (see example Appendix V) will be completed. To retrieve records from off-site storage, a one-week time period is required.

4.8. When off-site storage records are scheduled for destruction, a Notice of Impending Records Destruction form (see example in Appendix VI) will be completed only as needed.

4.8.1. If required, a copy of the Notice of Impending Records Destruction form will be forwarded to the appropriate client for review.

4.8.2. Records will be destroyed on the scheduled date unless the appropriate client responds within 30 days. If no response is received, the records will be destroyed.

5. Definitions

5.1. Additional definitions can be found in the STL Knoxville LQM glossary and in the STL Quality Management Plan.

5.2. Active Records - Those records that are referenced frequently in the daily operations of the business.

5.3. Archive - The permanent retention of a record for historical reasons.

5.4. Data - Raw material (information) used in the process of collecting information.

5.5. Degauss - To reformat or de-magnetize media. (Example: floppy disc, hard drive, and magnetic media.)

5.6. Disposition - The process of destroying obsolete records.

5.7. Electronic Filing - Storage and retrieval of information in digital form.

5.8. File - A group of related documents.

5.9. Hardcopy - Records that are printed on paper.

5.10. Inactive Record - Records that are referred to less than once a month.

5.11. Magnetic Media - Various types of records (tapes, disks, diskettes) on which the computer may electronically store its output.

5.12. Media - The floppy disks, paper tapes, magnetic tapes, cassettes, magnetic disks or cartridges on which information is stored.

5.13. Off-site Records Center - An off-site location used to house inactive and vital records.

5.14. Outfolders/Outsheets - A guide indicating what material has been taken from the file and by whom. Also referred to as sign-out card.

5.15. Purge - Removal from a file of information that is of no further value and has met the retention period.

5.16. Record - Any form of recorded information, regardless of medium.

5.17. Records Disposition - The final stage of a record's life cycle, concluding with either disposition or permanent storage.

5.18. Records Management - The systematic control of an organization's records from their creation or receipt to their ultimate preservation or destruction.

5.19. Records Retention Schedule - A document that outlines specific periods set by government regulations and company policies as to how long records should be retained and disposed of.

5.20. Record Series - A group of similar or related records, used or filed as a unit and permit evaluation as a unit for retention scheduling purposes.

5.21. Recycle – White paper from STL Knoxville is picked up in bulk and shredded by Knoxville Recycling Coalition for recycling.

5.22. Semi-active Records - Records that are used about twice a month and stored in less accessible areas.

5.23. Shredder - A machine used for the destruction of records by reducing documents to fine strips, shreds, or particles.

6. Appendices

6.1. Appendix I – References

6.1.1. STL Quality Management Plan (QMP), current revision.

6.1.2. STL Knoxville Laboratory Quality Manual (LQM), current revision

6.2. Appendix II - STL Record Retention Schedule

6.3. Appendix III - Example Certificate of Record Destruction

6.4. Appendix IV - Example Record Transfer Form

6.5. Appendix V - Example Security Business Records Management Request Form

6.6. Appendix VI - Example Notice of Impending Records Destruction Form

6.7. Appendix VII – Summary of electronic data file locations

APPENDIX II - STL Knoxville Record Retention Schedule

Type of Record	Retention Time	Disposition
Information Services		
Daily (Incremental) Backups	6 weeks	Delete/Degauss
Weekly (Image) Backups	6 weeks	Delete/Degauss
Monthly (Image) Backups*	5 years	Delete/Degauss
Computer Software Distribution Media License	5 years from retirement	Delete/Degauss

General Laboratory Documents/Files	Retention Time	Disposition
Instrument output	5 yrs from project completion	Shred, burn or recycle or delete/degauss
Quality control data	5 yrs from project completion	Shred, burn or recycle or delete/degauss
Field sample data	5 yrs from project completion	Shred, burn or recycle or delete/degauss
Final analytical reports	5 yrs from project completion	Shred, burn or recycle or delete/degauss
Instrument logbooks*	5 yrs from last entry	Shred, burn or recycle or delete/degauss
Equipment monitoring & maintenance records*	5 yrs from last entry	Shred, burn or recycle or delete/degauss
Instrument calibration records*	5 yrs from last entry	Shred, burn or recycle or delete/degauss
Standard preparation logs*	5 yrs from last entry	Shred, burn or recycle or delete/degauss
Standards certificates*	5 yrs from last entry	Shred, burn or recycle or delete/degauss
Measurement & test equipment logs (e.g., refrig., balances, etc.) *	5 yrs from last entry	Shred, burn or recycle or delete/degauss
Method & instrument validation records*	5 yrs from last entry	Shred, burn or recycle or delete/degauss
Instrument manuals	Retain until superseded	Trash
LQM, policies, & SOPs	5 yrs from date of archiving	Shred, burn or recycle or delete/degauss
Analyst demonstrations of proficiency*	5 yrs from date of archival	Shred, burn or recycle or delete/degauss
Quality assurance audits	5 yrs from last entry	Shred, burn or recycle or delete/degauss
Certifications & approvals*	5 yrs from last entry	Shred, burn or recycle or delete/degauss

APPENDIX II - STL Knoxville Record Retention Schedule, continued

General Laboratory Documents	Retention Time	Disposition
Employee signature list*	5 yrs from date of archival	Shred, burn or recycle
MDL Studies*	5 yrs from last entry	Shred, burn or recycle
Performance testing studies*	5 yrs from last entry	Shred, burn or recycle
QA reports to management	5 yrs from last entry	Shred, burn or recycle
Quality control charts	5 yrs from last entry	Shred, burn or recycle

Project Management & Customer Service	Retention Time	Disposition
Bids, Proposals & Price Quotes	2 yrs from expiration	Shred, burn or recycle
Project Management Files	5 yrs from completion	Shred, burn or recycle
- Contract Copies, Work Orders, Task Orders	5 yrs from completion	Shred, burn or recycle
- Change Orders	5 yrs from completion	Shred, burn or recycle
- Correspondence	5 yrs from completion	Shred, burn or recycle
- QAPPs & Work Plans	5 yrs from completion	Shred, burn or recycle
- Notice of Deficiencies/Requests for re-work	5 yrs from completion	Shred, burn or recycle
- Telephone Logs – project specific (copy for file)	5 yrs from completion	Shred, burn or recycle

* Either hardcopy or electronic versions of these records must also be retained for 10 years to support the programs listed in Table 2.

Appendix III – Example Certificate of Record Destruction Form

STL Knoxville

CERTIFICATE OF RECORD DESTRUCTION

Name _____

Location _____ Department _____

Description of Records:

_____

_____

_____

_____

_____

I certify that the records described above meet the identification and description above. These records have been destroyed in accordance with the Record Retention Policy (latest revision).

Authorized Signature

_____

Title

_____

Date

_____

APPENDIX IV - Example Record Transfer Form

STL Knoxville
RECORD TRANSFER FORM

Complete this form for each box of records being archived (Use an additional form, if necessary)
Transfer of documents shall be made to the PA or designee

Released By/Date: _____ Dept. Box ID (if applicable):_____
Dept. Name: _____ Dept. Number:_____

☐ Original ☐ Modified PAGE _____ of _____

RECORD TITLE _____

RECORD SERIES _____

TIME PERIOD COVERED _____ RETENTION PERIOD _____

DATE RECORDS TO BE REVIEWED: _____

BOX CONTENTS

PA Reviewer/Date: _____ Bar Code _____

AD004R2.DOC, 4/19/01

APPENDIX V – Example Security Business Records Management Request Form

SECURITY
BUSINESS RECORDS MANAGEMENT

PO Box 3425 • Knoxville, Tennessee • 37927 • (423) 546-8552

REQUEST FORM
FAX#(423) 546-8597

COMPANY NAME_____ DATE&TIME_____

PERSON REQUESTING _____BY WHAT DATE&TIME_____

DELIVERY ADDRESS_____

FILES

1.NAME_____CHART/ACCNT#_____ NF____
SBRM BARCODE#_____ LOCATION_____ FAX?_____

2.NAME_____CHART/ACCNT#_____NF____
SBRM BARCODE#_____ LOCATION_____ FAX?_____

3.NAME_____CHART/ACCNT#_____ NF____
SBRM BARCODE#_____ LOCATION_____ FAX?_____

4.NAME_____CHART/ACCNT#_____ NF____
SBRM BARCODE#_____ LOCATION_____ FAX?_____

5.NAME_____CHART/ACCNT#_____NF____
SBRM BARCODE#_____ LOCATION_____ FAX?_____

6.NAME_____CHART/ACCNT#_____ NF____
SBRM BARCODE#_____ LOCATION_____ FAX?_____

7.NAME_____CHART/ACCNT#_____ NF____
SBRM BARCODE#_____ LOCATION_____ FAX?_____

8.NAME_____CHART/ACCNT#_____NF____
SBRM BARCODE#_____ LOCATION_____ FAX?_____

CARTONS

BARCODE#_____ LOCATION_____ BARCODE#_____ LOCATION_____

BARCODE#_____ LOCATION_____ BARCODE#_____ LOCATION_____

BARCODE#_____ LOCATION_____ BARCODE#_____ LOCATION_____

BARCODE#_____ LOCATION_____ BARCODE#_____ LOCATION_____

BARCODE#_____ LOCATION_____ BARCODE#_____ LOCATION_____

CK SRVC NEEDED: DELIVER_____ PICK-UP_____ DOCK ACCESS_____ FAX_____

COMMENTS:_____

REQUEST TAKEN BY:_____

APPENDIX VI – Example Notice of Impending Records Destruction Form

STL Knoxville
Notice of Impending Records Destruction

TO: _____ DATE: _____

LOCATION: _____

FROM: _____

THE RECORDS THAT YOU HAVE SENT TO OFF-SITE STORAGE HAVE EXCEEDED THEIR RETENTION PERIOD!
(Attached - See acknowledgement copy of specific records)

The documents will be destroyed by the date marked on your acknowledgement copy.

If for some reason these records cannot by destroyed, you have **30 days** to respond. Please contact your Record Liaison located at your facility.

RESPONSE DATE: _____

YOU WILL NOT RECEIVE ANOTHER NOTICE OF DESTRUCTION!

IF WE DO NOT HEAR FROM YOU BY THE ABOVE DATE, YOUR RECORDS WILL BE DESTROYED PER THE STL KNOXVILLE RECORD RETENTION POLICY.

AD006R2.doc, 11/7/01

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street, Suite 200
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

STANDARD OPERATING PROCEDURE

DATA ARCHIVING

SOP NUMBER	MN-L-106-D
AUTHOR	Sarah A. Cherney
EFFECTIVE DATE	Date of Final Signature
REVIEW DATE	December 21, 2003
SUPERSEDES	MN-L-106-C

ORIGINAL

APPROVAL

Brian E Warden
General Manager — Date 12/24/01

Sarah A Cherney
Quality Assurance Officer — Date 21DEC2001

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Table 1 8

I. PURPOSE

This Standard Operating Procedures (SOP) sets forth the policies and procedures to be followed to ensure acceptable performance of data storage and retrieval operations.

II. SCOPE/APPLICATION

A. After data have been acquired for specific periods of time, they need to be stored on a device other than the hard drive of the computer that controlled the acquisition process. This process requires that the files be transferred to a compact disc (CD).

B. In conjunction with the electronic media storage, all paper documentation must be catalogued and stored for a period of time relating to the federal program guidelines the samples were analyzed under.

III. SUMMARY OF METHOD

A. Archives for orderly storage and expedient retrieval of all raw data, documentation, and records generated in the design and operation of the automated data collection system will be maintained by the laboratory. Conditions of storage shall minimize potential deterioration of documents or magnetic media in accordance with the requirements for the retention period and the nature of the documents or magnetic media. Only personnel with documented authorization to access the archives shall be permitted this access.

B. The laboratory shall provide adequate storage capability of the automated data collection system or of the facility itself to provide for retention of raw data, including archives of computer-resident data.

IV. INTERFERENCES

Not Applicable.

V. SAFETY

Not Applicable.

VI. DEFINITIONS

Not Applicable

VII. RESPONSIBILITIES AND DISTRIBUTION

A. Personnel

1. All personnel are responsible for adherence to this SOP. A controlled copy will be available for review and consultation within the area methods manual.

2. Personnel are responsible for ensuring that any deviations to this SOP are reported to the laboratory manager.

B. Laboratory Manager

1. The laboratory manager is responsible for ensuring adherence to this SOP and will receive a controlled copy of this SOP.

2. The laboratory manager is responsible for reporting any required revisions to the Quality Assurance Office.

C. Quality Assurance Office

1. The QA Office is responsible for conducting laboratory audits to monitor adherence to this and other SOPs. Results of the audit will be reported to Management.

2. The QA Office is responsible for ensuring that all revisions to the SOP are implemented.

3. The QA Office is responsible for maintaining the original and complete distribution records.

D. Revisions

1. This SOP will be reviewed every two years at a minimum or whenever there are procedural changes to this SOP, and any required revisions will be incorporated.

VIII. SAMPLE COLLECTION, PRESERVATION AND HANDLING

Not Applicable.

IX. EQUIPMENT AND SUPPLIES

Not Applicable.

X. REAGENTS AND STANDARDS

Not Applicable.

XI. CALIBRATION

Not Applicable.

XII. PROCEDURE

A. Hardcopy (paper) archiving

1. Upon completion of data, reports, logbooks, traceability, etc., the information will be put into data storage boxes such as Banker boxes.

2. The information should be stored by data type and laboratory area. Please refer to Table 1 for a listing for data types and areas.

3. After a box is full, the outside of the front of the box must be labeled with the file type, laboratory area, and data range which encompasses the information included within the box, at a minimum.

4. The quality assurance office (QAO) is contacted and a unique number is given to each box. The QAO will record the information on the outside of the box for later entry into the data storage database.

5. The database is an ACCESS program, which allows for data searches by any of the fields documented on the outside of the boxes.

6. Once the information is taken, the boxes are sent to an off-site to a location, which allows for protection from the weather, vermin, etc.

7. Data are stored for a minimum of five years or longer depending on the federal program guidelines.

B. Electronic System Backup (Target)

1. Each day data is automatically transferred from the Target Chemservers (2 servers: 1.0.2.10 and 1.0.2.20) to a networked PC equipped with a CD-ROM burner.

   a. A person must be first logged in as a Superuser on the Chemserver (e.g. 1.0.2.20). At the prompt type:

   >su [enter]
   passwork.xxxx[enter]

   b. At the prompt type: #bdf. Look for /cdburner. This drive must be mounted before you continue. If not, at the prompt type:

   #cd (changing directory to root)
   #/usr/local/bin/MountBurner burn m

   c. On the workstation with CD burner look for NFS server on the bottom menu bar. If the server is not connected, you'll need to connect by shutting down and restarting the computer.

2. Now the Target system and the PC with CD-burner are communicating.

3. A script running in a UNIX crontab entry on each Chemserver accomplishes the data transfer.

   a. On the Target system, type:

   #cd /var/chem.
   #./TarThemOnTheWayOutButLeaveEm ___ ___ ___ ___[enter}

   b. Determine a commonality for the system to grab the files you want to transfer and enter this commonality in the spaces after the command chain, leaving a space between each (e.g. 121 122, this will give you all the instruments for the data 1210 thru 1219 and 1220 thru 1229)

4. The data is extracted for a period of three consecutive days.

5. Data is stored on the PC harddrive until such time as the volume stored will fill a CD.

6. The original data remains on the Chemserver for five weeks. The data is then transferred to the burner PC, removed from the Chemserver, and burnt on a permanently stored CD, which is kept in a fireproof file cabinet.

a. To burn the data onto a CD, begin with going to the PC station. Look at C:\var\chem

b. This will show you all of the directories you just copied over from the Target system. NEVER close the NFS server.

1. Start the program, ADAPTEC EAST CD CREATOR, Easy CD Creator (cancel the Wizard)

2. Data CD Layout is the card you want to burn

3. Drag and drop the files form C:\var chem. Directory into the Yellow Box on the Data CD Layout card.

   a. At the bottom of the card, the total file size brought over will show.
   b. One CD will hold a maximum of 644 MB.

4. Note: never open the instrument directory in the C:\var\chem. And drag only tar files. If you do, you will continually overwrite each tar directory since they are not unique unless as a part of the instrument pathway.

5. If you drag too much data onto the Data CD Layout card to transfer, just open the Yellow Box and remove the individual instrument until you have less than 644 MB.

6. Place a new CD on the top rack of the controller box.

7. Press the RED Button on the top menu bar to BURN CD. Other options include:

   a. CREATE CD
   b. ADVANCED
   c. CLOSE DISK

8. Continue above steps until all remaining data on the C:\var\chem. Directory is transferred to a CD.

9. When you finished, return to C:\var\chem. Directory and grab all files that were transferred successfully in the CD burn and delete from PC.

10. Umount the cdburner on the Chemserver. #/usr/local/bin/MountBurner burn u

7. Mapping the data for retrieval:

   a. Insert the CD which you just burned to CD-read drive

      1. You must be logged on as a superuser (#prompt) at the Target system

         a. #/usr/local/bin/MountBurner data m
         b. #cd /var/chem.
         c. # ./ReadCDDiskContent_____[enter]

      2. Insert the disk number that you want to map in the space above in the command. Notice the green light lashing on the CD-ROM box-working.

      3. Once you have mapped your CDs, open the cdfind.mdb database and click an append button.

      4. After you finished return to Target and delete four files:

         a. #cd /var/chem.
         b. #rm –rf FileListOFCDs*
         c. # rm –rf DiskContentsOfCDs*

      5. Umount the cdburner on the Chemserver.

         a) # /usr/local/bin/MountBurner data u

8. Retrieval of data from the CD

   a. Open the cdfind database to find a CD with data which you need

      1. Insert your CD to the CD-ROM drive

      2. You must be logged on as a superuser (#prompt) at the Target system

         a. # /usr/local/bin/MountBurner data m
         b. # cd /var/chem.

c. # tar xvf /olddata/<instrument name>/<batch>.tar [enter]

where: xvf = extract verbosely from the file that follows
the tar text must be exact
you must determine the pathway of the file form the access database

d. Umount cdburner. # /usr/local/bon/MountBurner data u

XIII. QUALITY CONTROL

Not Applicable.

XIV. METHOD PERFORMANCE

Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures. The analyst must read and understand this procedure with written documentation maintained in his/her training file.

XV. POLLUTION PREVENTION AND WASTE MANAGEMENT

Not Applicable.

XVI. REFERENCES

A. All references are to the current issue of the document available at the time the procedure was prepared. As these documents are revised they will supersede the reference documents. The requirements of the most current approved copy shall be implemented for compliance with the requirements of this procedure.

TABLE 1

File Type

1. Raw Data
2. Reports
3. Invoices
4. Logbooks
5. Training Files
6. QA Data
7. Initial Calibrations

Laboratory Area

1. PM, Project Management
2. MSV, Mass Spectrometer in Volatiles Laboratory
3. MSSV, Mass Spectrometer in Semivolatiles Laboratory
4. GCV, Gas Chromatography in Volatiles Laboratory
5. AIR, Air Laboratory
6. QA, Quality Assurance
7. GCSV, Gas Chromatography in Semivolatiles Laboratory
8. WET CHEM, Wet Chemistry (inorganics) Laboratory
9. METALS, Metals Laboratory
10. HPLC, High Pressure Liquid Chromatography Laboratory
11. HRMS, High Resolution Mass Spectrometry Laboratory
12. LRMS, Low Resolution Mass Spectrometry Laboratory
13. PKG, Data Packages

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STANDARD OPERATING PROCEDURE

Extraction of Biological Samples for Organochlorine Pesticides/PCBs

Reference Methods: SW-846 Method 3540C

SOP NUMBER:	KM-O-001-Rev.0
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	N/A

APPROVAL

Glen A. Coder — Glen Coder, Assistant General Manager — 1/26/05 — Date

Bruce Warden — Bruce Warden, General Manager — 1/20/05 — Date

Julie Trivedi — Julie Trivedi, Quality Manager — 1/26/05 — Date

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1. Purpose

1.1 The purpose of this Standard Operating Procedure (SOP) is to describe the extraction of homogenized biological tissue and plant samples compliant with SW-846 Method 3540C for Organochlorine pesticide and/or PCB analysis.

2. Scope and Application

2.1. This procedure is applicable to extraction and concentration of Organochlorine pesticides and PCBs from homogenized biological tissue and plant samples. Extracts may be prepared by this method for analysis by several chromatographic methods including, but not limited to, SW-846 Methods 8081A and 8082.

2.2. The policies and procedures contained in this SOP are applicable to all personnel involved in the preparation of extracts for chromatographic analysis.

3. Summary of Methods

3.1. Approximately 20 grams of homogenized tissue or plant sample is mixed with sodium sulfate and extracted with methylene chloride for a minimum of 16 hours in a soxhlet extractor. The methylene chloride extracts are then concentrated, exchanged to hexane (dependent upon further extract cleanup) and concentrated to a volume of 10 mL.

4. Interferences

4.1. Interferences may be introduced into sample extracts by contaminants in solvents, reagents, glassware, and any other material that comes in contact with the sample or extract during extract preparation. These interferences must be closely monitored by analyzing Method Blank samples and taking corrective action as required.

4.2 Interferences co-extracted from samples will vary considerably depending on the source of the material. Contaminants that may interfere with the analysis may be removed from the extracts using any combination of cleanups including, but not limited to Gel Permeation Chromatography (GPC), Florisil column cleanup, Florisil cartridge cleanup, and Silica Gel Separation. These cleanup procedures are described in separate SOPs.

5. Safety

5.1. **Standards and Reagents** - The toxicity and carcinogenicity of standards and reagents used in this method have not been fully defined. Each chemical compound should be treated as a potential health hazard. Reduce exposure by the use of gloves, lab coats and safety glasses. Material Safety Data Sheets (MSDSs) are on file in the laboratory and available to all personnel. Standard solutions should be prepared in a hood.

5.2. **Samples** - Take precautions when handling samples. Samples should always be treated as potentially hazardous "unknowns". The use of personal protective equipment (gloves, lab coats and safety glasses) is required when handling samples.

6. Definitions

6.1. Definitions of terms found in this SOP can also be found in the Pace Quality Manual.

When definitions are not consistent with NELAC defined terms, an explanation will be provided in this SOP or the Pace Analytical Services' Quality Manual Glossary, Section 12.0.

6.2. **Duplicate Sample** – A second aliquot of the same environmental sample analyzed in the same manner as the original sample in order to evaluate precision.

6.3. **Laboratory Control Sample (LCS)** – A blank matrix sample spiked with a known concentration of analytes of interest. The material is from a second source (not from same as calibration material). Laboratory accuracy is evaluated using the LCS. Refer to the determinative SOP for corrective action and contingencies for handling out of control data.

6.4. **Laboratory Information Management System (LIMS)** – A system for transferring, processing, storing, and reporting analysis results.

6.5. **Lot** – A quantity of bulk material of similar composition processed or manufactured at the same time.

6.6. **Matrix Spike (MS)** – An aliquot of an environmental sample spiked with known quantities of specified target compounds and subjected to the entire sample preparation and analysis procedure. The analysis results from a matrix spike sample are compared to results from an unspiked aliquot of the same sample to determine recovery of the spike from the sample matrix. Refer to the determinative SOP for corrective action and contingencies for handling out of control data.

6.7. **Matrix Spike Duplicate (MSD)** – A second aliquot of the sample that is treated the same as the original matrix spike sample. The relative percent difference between the matrix spike and matrix spike duplicate is calculated and used to assess method precision. Refer to the determinative SOP for corrective action and contingencies for handling out of control data.

6.8. **Method Blank (MB)** – A blank sample prepared in the laboratory containing all reagents and internal standards and is carried through the entire analytical procedure. The method blank is used to evaluate laboratory background and contamination. Refer to the determinative SOP for corrective action and contingencies for handling out of control data.

6.9. **Method Detection Limit (MDL)** – The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. MDLs are determined by analyzing replicate spike samples prepared by the lab and taken through all preparation and analysis steps of the method. The method detection limit is calculated using the appropriate Student's t-parameter times the standard deviation of a series of spiked samples. MDL study information is located in the quality assurance office.

7. Responsibilities and Distribution

7.1. **Analyst** – Any analyst using this procedure is responsible for reading, understanding, and following this SOP. Any deviation from this SOP must be reported to the appropriate supervisor. The analyst must make their recommendations for changing the SOP to their

supervisor or the QM in writing.

7.2. **Assistant General Manager** – The Assistant General Manager must ensure that all analysts are properly trained and qualified to use this procedure. The Assistant General Manager is also responsible to ensure that the SOP is followed. The Assistant General Manager is responsible for reviewing the SOP and communicating recommended changes to the QM.

7.3. **Quality Manager (QM)** – The QM is responsible for monitoring the implementation of the SOPs. The QM shall participate in the revision of the SOP and make sure it is current. The QM shall review and approve all SOPs.

7.4. **General Manager** – The General Manager has overall responsibility for ensuring that SOPs are prepared and implemented for all activities appropriate to the laboratory. The General Manager shall review and approve all SOPs.

7.5. **Distribution** – The official version of this SOP is the signed hardcopy version found in the laboratory. A copy of the SOP shall be kept in the department for reference.

7.6. **Revision** – This SOP shall be reviewed every two years at a minimum. Independent of the minimum review frequency, revisions shall be incorporated as needed if procedures or methods change.

8. Sample Collection, Preservation, and Handling

8.1. The homogenized samples must be kept frozen in glass jars.

8.2. Extracts should be stored at 4°±2°C in the dark in Teflon-sealed containers until analysis is complete. The sample extracts must be analyzed within 40 days from extraction.

9. Equipment and Supplies

9.1. Soxhlet extractors: 55 mm inner diameter X 340 mm length holding cell with heaters and cold water condensers

9.2. Concentrator tubes: Kuderna-Danish, 10 ml, graduated (Kontes K-570050-1025 or equivalent)

9.3. Evaporation flasks: Kuderna-Danish 500 ml (Reliance G-9601-001 or equivalent)

9.4. Snyder columns: Kuderna-Danish, three-ball macro (Kontes K-503000-0121 or equivalent)

9.5. Culture tubes: 15 ml and 9 ml with Teflon-lined screw cap

9.6. Boiling chips: Teflon or pre-rinsed silicone carbide

9.7. Sodium Sulfate (Na_2SO_4): Preheated at 400°C for 4 hours in a crucible to remove contaminants

9.8. Water bath: Heated, with concentric ring cover, capable of temperature control within ±5°C. The bath should be used in a hood.

9.9. Syringes: 250-1000µL Gastight syringes (Hamilton 1000 series or equivalent)

9.10. Beakers: 250 mL

9.11. Erlenmeyer flasks: 500 mL

9.12. Glass wool

9.13. Stainless steel spatulas

9.14. Analytical balance: Capable of weighing 300g ± 0.01g

9.15. Disposable Pasteur pipettes

10. Reagents and Standards

10.1. Methylene chloride, pesticide grade

10.2. Acetone, pesticide grade

10.3. Hexane, pesticide grade

10.4. Surrogate spiking solution: See Table 1 for standard preparation.

10.5. Matrix spiking solution: Dependent upon analysis requested. See Table 1 for standard preparation.

Table 1

Standard	Stock Standard	Conc	Amount Used	Final Volume	Solvent Used	Final Conc
Surrogate spiking solution	TMX (Tetrachloro-m-xylene) and DCB (Decachlorobiphenyl)	200µg/mL	10 mL	1000 mL	Acetone	2.0µg/mL
PCB Matrix Spike	One of either Aroclor 1016, 1242, 1248, 1254, or 1260	1000 µg/ml	1000 µL	200 mL	Acetone	5.0µg/mL
Pesticide Matrix Spike	Custom Pesticide Mix A and Custom Pesticide Mix B	5.0 - 50 µg/ml	2000 µL each of Mix A and Mix B	25 mL	Acetone	0.4 - 4.0µg/mL
Toxaphene Matrix Spike	Toxaphene Mix	1000 µg/ml	2500 µL	50 mL	Acetone	50.0µg/mL

Historical data or requirements of specific projects may determine the analytes and concentrations added to the sample spikes.

Custom Pesticide Mix A contains alpha-BHC, gamma-BHC, Heptachlor, Endosulfan I, Dieldrin, Endrin, 4,4'-DDD, 4,4'-DDT, and Methoxychlor.

Custom Pesticide Mix B contains beta-BHC, delta-BHC, Aldrin, Heptachlor epoxide, alpha-chlordane, gamma-chlordane, 4,4'-DDE, Endosulfan II, Endrin aldehyde, Endosulfan sulfate, and Endrin ketone.

11. Calibration

11.1 Refer to the most current version of MN-BE-006 for the proper procedure to calibrate the analytical balance.

12. Procedure

12.1. **Extraction**

12.1.1. Attach Soxhlet extractors (55 mm i.d. X 340 mm length) to 500-mL Erlenmeyer flasks with ground glass joints.

12.1.2. Add two plugs of glass wool to each extractor, one to cover the bottom to prevent sample from entering the solvent return arm and the other to cover the top of the sample.

12.1.3. Add 300 mL of glass-distilled Methylene chloride to the Erlenmeyer flask, along with about five boiling chips. Attach the Erlenmeyer to the Soxhlet extractor.

12.1.4. Attach the extractors to the condensers in the fume hood.

12.1.5. Adjust the temperature so the extractors cycle at a rate of 12 to 15 cycles/hour.

12.1.6. Allow the extractors to rinse for 4 hours, then shut off the heaters and allow them to cool.

12.1.7. Remove the condensers and drain all the solvent remaining in the extractors into the Erlenmeyer flask.

12.1.8. Discard the solvent and add new boiling chips to Erlenmeyer flask.

12.1.9. The extractors are now ready for the samples.

12.1.10. Weigh 20g of sodium sulfate or control matrix into a 250-mL beaker; this will represent the method blank. Weigh 20g of the control matrix into a second 250-mL breaker; this will be used for the control spike. Weigh 20g samples into separate 250-mL beakers. Record the actual weight in the extraction logbook.

12.1.11. Add 40g of anhydrous sodium sulfate to each beaker and mix. More sodium sulfate may be necessary: when a sufficient amount has been added, the sample will appear granular.

12.1.12. Place the beakers in a fume hood and let them dry, stirring occasionally.

12.1.13. Remove the top glass wool plug from the Soxhlet extractors that have been pre-rinsed.

12.1.14. Transfer the entire sample from the beaker to the extractor and place the glass wool plug on top. The sample level in the extractor should not exceed the top of the solvent return arm; this will keep the entire sample immersed in solvent during the extraction process. Rinse the sample beaker with $MeCl_2$ and add to the top of the Soxhlet extractor.

12.1.15. Add 500 µL of the 2.0 µg/mL surrogate spiking solution to all samples, laboratory control spikes, matrix spikes, and method blanks. (The amount of surrogate spiking solution added may need to be adjusted for the final volume of the sample extract.)

12.1.16. Add the appropriate amount of Matrix Spike solution(s) to the laboratory control spikes and matrix spikes. This will depend upon the analytes of interest and project specific requirements. (The amount of matrix spike solution added may need to be

adjusted for the final volume of the sample extract.)

12.1.16.1. For pesticide analysis add 1000 µL of the 0.4 - 4.0 µg/mL Pesticide Matrix Spike solution.

12.1.16.2. For PCB analysis add 1000 µL of the 5.0 µg/mL PCB Matrix Spike solution.

12.1.16.3. For Toxaphene analysis add 800 µL of the 50 µg/mL Toxaphene Matrix Spike solution.

12.1.16.4. Additional compounds which may be added include 2,4-DDT, 2,4-DDD, 2,4-DDE, Hexachlorobenzene, Pentachloroanisole, Oxychlordane, Trans-nonachlor, Cis-nonachlor, and Mirex.

12.1.17. Add 350 mL of glass-distilled methylene chloride to each Soxhlet extractor.

12.1.18. Attach the condensers and set the temperature so that the extractors cycle at a rate of 12 to 15 cycles per hour.

12.1.19. Let the extractors cycle for 16 hours.

12.1.20. After 16 hours shut off the heating elements and allow the samples to cool.

12.1.21. Rinse the extractor with about 50 mL of Methylene chloride and drain it into the collection Erlenmeyer flask.

12.1.22. Drain all solvent remaining in the extractor into the Erlenmeyer flask.

12.2. **Concentration**

12.2.1. Assemble a K-D concentrator by attaching a 10-mL concentrator tube to a 500 mL evaporative flask. Other concentration devices or techniques may be used in place of the K-D if equivalency is demonstrated for all analytes of interest.

12.2.2. Pour the extracts into the K-D concentrators. Rinse the Erlenmeyer flasks with 20 to 30 mL of methylene chloride to complete the quantitative transfer.

12.2.3. Add one or two clean boiling chips to the evaporative flasks and attach a three-ball Snyder column. Place the K-D apparatus on a hot water bath (100°C to 105°C) so that the concentrator tube is partially immersed in the hot water and the entire lower rounded surface of the flask is bathed with hot water and the entire lower rounded surface of the flask is bathed with hot vapor. Adjust the vertical position of the apparatuses and the water temperature as required to complete the concentration in 10 to 15 minutes. At the proper rate of distillation, the balls of the column will actively chatter but the chambers will not flood with condensed solvent. When the apparent volume of liquid reaches 5 to 10 mL, remove the K-D apparatus. Allow it to drain and cool for at least 10 minutes.

12.2.4. Adjust the volume to 10 mL using methylene chloride.

12.2.5. Samples that are to be analyzed for PCBs only will require the extracts to be exchanged to hexane. For these extracts, add approximately 50 mL of hexane to the K-D apparatus and continue concentration to a volume of 4-6 mL. Remove the K-D apparatus from the water bath and allow it to drain and cool for at least

10 minutes or until extracts have cooled to air temperature. Adjust the final volume to 10 mL using hexane.

12.3. Extract Cleanups

12.3.1. Lipid Determination: One milliliter of the extract is used to determine the percent lipids using SOP KM-L-003-Rev.0. The remaining nine milliliters should go through the following cleanups necessary for the required analysis.

12.3.2. GPC Cleanup of Extracts: Sample extracts requiring pesticide and PCB analysis should have contaminants removed using gel permeation chromatography. This cleanup is not necessary for samples requiring only PCB analysis because the Florisil column cleanup procedure is validated specifically to remove contaminants from the PCBs.

12.3.3. Florisil Column Cleanup of Extracts for PCBs: Extracts requiring only PCB analysis should be cleaned using column chromatography with Florisil.

12.3.4. Florisil Cartridge Cleanup for pesticides: Extracts requiring pesticide analysis may be cleaned using Florisil cartridge cleanup.

12.3.5. Silica Gel Separation of Pesticides and PCBs: Extracts which are to be analyzed for both pesticides and PCBs may have the PCBs separated from the majority of the pesticides using column chromatography with silica gel. Extracts may be screened prior to this cleanup to determine if PCBs will cause a problem with the identification of pesticides in the extract. If PCBs are not present, or present at levels which will not interfere with pesticide analysis, this cleanup is not necessary.

13. Quality Control

13.1 One method blank is extracted per 20 samples OR per extraction batch, whichever is more frequent. The method blank should be blank sodium sulfate or an analyte-free biota matrix such as tuna fish for animal extractions or alfalfa for plant analyses.

13.2 A laboratory control spike is extracted per 20 samples OR per extraction batch whichever is more frequent. Control spikes are usually prepared using analyte-free tuna fish for animal analysis or alfalfa for plant analyses. The control spike is fortified with a representative list of the analytes of interest.

13.3 A matrix spike and a matrix spike duplicate must be performed for every 20 samples when appropriate sample volume is present, otherwise a laboratory control spike duplicate will be performed. Matrix spikes are used to indicate matrix effects on the analysis of the analytes of interest.

13.4 Surrogate standards must be added to all samples, laboratory control spikes, matrix spikes, and method blanks prior to extraction. Surrogates are used to monitor the efficiency of the method on each sample and possible matrix related effects.

13.5 All quality control samples (MB, LCS, MS, MSD, and duplicate samples) must be analyzed by the same determinative methods as the samples in the batch. The acceptance criteria and corrective actions are described in the determinative method SOPs.

14. Method Performance

14.1 There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual.

14.2 The analyst must read and understand this procedure with written documentation maintained in his/her training file.

14.3 An initial demonstration of capability (IDC) must be performed per MN-Q-211, *Training Procedures*. A record of the IDC will be maintained in his/her QA file with written authorization from the Laboratory Manager and Quality Manager.

14.4 An annual method detection limit (MDL) study will be completed per ALL-Q-004, *Method Detection Limit Studies*, for this method and whenever there is a major change in personnel or equipment. The results of these studies are retained in the quality assurance office.

14.5 Periodic performance evaluation (PE) samples are analyzed per ALL-Q-010, *PE/PT Program*, to demonstrate continuing competence. All results are stored in the QA office.

15. Pollution Prevention and Waste Management

15.1. Procedures for handling waste generated during this analysis are addressed in individual laboratory SOPs for waste management.

15.2. In order to minimize the amount of waste generated during this procedure, analyst should prepare reagents in an amount which may be used in a reasonable amount of time (i.e. before a reagent expires)

15.3. The laboratory Chemical Hygiene Plan/Health and Safety Plan contains additional information on pollution prevention.

16. References

16.1. USEPA, SW-846, Method 3540C, "Soxhlet Extraction", December 1996.

17. Tables, Diagrams, Flowcharts, Appendices, etc.

Not Applicable

18. Revisions

Document Number	Reason for Change	Date
KM-O-001-rev.0	Converted SVO 60 Rev 1 to new format.	January 20, 2005

Incorporated associated cleanup method references.

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STANDARD OPERATING PROCEDURE

Biological Tissue and Plant Preparation

Reference Methods: N/A

SOP NUMBER:	KM-L-001-Rev.1
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	KM-L-001-Rev.0

APPROVAL

Glen Coder, Assistant General Manager — Date: 12/29/05

Julie Trivedi, Quality Manager — Date: 29Dec05

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1. Purpose

1.1 The purpose of this Standard Operating Procedure (SOP) is to describe the processes utilized to grind plant and biological tissue samples into a homogenous sample suitable for use by the organic extraction and inorganic preparation staff.

2. Scope and Application

2.1. The policies and procedures contained in this SOP are applicable to all personnel involved in the preparation of plant and biological tissue samples.

3. Summary of Methods

3.1 Necropsy and/or filleting of whole body animals may be performed to isolate the individual organs or portions of the specimen to be homogenized and utilized for analysis.

3.2 This SOP involves instruction to chop, grind, and blend plant materials and biological tissue into a homogenized sample compatible with analysis of volatile organic compounds, semivolatile organic compounds, and metals.

4. Interferences

4.1. Solvents, reagents, glassware, and other sample processing hardware may yield discrete artifacts and/or elevated baselines causing misinterpretation of the analytical results. All of these materials must be free from interferences under the conditions of the analysis by performing method blanks.

5. Safety

5.1. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of any chemical. A reference file of Material Safety Data Sheets (MSDS) and a formal safety plan is made available to all personnel involved in chemical analysis and should be consulted prior to handling samples and standards.

5.2. Protective eyeware, gloves, and a lab coat must be worn at all times. Hearing protection should be worn when the blender is in operation.

6. Definitions

6.1. Definitions of terms used in this SOP are found in the Pace Quality Manual Glossary. When definitions are not consistent with NELAC defined terms, an explanation will be provided in this SOP.

7. Responsibilities and Distribution

7.1. **Analyst** – Any analyst using this procedure is responsible for reading, understanding, and following this SOP. Any deviation from this SOP must be reported to the appropriate supervisor. The analyst must make their recommendations for changing the SOP to their supervisor or the QM in writing.

7.2. **Assistant General Manager (AGM)** – The Assistant General Manager must ensure that all analysts are properly trained and qualified to use this procedure. The AGM is also responsible to ensure that the SOP is followed and for reviewing the SOP and

communicating recommended changes to the QM.

7.3. **Quality Manager (QM)** – The QM is responsible for monitoring the implementation of the SOPs. The QM shall participate in the revision of the SOP and make sure it is current. The QM shall review and approve all SOPs.

7.4. **Distribution** – The official version of this SOP is the signed hardcopy version found in the laboratory, including applicable addenda. A copy of the SOP shall be kept in the department for reference.

7.5. **Revision** – This SOP shall be reviewed every two years at a minimum. Independent of the minimum review frequency, revisions shall be incorporated as needed if procedures or methods change.

8. Sample Collection, Preservation, and Handling

8.1. Unprocessed samples must be kept frozen in their original sample containers.

8.2. Small rodents must undergo a special procedure to destroy any Hantavirus which may be present. Refer to the most recent version of SOP KM-L-002 for details.

8.3 After processing, the homogenate must be kept frozen in glass jars. Individual jars of samples are grouped together as appropriate and stored in a labeled cardboard box within the freezer.

9. Equipment and Supplies

9.1. Stainless steel spatula

9.2. HDPE or stainless steel cutting boards

9.3. Heavy bladed knives and/or meat cleavers

9.4. Mallets, plastic faces, 2-3 pounds

9.5. Hobart stainless steel meat grinder

9.6. Blender, stainless steel blade with glass or stainless steel containers (plastic containers not suitable)

9.7. Vial: 40 mL with Teflon-lined septum caps

9.8. Wide mouth 4-16 ounce glass jars with Teflon-lined septum caps

9.9. Catfish, Tilapia, or Canned tuna fish

9.10. Tekmar Tissumizer

9.11 Liquid Nitrogen or dry ice

9.12 Balance, 3 place

9.13 Aluminum foil

9.14 Forceps

9.15 Scaler, stainless steel spoons

9.16 Pliers

10. Reagents and Standards

10.1. Methanol

10.2. Deionized Water

11. Calibration

11.1 Refer to the current revision of *Support Equipment* (ALL-Q-013) for how to calibrate a balance.

12. Procedure

12.1. Clean the work area by wiping the surfaces with a damp cloth. Wash utensils and grinders with hot water and liquinox. Rinse with tap water. Rinse with DI water. Rinse with methanol. Allow the utensils and grinders to air dry. Cover with aluminum foil as needed to prevent contamination.

12.2. Depending on the sample matrix and specific instructions provided by the customer, the method for ensuring homogeneity may vary. Necropsy and/or filleting of whole body animals may be performed to isolate the individual organs or portions of the specimen to be homogenized and utilized for analysis. The project manager must be contacted for clarification prior to thawing the samples if there are any questions.

12.3. Select a set of samples for processing. Depending on the size of the specimen, remove the samples from the freezer to allow the specimen to partially thaw. Large specimen typically need to thaw overnight at room temperature. Small specimen require a shorter amount of time and may be placed in a refrigerator overnight or thawed at room temperature for 2-3 hours during the day of processing. It is important to make sure that each specimen is not touching another specimen during the thawing process.

12.4. Record the date and time the specimen are taken out to thaw in the notebook.

12.5. Pre-label sample jars with the LIMS numbers. Transport the clean, dry utensils and pre-labeled jars to the countertop work area.

12.6. Once the specimen is adequately thawed, processing may begin. Compare the label on the specimen with the pre-labeled jar to make sure errors have not occurred.

12.7. Small fish, such as minnows, are usually collected as composites and will represent a single composite sample. Large whole fish that require compositing are chopped into cubes and put through the meat grinder together (refer to 12.10) and aliquots of the ground tissue are blended with liquid nitrogen (refer to 12.11).

12.8. If the specimen requires filleting prior to homogenization, thaw the fish to the point that it can be cut into with a sharp clean knife. Skinning or scaling may be necessary prior to filleting the fish.

12.8.1. **Skinning:** Catfish, bullheads, and other fish may need to be skinned prior to removing fillets. With a sharp knife slice the skin front to back along the dorsal side of fish. Make another incision from top to bottom just behind the gills. Hold the fish head with one hand and grasp an edge of the skin just behind the gill with pliers. Peel the skin back toward the tail.

12.8.2. **Scaling:** If scales are to be removed prior to filleting, lay the fish flat on a cutting board. Grasp the fish with one hand and with the other hand use a scaler to scrape the scales off the fish. Work the scaler from the tail toward the head. Rinse the scales and slime from fish prior to filleting.

12.8.3. **Filleting:** Begin with an incision just behind the gills, cutting through the fish from back to belly.

12.8.4. Next, make a clean cut along the dorsal ridge towards the tail. Be careful not to cut into the gut cavity.

12.8.5. After cutting through to the tail, separate the fillet from the rib cage, peeling the fillet from the carcass with the non-cutting hand.

12.8.6. Pick out any bones with forceps.

12.9 Chop large whole body specimens, plant material, or fillets into 2-3 inch cubes using a sharp knife and mallet. Smaller samples of limited quantity must be finely ground using the blender in step 12.11.

12.10 Grind the cubes in a large commercial meat grinder to coarse texture.

12.11 Transfer the course ground sample to a stainless steel bowl containing liquid nitrogen. Place the frozen sample in a blender cup and blend the frozen tissue to a powder consistency.

12.12 Samples such as eggs, insects, and small individual organs (liver, brain) may be prepped with the tissumizer in a jar to avoid loss of sample. The technician documents that the sample was prepared in the jar on the prep worksheet or notebook.

12.13 Transfer the blended sample into the pre-labeled jars.

12.14 Clean the work area and the utensils in accordance with step 12.1 between samples.

12.15 Periodically, canned tuna or other fish is homogenized using this procedure for use as a quality control matrix in the laboratory.

13. Quality Control

Not Applicable

14. Method Performance

14.1. There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures.

14.1.1 The analyst must read and understand this procedure with written documentation maintained in the training file.

15. Pollution Prevention and Waste Management

15.1. Procedures for handling waste generated during this analysis are addressed in individual laboratory SOPs for waste management.

15.2. In order to minimize the amount of waste generated during this procedure, analyst should prepare reagents in an amount which may be used in a reasonable amount of time (i.e. before a reagent expires)

15.3. The laboratory Chemical Hygiene Plan/Health and Safety Plan contains additional information on pollution prevention.

16. References

16.1. USEPA National Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume I: Fish Sampling and Analysis-Third Edition.

17. Tables, Diagrams, Flowcharts, Appendices, etc.

Not Applicable

18. Revisions

Document Number	Reason for Change	Date
KM-L-001.Rev.0	Converted LAB 27 Rev 0 to new format. Incorporated how to fillet a fish.	20Jan2005
KM-L-001 Rev.1	Incorporated how to skin and scale a fish. Added scaler and pliers to the equipment section.	20Dec2005

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STANDARD OPERATING PROCEDURE

NT Server Backup

SOP NUMBER	WI-L-001-Rev. 0
AUTHOR	Arthur F. Lautenbach
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APPROVAL

Nils Melberg, Assistant General Manager — Date 11/15/04

Glen Coder, Assistant General Manager — Date 11/10/2004

Arthur F. Lautenbach, Quality Manager — Date 11/10/2004

Julie Trivedi, Quality Manager — Date 11/10/2004

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1. Purpose

1.1 The procedure describes the instructions for morning and evening incremental data backups and the weekly backups of the servers for Pace Analytical Services, Inc.'s Green Bay and Kimberly laboratories located at 1241 Bellevue Street, Green Bay, WI 54302, and 1090 Kennedy Ave., Kimberly, WI 54136.

2. Scope and Application

2.1 The policies and procedures contained in this SOP are applicable to all personnel involved in the planning, coordination, preparation, use, and review of NT Server Backups.

3. Summary of Method

3.1 The SOP contains the procedure to backup and store the data files produced by the day to day computerized operations of Pace Analytical Services, Inc.'s Green Bay and Kimberly laboratories.

3.2 The VXA autoloader is located in the Green Bay Server Room of the 1241 Bellevue Street building.

3.3 The DLT 8000 tape drive is located in the Kimberly Server Room of the 1090 Kennedy Ave. building.

3.4 The Green Bay backup tapes and all permanent storage tapes are stored in the fire safe in the 1795 Industrial Drive building.

3.5 The Kimberly backup tapes are stored in the desk drawer in the server room.

4. Interferences

4.1 Not Applicable.

5. Safety

5.1 Not Applicable.

6. Definitions

6.1 Refer to the most current version of SOP MN-Q-241, *Analytical Definitions,* for the terms used at Pace Analytical.

7. Responsibilities and Distribution

7.1 Personnel

7.1.1 All personnel involved with sample preparation and analysis are responsible for adherence to this SOP. A controlled copy will be available for review and consultation within the area methods manual.

7.1.2 Personnel are responsible for ensuring that any deviations to this SOP are reported to the laboratory manager.

7.2 Laboratory Manager

7.2.1 The laboratory manager is responsible for ensuring adherence to this SOP and will receive a controlled copy of this SOP.

7.2.2 The laboratory manager is responsible for performing a biennial review of the SOP and reporting any required revisions to the Quality Assurance Office.

7.3 Quality Assurance Office

7.3.1 The QA Office is responsible for performing a biennial review of the SOP in conjunction with the purchasing department and revising as needed.

7.3.2 The QA Office is responsible for ensuring that all revisions to the SOP are implemented.

7.4 Revisions

7.4.1 This SOP will be reviewed on a biennial basis at a minimum, and any required revisions will be incorporated.

8. Sample Collection, Preservation and Handling

8.1 Not Applicable.

9. Reagents and Standards

9.1 Not Applicable.

10. Calibration

10.1 Not Applicable.

11. Procedure

11.1 Backup Sets

11.1.1 Attachment I is the backup jobs for the Green Bay servers.

11.2 Backup Schedule

11.2.1 Attachment II is the Green Bay backup schedule.

11.3

11.3.1 Attachment III is the backup jobs for the Kimberly servers.

11.4

11.4.1 Attachment IV is the Kimberly backup schedule.

11.5 **Tape Rotation**

11.5.1 In Green Bay, there are 14 tapes in the rotation. 10 of the tapes are V17 tapes (170m) and 4 are V23 (230m). The V17 tapes are for the full backup and the V23 tapes are for the incremental backups. The oldest tape in the incremental rotation needs to put in the tape drive after the **Target Data Daily** backup runs on Friday and before the **Target Data Diff – Overwrite** backup runs on Monday. The 2 oldest tapes in the full backup rotation needs to be put in the tape drive after the **Truncate SQL** backup completes on Friday night and before the **Full Backup** runs on the following Friday.

11.5.2 In Kimberly, there is a minimum of 8 tapes in the rotation. Tapes are changed on Monday and Friday. On each of these days, the oldest tape in the rotation is placed in the DLT 8000 tape drive.

11.5.3 In Green Bay and Kimberly, the first full backup of every month needs to be read/write protected, cataloged, and placed in the fire safe for archive purposes. This media is to be kept and never overwritten.

12. Quality Control

12.1 Not Applicable.

13. Method Performance

13.1 Not Applicable

14. Pollution Prevention and Waste Management

14.1 Not Applicable.

15. References

15.1 Not Applicable.

16. Tables, Diagrams, Flowcharts, Appendices, Addenda etc.

16.1 Attachment I –Backup Jobs For The Green Bay Servers

Backup Name	Backup Type	Servers/Directories in Backup Set
Full Backup	Full	Dynamics, EnnovativeWeb, LXGB1, GBAspen, GBFile, GBTarget, Intranet, Termserv, Termserv2, MDFile, Exchange
Incremental Backup	Incremental	GBAspen, GBFile, GBTarget, MDFile
Target Data Diff – Overwrite	Working (3 days)	lxgb1\data\chem, lxgb1\data2\chem
Dynamics Server Inc.	Incremental	Dynamics
LXGB1 Daily	Working (2 days)	lxgb1\data, lxgb1\data2
Target Data Daily	Working (2 days)	lxgb1\data\chem, lxgb1\data2\chem
Exchange IS	Full	Exchange IS Store
Truncate SQL	Full	GBAspen\SQL Logs – backs up logs then truncates

16.2 Attachment II – Backup Schedule for Green Bay

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Noon	Target Data Diff-Overwrite	Target Data Daily	Target Data Daily	Target Data Daily	Target Data Daily	
Night	1. Dynamics Inc. 2. lxgb1 Daily 3. Incremental 4. Truncate SQL	1. Dynamics Inc. 2. lxgb1 Daily 3. Incremental 4. Truncate SQL 5. Exchange IS	1. Dynamics Inc. 2. lxgb1 Daily 3. Incremental 4. Truncate SQL	1. Dynamics Inc. 2. lxgb1 Daily 3. Incremental 4. Truncate SQL	1. Full Backup 2. Truncate SQL	

16.3 Attachment III – Backup Jobs For The Kimberly Servers

Backup Name	Backup Type	Servers/Directories in Backup Set
Kimberly Daily Overwrite	Daily	MDNT, Ntkimberly
Kimberly Full	Full	MDNT, Ntkimberly
Kimberly Daily	Daily	MDNT, Ntkimberly
Kimberly Daily Eject	Daily	MDNT, Ntkimberly

16.4 Attachement IV – Backup Schedule for Kimberly

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Night	1. Kimberly Daily Overwrite	1. Kimberly Daily	1. Kimberly Daily	1. Kimberly Daily Eject	1. Kimberly Daily Overwrite	1. Kimberly Full

17. Revisions

Revision Number	Reason for Change	Date

STL KNOXVILLE

STANDARD OPERATING PROCEDURE

TITLE: Lot Checking Sample Containers for the Fox River Project

(SUPERSEDES: None)

Prepared By: _____

Reviewed By: _____ 5-25-06 _____ 5-25-06
Technical Specialist

Approved By: _____ 05/25/06
Quality Assurance Manager

Approved By: _____ 5-25-06
Environmental, Health and Safety Coordinator

Approved By: _____ 5-25-06
Laboratory Director

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1. Purpose

1.1 This procedure describes requirements for lot checking the sample bottles sent to the field for environmental sampling for the Fox River project for EPA Method 1668A. The containers shipped to the field must be demonstrated to be clean according to this procedure. The procedure also describes the documentation requirements.

2. Responsibilities

2.1 The sample receiving associate is responsible for verifying bottle lots have been approved for use for the Fox River project before sending the bottles to the field. The sample receiving associate is also responsible for ensuring there is a sufficient supply of approved bottles.

2.2 The SOG extraction group leader is responsible for initiating, performing and documenting the new lot check when appropriate.

3. Safety

3.1 Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

3.2 Eye protection that satisfies ANSI Z87.1 (as per the STL Corporate Safety Manual), laboratory coat and appropriate gloves must be worn while samples, standards, solvents and reagents are being handled. Disposable gloves that have become contaminated will be removed and discarded, other gloves will be cleaned immediately.

3.2.1 Latex and vinyl gloves provide no protection against most of the organic solvents used in this method. For the operations described herein, Nitrile clean room gloves are worn. For operations using solvents that splash, silver shield gloves are recommended. Silver shield gloves protect against breakthrough for most of the solvents used in this procedure.

3.3 Primary Materials Used: The following is a list of the materials used in Method 1668A, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major

changes to the MSDS.

Material	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Methylene Chloride	Carcinogen, Irritant	25 ppm-TWA, 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
Hexane	Flammable, Irritant	500 ppm-TWA	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

3.4 Chemicals that have been classified as **carcinogens**, **potential carcinogens**, or **mutagens include**: methylene chloride. The toxicity or carcinogenicity of each reagent used in this method is not precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be kept to a minimum.)

3.5 Chemicals known to be **flammable** are: hexane.

3.6 Exposure to chemicals will be maintained as low as reasonably achievable; therefore, unless they are known to be non-hazardous, all samples will be opened, transferred and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

3.7 The preparation of all standards, reagents, and glassware cleaning procedures that involve solvents will be conducted in a fume hood with the sash closed as far as the operations will permit.

3.8 Equipment goggles or a face shield **must** be used when employees are using solvents to rinse or clean glassware

3.9 Personal Hygiene: Thorough washing of hands and forearms is recommended after each manipulation and before breaks (coffee, lunch, and shifts).

3.10 Confinement: Work areas should be isolated and posted with signs. Glassware and tools should be segregated. Benchtops should be covered with plastic backed absorbent paper.

3.11 Waste: Good technique includes minimizing contaminated waste. Plastic bag liners should be used in waste cans.

3.12 Accidents: Remove contaminated clothing immediately, taking precautions not to

contaminate skin or other articles. Wash exposed skin vigorously and repeatedly until medical attention is obtained.

3.13 All work must be stopped in the event of a known or potential compromise to the health or safety of laboratory personnel. The situation must be reported immediately to a laboratory supervisor.

4. Procedure

4.1 All sample containers provided by STL Knoxville are new. The Knoxville laboratory purchases clean containers from EP Scientific, ESS and I-Chem (ESS QC class and I-Chem 300 Series containers). One liter containers used for sampling are ESS QC 1000-0150 or equivalent. Alternate container volumes of the same quality may be used with agreement of both the client and STL Knoxville.

4.2 Sample bottles shipped to the field by STL Knoxville to collect samples for EPA Method 1668A for the Fox River project must be from a bottle lot that has been approved for use by STL Knoxville. A representative bottle from each lot must be checked according to the procedure below and meet the acceptance criteria in order for the lot to be approved. The sample receiving associate must ensure there are an adequate number of bottle cases set aside from an approved lot for use in the field. This will require sufficient advance notice by the client regarding the number of samples to be collected to ensure that, if necessary, there is time for check and approval of a new bottle lot.

4.3 Bottle Lot Check and Approval: Upon receipt of a new lot of bottles to be used for collection of the Fox River Project samples for EPA Method 1668A, the following procedure is followed to verify the container lot is acceptable.

4.3.1 Select, at random, one bottle belonging to the new lot.

4.3.2 Log in one sample into the LIMS; select units of pg/sample. Specify the bottle lot number in the LIMS sample client ID.

4.3.3 Spike the bottle with 1.0 mL of the low-level PCB congener internal standard spiking solution.

4.3.4 Add approximately 60 mL of reagent dichloromethane and cap the bottle.

4.3.5 Swirl the bottle once and relieve pressure. Repeat until no pressure buildup is observed.

4.3.6 Shake the bottle for 15 seconds.

4.3.7 Transfer the solvent to a concentrator tube.

4.3.8 Repeat steps 4.3.4 - 4.3.7 two more times.

4.3.9 Proceed with the concentration of the solvent, in accordance with SOP KNOX-ID-0013, current revision, Section 11.8. Concentrate to a final volume of 20 uL. No cleanup steps are necessary for this sample.

4.3.10 Analyze the sample in accordance with SOP KNOX-ID-0013, current revision. Calculate the results based on pg/sample. A lot of bottles is approved for use if the results for the individual PCB congeners are <60 pg/sample or the total PCB congener concentration is < 900 pg/sample. See Appendix II for the Sample Container Verification Decision Flow Chart.

4.3.11 Report the results to the SOG extraction group leader.

4.4 If the lot meets the acceptance criteria, the SOG extraction group leader documents the lot is approved. See example form in Appendix I.

4.4.1 The sample data and documentation associated with the approval of the lot is reported to the Shaw Quality Manager for QA concurrence.

4.5 If the lot does not meet the acceptance criteria, the SOG extraction group leader documents the lot is not approved and must not be used for field sampling for the Fox River project. See example form in Appendix I.

4.6 Any unauthorized deviations from this procedure must be documented as a nonconformance, with a cause and corrective action described.

5. Definitions

5.1 Definitions can be found in the STL Knoxville LQM glossary and in the STL Quality Management Plan

6. References

6.1 STL Quality Management Plan (QMP), current revision.

6.2 STL Knoxville Laboratory Quality Manual (LQM), current revision.

7. Miscellaneous

7.1 Appendix I: Example of Form showing approved bottle lots for the Fox River project.

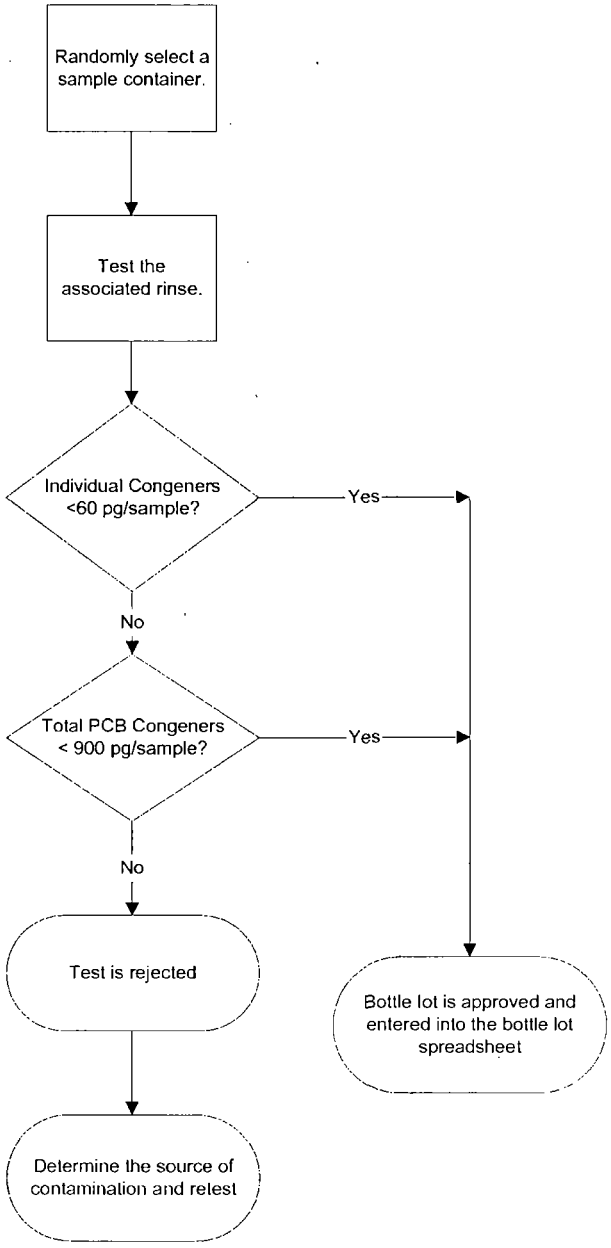
7.2 Appendix II: Sample Container Verification Decision Flow Chart

Appendix I: Example of Form showing approved bottle lots for the Fox River project

STL Knoxville
Fox River Bottle Lot Checks

Date Received	Manufacturer	Part Number	Description	LOT #	Lot Check Workorder	Date Reviewed	Approved? Y/N	Initials
	ESS	QC 1000-0150	1 Liter Amber					

Appendix II: Sample Container Verification Decision Flow Chart



APPENDIX

E

Appendix E –

Electronic Data Deliverable Format

Result EDD

Field Name	Field Type [max # of characters]	Required Field	Example
sample_name	Text [30]	Yes	715001-1
sys_sample_code	Text [20]	Yes	
lab_anl_method_name	Text [35]	Yes	
analysis_date	Date	Yes	
analysis_time	Time	Yes	
total_or_dissolved	Text [1]	Yes	
column_number	Text [2]		
test_type	Text [10]	Yes	
lab_matrix_code	Text [10]	Yes	
analysis_location	Text [2]	Yes	
basis	Text [10]	Yes	
container_id	Text [30]		
dilution_factor	Single		
lab_prep_method_name	Text [35]		
prep_date	Date		
prep_time	Time		
leachate_method	Text [15]		
leachate_date	Date		
leachate_time	Time		
lab_name_code	Text [10]	Yes	
qc_level	Text [10]	Yes	
lab_sample_id	Text [20]		
percent_moisture	Text [5]		
analyst_name	Text [30]		
instrument_id	Text [50]		
comment	Text [255]		
preservative	Text [50]		
cas_rn	Text [15]	Yes	
chemical_name	Text [60]	Yes	
result_value	Text [20]		
result_error_delta	Text [20]		
result_type_code	Text [10]	Yes	
reportable_result	Text [10]	Yes	
detect_flag	Text [2]	Yes	
lab_qualifiers	Text [7]		
validator_qualifiers	Text [7]		
organic_yn	Text [1]	Yes	
method_detection_limit	Text [20]		
reporting_detection_limit	Text [20]		
quantitation_limit	Text [20]		
result_unit	Text [15]	Yes	
detection_limit_unit	Text [15]		
result_comment	Text [255]		

Sample EDD

Field Name	Field Type [max # of characters]	Required Field	Example
sys_sample_code	Text [20]	Yes	
sample_name	Text [30]		
sample_matrix_code	Text [10]	Yes	
sample_type_code	Text [10]	Yes	
sample_source	Text [10]	Yes	
parent_sample_code	Text [20]	For field duplicate sample	
sample_date	Date	Yes	
sample_time	Time		
loc_name	Text [20]	Yes	
start_depth	Double	For sediment cores only	
end_depth	Double	For sediment cores only	
depth_unit	Text [15]	For sediment cores only	
chain_of_custody	Text [15]		
sent_to_lab_date	Date		
sample_receipt_date	Date		
sampler	Text [30]		
sampling_company_code	Text [10]	Yes	
sampling_technique	Text [40]		
task_code	Text [20]		
composite_yn	Text [1]	Yes	
composite_desc	Text [255]	For composite_yn = "Yes"	
common_name	Text [50]	For Tissue samples	Walleye
custom_field_2	Text [50]	For Tissue samples	whole fish
comment	Text [255]		

Location EDD

Field Name	Field Type [max # of characters]	Required Field	Example
sys_loc_code	1 Text(20)	Yes	
X_coord	3 Double	Yes	
Y_coord	4 Double	Yes	
surf_elev	5 Double	Yes	
elev_unit	6 Text(15)	Yes	
coord_sys_desc	7 Text(70)	Yes	
observation_date	8 Date		
alt_x_coord	9 Text(20)		
alt_y_coord	10 text(20)		
Alt_coord_sys_desc	7 Text(70)	Yes For Alt Cords only	
coord_type_code	11 Text(20)	Yes	
horz_collect_method_code	13 Text(2)		
elev_collect_method_code	17 Text(2)		
subcontractor_name_code	22 Text(10)		
loc_name	Text [20]	Yes	715001
loc_desc	28 Text (70)		
loc_type	29 Text(10)		
loc_purpose	30 Text(20)		
primary_site_code	31 Text(20)	Yes	
within_facility_yn	32 Text(1)	Yes	
remark	38 Text(255)		
total_depth	39 Double		
area	Text [50]	Yes	LLBDM
deposit	Text [50]	Yes	Non-Dep
tube_length	Double	Yes	For sediment cores only
water_depth	Double	Yes	For sediment cores only
penetration_depth	Double	Yes	For sediment cores only
recovered_depth	Double	Yes	For sediment cores only
process_date	Date	Yes	For sediment cores only

APPENDIX

F

Appendix F –

Health & Safety Plan

Document List

1. Health and Safety Plan
2. Shaw Health and Safety Plan Amendment

Lower Fox River Pre-Design Sampling Program
Operable Units 2, 3, 4, and-5, Lower Fox River
Wisconsin

HEALTH AND SAFETY PLAN
PREPARED FOR

Fort James Operating Company, Inc. and
NCR Corporation

June 7, 2004

George Hicks
Project Manager

Clifford Florczak, CSP, CIH
Health and Safety Representative

The information in this HASP has been designed for the methods presently contemplated by Shaw Environmental, Inc. (Shaw) for execution of the proposed work. Therefore, this HASP may not be appropriate if the work is not performed by or using the methods presently contemplated by Shaw. In addition, as the work is performed, conditions different from those anticipated may be encountered and the HASP may have to be modified. Therefore, Shaw only makes representations or warranties as to the adequacy of the HASP for currently anticipated activities and conditions.

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C Required Shaw H&S Procedures
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MSDSs
E Site Maps
F Job Safety Analyses

SITE EMERGENCY FORM

Contaminants of Concern: PCBs

Minimum Level of Protection: Level D

Hazard Determination: Serious_____ Moderate_____ Low__X___

SEE SECTION 7.0 FOR SITE EMERGENCY CONTINGENCY PROCEDURES

Do not endanger your own life. Survey the situation before taking any action.

Office Telephone	312-499-3509
Site Location Address	Operable Units 2-5, Lower Fox River, WI

EMERGENCY PHONE NUMBERS IN THE EVENT OF ANY EMERGENCY CONTACT PROJECT MANAGER (PM) OR THE HEALTH AND SAFETY REPRESENTATIVES

Ambulance	911
Fire	911
Police	911
Poison Control	1-800-222-1222
Local Shaw Medical Provider	TBD
Shaw Medical Case Manager	Dr. Jerry H. Becke, MD, MPH, Health Resource (781) 935-8581 (direct dial) (800) 350-4511 (toll free)
Hospital Name and Number North	St. Vincent Hospital Green Bay, WI 920-433-0111
Hospital Name and Number South	St. Elizabeth Hospital Appleton, WI 920-738-2000
Project Manager (PM)	George Hicks 312-499-3509
Site Safety and Health Officer (SSHO)	TBD
Health and Safety Representative (HSR)	Clifford Florczak 630-771-9205
Client Contact	Ben Hung
State Agency	Wisconsin Dept. of Natural Resources 608-266-2621

UTILITY MARKER EMERGENCY TELEPHONE NUMBERS

Utility	Color Code	Telephone Number
Water	Blue	
Gas	Yellow	
Electric	Red	
Telephone/Cable	Orange	
Sewer	Green	
Utility 800 number here: Diggers Hotline 1-800-242-8511		

HOSPITAL LOCATION MAP	
Full Route: Destination Route:	
HOSPITAL DIRECTIONS: Hospital to the north end of the Fox River.	**HOSPITAL INFORMATION:** **Name:** St Vincent Hospital **Address:** 835 Van Buren Street **City, State:** Green Bay, WI 54305 **Phone:** Emergency: 920-433-0111 General: 920-433-0111

HOSPITAL LOCATION MAP	
Full Route: Destination Route:	
HOSPITAL DIRECTIONS: Hospital to the south end of the Fox River.	**HOSPITAL INFORMATION:** **Name:** St Elizabeth Hospital **Address:** 1506 S. Oneida St. **City, State:** Appleton, WI 54915 **Phone:** Emergency: 920-738-2000 General: 920-738-2000

EMERGENCY FIRST AID PROCEDURES

RESPONDER MUST HAVE A CURRENT CERTIFICATE TO ADMINISTER FIRST AID OR CPR

1. Survey the situation. Do not endanger your own life. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND TRAINED. ENSURE ALL PROTOCOLS ARE FOLLOWED INCLUDING THAT A STANDBY PERSON IS PRESENT. IF APPLICABLE, REVIEW MSDSs TO EVALUATE RESPONSE ACTIONS FOR CHEMICAL EXPOSURES.
2. Call 911 (if available) or the fire department **IMMEDIATELY**. Explain the physical injury, chemical exposure, fire, or release.
3. Decontaminate the victim without delaying life-saving procedures.
4. If the victim's condition appears to be noncritical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by trained Emergency Medical Services (EMS) personnel: let the doctor assume the responsibility for determining the severity of the injury. If the condition is obviously serious, EMS must transport the victim.

Notify the PM, SS, and the SHSO. Complete the appropriate incident investigation reports.

STOP BLEEDING AND CPR GUIDELINES	
To Stop Bleeding	**CPR**
1. Give medical statement. 2. Assure airway, breathing, circulation. 3. Use **DIRECT PRESSURE** over the wound with clean dressing or your hand (use nonpermeable gloves). *Direct pressure will control most* bleeding. 4. Bleeding from an artery or several injury sites may require **DIRECT PRESSURE** on a **PRESSURE POINT**. Use pressure points for 30 60 seconds to help control severe bleeding. 5. Continue primary care and seek medical aid as needed.	1. Give medical statement. 2. Arousal: Check for consciousness. 3. Open airway with chin-lift. 4. Look. listen, and feel for breathing. 5. If breathing is absent, give 2 slow, full *rescue breaths.* 6. Check the pulse for 5 to 10 seconds. 7. If pulse is present, continue rescue breathing: **1 breath every 5 seconds**. 8. If pulse is absent, initiate CPR; 15 compressions for each two breaths.

1.0 INTRODUCTION

The policy of Shaw Environmental, Inc. (Shaw) is to provide a safe and healthful work environment for all employees. Shaw considers no phase of operations or administration to be of greater importance than injury and illness prevention. Safety takes precedence over expediency and shortcuts. At Shaw, it is believed all accidents and injuries are preventable. Shaw will take every reasonable step to reduce the possibility of injury, illness, or accident.

The objective of this plan, therefore, is to provide a mechanism for establishing safe working conditions at the site. The safety organization, procedures, and protective equipment have been established based upon an analysis of potential hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of accident or injury.

This HASP prescribes the procedures that must be followed during referenced site activities. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager and the Health and Safety Manager.

The provisions of this plan are mandatory for all personnel and subcontractors assigned to the project. All visitors to the work site must abide by the requirements of the plan. All project participants will attend a pre-job briefing where the contents of this HASP will be discussed. Accordingly, project staff assigned to this project must sign the Agreement and Acknowledgement Sheet (Appendix A) to confirm that they understand and agree to abide by the provisions of the plan.

All work will comply with the Occupational Safety and Health Act (OSHA) standard, "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120), Shaw Environmental, Inc. Company Health and Safety Procedures, and other federal, state, and local procedures that require the development and implementation of a HASP. Generation of this document certifies that the workplace has been evaluated for the hazards as described. A hazard assessment has been performed and the adequacy of the personal protective equipment (PPE) selected was evaluated as required by 29 CFR 1910.132(d), 1910.134, 1926.25, and 1926.55, and is duly noted by the signature(s) and date appearing on the cover page of this document.

1.1 Site Description/Background Information

The Lower Fox River is defined as the 39-mile portion of the Fox River, beginning at the outlet of Lake Winnebago and terminating at the mouth of the river into Green Bay. The Lower Fox River is the most industrialized river in Wisconsin, and has had reported water quality problems since the early 1900s. These water quality problems can be traced back to the mid-1800s when runoff from farmlands increased the sediment and nutrient loads into the river. The expanding industries and communities discharged increasing amounts of sewage and industrial wastes into the river. Polychlorinated biphenyls (PCBs) were discovered in the Lower Fox River in the 1970s.

The purpose of the pre-design investigation is to gather OUs 2-5 sediment field and analytical data necessary to support the remedial design for the OUs 2-5 cleanup remedy. The OUs 2-5 pre-design investigation will generate sediment characterization data essential to the engineering design of the OUs 2-5 remedial action. The primary activities associated with the OUs 2-5 pre-design investigation include baseline

surveying (by others); delineation of the 1-part per million (ppm) polychlorinated biphenyl (PCB) remedial action level (RAL), both horizontally and vertically; and physical characterization of the OUs 2-5 sediments as needed for design of the following remediation activities: removal (dredging), contingent capping, sediment handling, sediment dewatering, wastewater treatment, and sediment transport and disposal.

1.2 Scope of Work

- Vibracore sediment sampling and processing.

1.3 Key Safety Personnel

Shaw Environmental, Inc. Company will oversee and act accordingly during all phases of the project. The following management structure will be instituted for the purpose of successfully and safely completing this project.

Technical Advisor

John Pierdomenico, CIH
Shaw Environmental, Inc., West Chester, PA **(610) 241-5000**

The specific duties of the technical advisors include:

- providing technical input into the design and implementation of the site HASP; and
- advising on potential for worker exposure to project hazards along with appropriate methods and/or controls to eliminate site hazards.

The following individuals share responsibility for health and safety at the site. The role and responsibility for each is outlined in Table 1:

Project Manager (PM)	George Hicks (office) 312-499-3509 (cellular)
Site Health and Safety Officer (SHSO)	TBD
Client Representative	Ben Hung, WDNR (office)
Health and Safety Manager (HSM)	Clifford Florczak, CIH (office) 630-771-9205 (cell) 708-308-6200
Vice President, Health & Safety	Troy Allen, CSP (office) 225-932-2579

Table 1. Responsibilities of On-Site Personnel

Title	General Description	Responsibilities
Project Manager (PM)	Has authority to direct response operations. Assume total control over site activities.	• Prepares and organizes background review of the project, the work plan, and the field team. • Obtains permission for site access and coordinates activities with appropriate officials. • Sees that the work plan is properly carried out and on schedule. • Briefs the Site Supervisor (SS), SHSO, and field personnel on specific assignments. • Together with the SS and SHSO, sees that health and safety requirements are met. • Consults with the HSM regarding unsafe conditions, incidents, or changes in site conditions or the scope of work. • Ensures Company Accident/Incident report procedures are followed (Appendix B).
Site Supervisor (SS)	Reports to PM. Has authority to direct response operations. Assumes control over on-site activities.	• Conducts daily safety meetings. • Executes the work plan and schedule. • Manages the construction operations. • In conjunction with the SHSO, conducts periodic field health and safety inspections to ensure compliance with this HASP. • Enforces safety procedures. • Coordinates with the SHSO in enforcing worker protection levels. • Enforces site control. • Notifies when necessary, local public emergency officials. • In conjunction with the SHSO, responsible for follow-up of incident reports to the PM.
SHSO	Advises the PM on all aspects of health and safety on site. Stops work if site operations threaten worker or public health and safety. Informs the HSM of any changes in site conditions or project status.	• Conducts periodic inspections to assess whether the HASP is being followed. • Periodically inspects protective clothing and equipment. • Sees that protective clothing and equipment are properly stored and maintained. • Controls entry and exit at the access control points. • Performs air monitoring in accordance with this HASP. Maintains and oversees operation of monitoring equipment and interpretation of data from the monitoring equipment. • Monitors workers for signs of stress, including heat stress, cold exposure, and fatigue. • Enforces the "buddy" system. • Informed of emergency procedures, evacuation routes, and telephone number of local hospital, poison control center, fire department, and police department. • Notifies, when necessary, local public emergency officials. • Communicates incidents promptly to SS and PM. • Maintains communication with HSM on site activities. • If applicable, ensures decon and disposal procedures are followed. • Maintains the availability of required equipment. • Advises appropriate health services and medical personnel of potential exposures. • Notifies emergency response personnel in the event of an emergency. Coordinates emergency medical care

Title	General Description	Responsibilities
Work Team	Reports to the SS for on-site activities. Work parties must comprise at least two people for trench entry.	• Safely completes on-site tasks required to fulfill the work plan. • Complies with the HASP. • Attends and participates in daily safety meetings. • Notifies the SS and SHSO of suspected unsafe conditions. • Reports all incidents to the SS and SHSO.

1.4 Health and Safety Training Programs

Table 2 provides a description of the health and safety training programs to be complied with by site personnel working on this project.

Table 2. Health and Safety Training Programs

Activity	Description	Action
Medical Surveillance	The program tracks the physical condition of the Company's employees in compliance with Department of Transportation (DOT) regulations and OSHA standards, and other customer requirements.	• Medical examinations and consultations are completed for all employees prior to assignment, annually, upon termination, and in the event of injury and/or illness resulting from exposure at the work site. • Dr. Jerry H. Becke (MD, MPH), of Health Resources will review all medical examinations and will be available for medical consultation on an "as-needed" basis.
Training	Training requirements and programs comply with the OSHA Hazardous Waste Operations and Emergency Response regulation, 29 CFR 1910.120.	• Field personnel must complete a minimum of 40 hours of hazardous waste activity instruction. • Field personnel must complete a minimum of three days of supervised field instruction. • Field personnel assigned to the site will also receive 8 hours of refresher training each year. • On-site managers and supervisors directly responsible for employees engaged in hazardous waste operations receive an additional 8 hours of supervisory training. • Field personnel assigned to site also receive first aid/CPR and bloodborne pathogen training. • Other training may be required depending on the task to be performed (e.g., confined space, excavation/trenching, underground storage tank removal, fall protection, respiratory protection, and hazard communication). See JSAs.
Initial Orientation	Hazardous Waste Operations Initial Health and Safety Orientation	• All project participants engaged in site operations will attend an initial site orientation where this HASP will be discussed and followed. Personnel will acknowledge having been given the orientation by signing the agreement and acknowledgement form in Appendix A.

2.0 HAZARD ANALYSIS

The chemical hazards from potential soil contamination are addressed in section 2.1 (Table 3). Section 2.2 (Table 4) presents chemical handling procedures to be followed when handling corrosive materials. Based on the scope of work for this project, Job Safety Analyses (JSAs) for the boat safety has been developed and is included in Appendix F. Table 5, provide general guidelines that are common to most projects.

Any change in the scope of work will require an amendment to this HASP. Any task that will be conducted beyond the scope of work identified in this HASP must be evaluated using the JSA process. The PM and SS will be responsible for identifying conditions that are beyond the scope of work and communicating to the health and safety representatives. The HSM will work with the PM and SS to develop JSAs or provide guidance in the development of JSA's. JSAs will be reviewed and approved by the HSM and PM via the HASP amendment prior to initiation of the task. The JSA format is included in Appendix B. The completed JSAs must accompany the HASP.

2.1 Contaminants of Concern Profile

Based on recent site history and site characterization, Table 3 presents a summary profile of the hazards and control measures to follow for the contaminants of concern. For more detailed and specific information, always refer to the Material Safety Data Sheet (MSDS) or equivalent information for the compound located in Appendix D.

Table 3. Contaminants of Concern Profile

CHEMICAL	EXPOSURE ROUTES	PEL/TLV	HEALTH HAZARDS/ PHYSICAL HAZARDS
Polychlorinated Biphenyls	Skin, eye, inhalation, ingestion	0.5 mg/m^3	• Irritation of eyes, skin; acne-form dermatitis; potential carcinogen; liver damage • Reacts with strong oxidizers

2.2 Hazard Communication Procedures

The purpose of hazard communication (Employee Right-to-Know) is to ensure that the hazards of all chemicals located at this field project site are transmitted (communicated) according to 29 CFR 1926.59 to all Shaw personnel and Shaw subcontractors. Personnel must follow the hazard communication procedures below, as well as Table 4, specifically for handling corrosive materials.

2.2.1 Hazard Communication Program

Container Labeling

Shaw personnel will ensure that all drums and containers are labeled according to contents. These drums and containers will include those from manufacturers and those produced on site by operations. All incoming and outgoing labels shall be checked for identity, hazard warning, and name and address of responsible party.

Material Safety Data Sheets (MSDSs)

There will be an MSDS located on site for each hazardous chemical known to be used on site. All hazardous chemical MSDSs will be located in Appendix D of the HASP. The HASP can be found in the project office trailer.

Employee Information and Training

Training employees on chemical hazards is accomplished through on ongoing corporate training program. Additionally, chemical hazards are communicated to employees through daily safety meetings held at Shaw field projects and by an initial site orientation program.

At a minimum, Shaw and related subcontractor employees will be instructed on the following:

- Chemicals and their hazards in the work area
- How to prevent exposure to these hazardous chemicals
- What the company has done to prevent workers' exposure to these chemicals
- Procedures to follow if they are exposed to these chemicals.
- How to read and interpret labels and MSDSs for hazardous substances found on Shaw sites
- Emergency spill procedures
- Proper storage and labeling

Before any new hazardous chemical is introduced on site, each Shaw and related subcontractor employee will be given information in the same manner as during the safety class. The site supervisor will be responsible for seeing that the MSDS on the new chemical is available for review by on site personnel. The information pertinent to the chemical hazards will be communicated to project personnel.

Morning safety meetings will be held and the hazardous materials used on site will be discussed. Attendance is mandatory for all on site employees.

Refer to Appendix D of the site safety plan to find a list of hazardous chemicals anticipated to be brought to the site and the corresponding MSDSs for these chemicals.

Table 4. Corrosive Material Handling Procedures

Chemical	Description	Procedures
Acids and Bases Acids: including hydrochloric, nitric, and sulfuric acids Bases: including sodium hydroxide	Extremely corrosive materials with a variety of uses.	• Wear gloves and eye-splash protection while using acid dispensed from a small dropper bottle during water sampling. • Wear a full-face, air-purifying respirator equipped with combination cartridges (organic vapor/acid gas) as well as Tyvek? coveralls and nitrile gloves for large volume applications. • Have an eye wash bottle and/or portable eye wash station on-site. • Cap all drums after dispensing chemicals. • Do not add anything into a virgin chemical drum, including unused product. • Avoid mixing strong acids and bases. Consult HSM for task-specific evaluation. If mixing is absolutely necessary, do it slowly. Avoid vapors or fumes that are generated. • When diluting acids, add the acid to water in small quantities and mix cautiously. • When diluting bases, add water to the base in small quantities and mix cautiously.

3.0 HAZARD IDENTIFICATION AND CONTROL

In addition to the Task-Specific Job Safety Analyses, Table 5 lists the general procedures and practices that common to most projects. For additional information, refer to Shaw Environmental, Inc. health and safety procedures (required list is included in Appendix C), or consult with your health and safety professional. Applicable Shaw Environmental, Inc. Health and Safety Procedures shall be followed at all times. Since the employees will be working on the water please see extra precautions under the general hazard of soil sampling.

Table 5. General Hazards and Controls

General Hazard Or Program	General Controls
General	1. Legible and understandable precautionary labels shall be affixed prominently to containers of potentially contaminated soil, water, and clothing. 2. No food or beverages shall be present or consumed in a CRZ or EZ. These are only allowed in designated areas of the support zone. 3. No tobacco products shall be present or used, and cosmetics shall not be applied in a CRZ or EZ. These are only allowed in designated areas of the support zone, if areas have been designated. 4. Beards, facial hair, or other facial obstructions that interfere with respirator fit will preclude admission to the EZ when respirators are required. 5. An emergency eyewash unit shall be located immediately adjacent to employees who handle hazardous or corrosive materials, including decontamination fluids. All operations involving the potential for eye injury, splash, etc. must have approved eye wash units locally available capable of delivering at least 0.4 gallons per minute for at least 15 minutes. 6. All on-site activities will be conducted during daylight hours. If work after dusk becomes necessary due to an emergency, adequate lighting must be provided and notification of such activity made to the location contact. 7. Hazardous work, such as handling hazardous materials and heavy loads, and equipment operation, etc., should not be conducted during severe storms. 8. All temporary electrical power must have a ground fault circuit interrupter (GFCI) as part of it's circuit if the circuit is not part of permanent wiring. All equipment must be suitable and approved for the class of hazard present.
Incident Reporting	1. All occupational injuries/illnesses, vehicle accidents, and near miss incidents must be reported promptly to the PM and HSM and investigated (See Appendix B for incident forms). 2. Immediately notify the PM and HSM when an incident occurs. 3. All occupational Safety and Health Administration (OSHA) recordable injuries/illnesses and chargeable vehicle accidents must be reviewed by an Accident Review Board report.

General Hazard Or Program	General Controls
Daily Safety Meetings	1. Daily safety meetings will be held each morning prior to site activities (The purpose of these meetings is to place accident prevention foremost in the mind of each individual and to acquaint you and others with the necessary overall preventive action). 2. Subcontractors are required to attend all tailgate meetings. 3. The tailgate meeting form in Appendix B will be used to document the meeting.
Safety Inspections	1. The Site Supervisor, with assistance from the SHSO will inspect the site as appropriate and interview one or two site workers regarding areas of safety concerns or ideas for safety improvement. 2. The SS and SHSO will conduct site walkthroughs to assess site conditions and activities daily to identify changing conditions or potential hazards, and to identify any deficiencies in the effectiveness of this HASP. 3. Any personnel who identifies safety and occupational health deficiencies and suggested corrective measures will bring them to the attention of the Site Supervisor and SHSO. 4. Formal Safety review inspections will be conducted twice monthly and recorded and filed for reference by project management (See Appendix B for Inspection Checklist). These inspections will be shared by the PM, Site Supervisor, and SHSO. Subcontractor supervisory personnel will be asked to participate in inspections. 5. Any deficiencies in the effectiveness of this HASP will be immediately brought to the attention to the PM and HSM and corrected.
Safety Councils	1. Frequency will be 2 X / Mo.(≥ 20 personnel;> 60 days). 2. Chairperson(s): Primary-Project Manager; Alternate-Site Supervisor. 3. Members will be Field Technical, Field Laborers, Foremen, Equipment Operators, **Safety Personnel, and Subcontractor Personnel.** 4. Reports are submitted to Project Manager, Project Director, Business Line Leads, and Area Manager. 5. Discussion Topics will include Safety Incidents, Unsafe Practices / Conditions, Corrective Actions, Safety Recognition, and **Safety Procedures.**
Safety Incentive Award Program For Projects lasting one month or greater	1. An essential element of the company accident prevention program is to commend and reward exemplary team safety performance in accordance with Health and Safety Procedure HS023 – "Accident Prevention Program: Safety Incentive Award Program (SIAP). 2. Approval must be given by the project director, project manager, and Health and Safety Manager. 3. To be eligible for an award, individuals must be physically present at the site for five days or more during an eligibility period. 4. The minimum criteria is zero OSHA recordables, zero lost/restricted work days, and zero chargeable motor vehicle accidents.
Slip/Trip/Fall	1. Inspect each work area for slip/trip/fall potential prior to each work task. 2. Slip/trip/fall hazards identified must be communicated to all personnel. Hazards identified shall be corrected or labeled with warning signs to be avoided. 3. All personnel must be aware of their surroundings and maintain constant communication with each other at all times.

General Hazard Or Program	General Controls
Underground/ Utility Line Contact See Appendix B	1. Contact client or facility owner to have utility lines marked prior to excavation/trenching or drilling. 2. Refer to site drawings or customer interviews if on private property for utility locations. 3. Hand dig to 5 feet down and 5 feet each side of utility marker to avoid breaking utility lines. 4. Refer to Appendix B for Underground Utility Contact Prevention Management Plan.
Overhead Utility Line Contact	1. Maintain appropriate distance from overhead utilities: 2. Maintain at least 10 feet from overhead power lines, up to 50 kV 3. For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines. 4. If voltage is unknown, remain at least 20 feet from overhead power lines. 5. Conduct a site inspection on a daily basis to determine where activities will take place and location of overhead utilities and overhead obstructions. Once identified, place warning tape on poles and/or guy wires and attempt to plan the work so that no contact will be made with the overhead utilities or obstructions. Share the information with the all site personnel. 6. As a precaution, a spotter will be used at all times during the construction phase when near the overhead utilities or overhead obstructions. If contact is deemed unavoidable, consult with the plant manager and HSR to evaluate the area to determine if the particular overhead utility or obstruction can be removed prior to engaging in the activity.
General Falls/Ladders Shaw Procedure HS302	1. Assess work areas for fall hazards. A fall protection system is required if work is conducted 6 feet or over. 2. Use Type 1A rated ladders. 3. Make sure ladder rungs are sturdy and free of cracks. 4. Use ladders with secure safety feet. 5. Pitch ladders at a 4:1 ratio. 6. Secure ladders at the top or have another person at the bottom to help stabilize it. 7. Ladders used to access an upper landing surface shall extend at least three (3) feet above the upper landing surface. 8. Do not use ladders for access to air stripper towers above six feet – use aerial lift. 9. Use non-conductive ladders near electrical wires. 10. The top step of a stepladder should not be used as a step. 11. Do not carry any object or load that could cause a loss of balance or a fall.

General Hazard Or Program	General Controls
Heavy Equipment Operations	1. Wear leather gloves while attaching support members to protect against pinching injuries. 2. While working from elevated levels greater than 6 feet, ensure that all employees have 100% fall protection with full body harnesses and guardrails. 3. Do not stand under loads that are being raised or lowered with cranes or aerial lifts. 4. The subcontractor or Shaw Operator must conduct pre-operational inspections of all equipment. In addition, daily inspections will be conducted on the equipment prior to site activities. 5. Maintain appropriate distance from overhead utilities: 6. Maintain at least 10 feet from overhead power lines, up to 50 kV 7. For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines. 8. If voltage is unknown, remain at least 20 feet from overhead power lines. 9. Always stay out of the swing radius of all heavy equipment. Always use a spotter during movement of equipment. The spotter and others, as appropriate, shall maintain constant communication with the operator. 10. All operators must have adequate training and be qualified to operate the particular heavy equipment unit. 11. Conduct site evaluation to determine proper positioning for the unit. Make sure surface is level. Cordon off holes, drop-offs, bumps or weak ground surfaces. 12. When using a crane, do not use hands when the load is being lifted or lowered. Use non-conductive tag line to help direct and position the load. 13. Never climb a raised platform or stand on the mid-rail or top-rail. 14. Tools should always be hung or put into a belt whenever possible.

General Hazard Or Program	General Controls
Erecting Temporary Structure or Working From Aerial Lift	1. Wear leather gloves while attaching support members to protect against pinching injuries. 2. While working from elevated levels greater than 6 feet, ensure that all employees have 100% fall protection with full body harnesses and guardrails. 3. Do not stand under loads that are being raised or lowered with cranes or aerial lifts. 4. Conduct pre-operational inspection of aerial lifts to include: tire air pressure, hydraulic fuel level and pressure check, make sure pivot pins are secured, check hoses for worn areas, check for cracks or deviations in welded parts, the safety limit switch should work freely, security of the guardrail system on the platform, check both ground and platform control functions, raise and lower each boom system separately, listen for any unusual noises, vibrations, or uneven operations. 5. Maintain appropriate distance from overhead utilities: 6. Maintain at least 10 feet from overhead power lines, up to 50 kV 7. For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines. 8. If voltage is unknown, remain at least 20 feet from overhead power lines. 9. Conduct site evaluation to determine proper positioning for the unit. Make sure surface is level. Cordon off holes, drop-offs, bumps or weak ground surfaces. 10. Never climb a raised platform or stand on the mid-rail or top-rail. 11. Tools should always be hung or put into a belt whenever possible. 12. Specific training must be obtained on the aerial lift to be used.
Electric Shock Shaw Procedure HS315	1. Maintain appropriate distance from overhead utilities: 2. Maintain at least 10 feet from overhead power lines, up to 50 kV 3. For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines. 4. If voltage is unknown, remain at least 20 feet from overhead power lines. 5. Use ground-fault circuit interrupters as required. 6. Perform LO/TO procedures in accordance with Shaw Procedure HS315. 7. Use three-pronged plugs and extension cords. 8. Contact your local underground utility-locating service. 9. Follow code requirements for electrical installations in hazardous locations. 10. Always use qualified electricians to install electrical equipment and when conducting troubleshooting activities within 10 feet of exposed live wires.

General Hazard Or Program	General Controls
Hand and Power Tools	1. Keep hand tools sharp, clean, oiled, dressed, and not abused. 2. Worn tools are dangerous e.g., the "teeth" in a pipe wrench can slip if worn smooth; an adjustable wrench will slip if the jaws are sprung; hammer heads can fly off loose handles. 3. Tools subject to impact (chisels, star drills, and caulking irons) tend to "mushroom". Keep them dressed to avoid flying spalls. Use tool holders. 4. Don't force tools beyond their capacity. DO NOT USE "cheaters". 5. Don't use tools for pry bars. 6. Flying objects can result from operating almost any power tool, so you must always warn people around you and use proper eye protection. 7. Each power tool should be examined before use, for damaged parts, loose fittings, and frayed or cut electric cords. Tag and return defective tools for repairs. Inspect also for adequate lighting, proper lubrication, and abandoned tools or material that could "vibrate into trouble". 8. Air must be shut off or the electric cord unplugged before making tool adjustments. Air must be "bled down" before replacement or disconnection. 9. Proper guards or shields must be installed on all power tools before issue. Do not use improper tools or tools without guards in place. No "homemade" handles or extensions (cheaters) are permitted! 10. Replace all guards before start-up. Remove cranks, key, or wrenches used in service work.
Physical Injury	1. Wear hard hats and safety glasses when on site. 2. Maintain visual contact with the equipment operator and wear an orange safety vest when heavy equipment is used on-site or when adjacent to or in roadways. 3. Avoid loose-fitting clothing (driller and driller's helper). 4. Prevent slips, trips and falls; keep work area uncluttered. 5. Keep your hands away from moving parts (i.e., augers). 6. Test the emergency shutoff switch on the drill rig daily.
Vehicular Traffic	1. Wear traffic safety vest when vehicle hazard exists. 2. Use cones, flags, barricades, and caution tape to define work area. 3. Use vehicle to block work area. 4. Engage police detail for high-traffic situations. 5. Always use a spotter in tight or congested areas for material deliveries. 6. Review Shaw Procedure HS800, Motor Vehicle Operation.
Noise Shaw Procedure HS402	1. Wear hearing protection when equipment such as a drill rig, jackhammer, cut saw, air compressor, blower or other heavy equipment is operating on the site. 2. Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; this much noise indicates the need for protection. 3. Conduct noise monitoring of suspected high noise operations at the beginning of the workday or start up of new operations to verify noise control/hearing protection requirements.

General Hazard Or Program	General Controls
Lifting and Material Handling	1. Use leather gloves when handling metal, wire rope, sharp debris, or transporting materials (wood, piping, drums, etc.). 2. The size, shape, and weight of the object to be lifted must first be considered. No individual employee is permitted to lift any object that weights over 60 pounds. Multiple employees or the use of mechanical lifting devices are required for objects over the 60-pound limit. 3. If you must lift, plan the lift before doing it. Lift with the legs; keep the natural curves of the back; do not use your back muscles. 4. Check your route for clearance. 5. Bend at the knees and use leg muscles when lifting. 6. Use the buddy system when lifting heavy or awkward objects. 7. Do not twist your body while lifting. 8. Know the capacity of the handling device (crane, forklift, chainfall, come-along) that you intend to use. 9. Use tag lines to control loads. 10. Ensure that your body, material, tools and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, blowing, or any other uncontrolled motion. 11. Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released. 12. Chock all material and equipment (such as pipe, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling. 13. Tie down all light, large-surface-area material that might be moved by the wind. 14. When working at heights, secure tools, equipment, and wrenches against falling. 15. Do not store materials or tools on ducts, lighting fixtures, beam flanges, hung ceilings, or similar elevated locations. 16. *Fuel-powered tools used inside buildings or enclosures shall be vented* and checked for excessive noise
Fire Control	1. Smoke only in designated areas. 2. Keep flammable liquids in closed containers. 3. Keep site clean; avoid accumulating combustible debris such as paper. 4. Follow Hot Work Safety Procedures when welding or performing other activities requiring an open flame. 5. Isolate flammable and combustible materials from ignition sources. 6. Ensure fire safety integrity of equipment installations according to NEC specifications.
Static Electricity/Transfer of Flammable Liquids	1. Do not create static discharge in flammable atmosphere. 2. Electrically bond and ground pumps, transfer vessels, tanks, drums, bailers and probes when moving flammable liquids. 3. Electrically bond and ground vacuum trucks and the tanks they are emptying. 4. Do not splash fill containers with flammable liquids. 5. Pour flammable liquids slowly and carefully. 6. Two Fire extinguishers (2A20: BC) must be available, charged, inspected, and readily accessible.

General Hazard Or Program	General Controls
Soil Sampling – Vibracore/Water Safety (JSA for boat safety also in Appendix F)	1. Wear appropriate PPE to avoid skin, eye, and inhalation contact with contaminated groundwater and/or soil. 2. Stand upwind when conducting tasks and minimize possible inhalation exposure. 3. Conduct air monitoring to determine level of respiratory protection. 4. Utilize engineering controls such as portable venturi air movers to draw away or blow away chemical vapors. 5. Boat should be checked each day prior to departure for any problems. 6. Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jacket or buoyant work vests. 7. Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used. 8. Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet. 9. At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.
Insects Spiders	1. Tuck pants into socks. 2. Wear long sleeves. 3. Use insect repellent. 4. Avoid contact by always looking ahead to where walking, standing, sitting, leaning grabbing, lifting or reaching-in-to. 5. Check for signs of insect/spider bites, such as redness, swelling and flu-like symptoms.
Ticks	1. Do not try to detach a tick with your bare fingers; bacteria from a crushed tick may be able to penetrate even unbroken skin. Fine-tipped tweezers should be used. 2. Grip the tick as close to your skin as possible and gently pull it straight away from you until it releases its hold. 3. Do not twist the tick as you pull and do not squeeze its bloated body. That may actually inject bacteria into your skin. 4. Thoroughly wash your hands and the bite area with soap and water. Then apply an antiseptic to the bite area. 5. Save the tick in a small container with the date, the body location of the bite, and where you think the tick came from. 6. Notify the SHSO of any tick bites as soon as possible.
Poisonous Snakes	1. Avoid walking in areas where snake may nest or hide. Always look ahead to where walking for signs of snakes. 2. Use extreme caution when moving or lifting objects that could be used by snakes as cover. 3. Never reach under or behind objects or into other areas where snakes may hide. 4. Poisonous snakebites are medical emergencies - seek immediate medical treatment. 5. Wear sturdy leather boots.
Poisonous Plants (Such as Poison Ivy, Oak or Sumac).	1. Avoid entering areas infested with poisonous plants. 2. Immediately wash any areas that come into contact with poisonous plants. 3. Utilize PPE when possibility of walking into infested areas occurs.

General Hazard Or Program	General Controls
Heat Stress Shaw Procedure HS400	1. Increase water intake while working. 2. Increase number of rest breaks and/or rotate workers in shorter work shifts. 3. Watch for signs and symptoms of heat exhaustion and fatigue. 4. Monitor WBGT or pulse and oral temperature to determine work/rest periods (See Appendix B for heat stress monitoring procedures and monitoring form, per Shaw Procedure HS400). 5. Plan work for early morning or evening during hot months. 6. Use ice vests when necessary 7. Rest in cool, dry areas. 8. In the event of heat stroke, bring the victim to a cool environment and initiate first aid procedures. Immediately seek medical attention.
Cold Stress Shaw Procedure HS401	1. Take breaks in heated shelters when working in extremely cold temperatures. 2. Remove the outer layer of clothing and loosen other layers to promote evaporation of perspiration, upon entering the shelter. 3. Drink warm liquids to reduce the susceptibility to cold stress. 4. Be aware of cold stress symptoms such as shivering, numbness in the extremities and sluggishness. 5. Follow cold stress procedures in Appendix B, per Shaw Procedure HS401.
Inclement Weather	1. Stop outdoor work during electrical storms, hailstorms, and other extreme weather conditions such as extreme heat or cold temperatures. 2. Take cover indoors or in vehicle. 3. Listen to local forecasts for warning about specific weather hazards such as tornadoes, hurricanes, and flash floods.
Welding, Cutting, Brazing Shaw Procedure HS314	1. Conduct fire safety evaluation. 2. Complete Hot Work Permit using form in Appendix B. 3. Follow job safety analysis (JSA) guidelines for hot work in Appendix F. 4. Ensure flammable materials are protected from hot work, sources of ignition. 5. Ensure fire watch/fire extinguisher is on standby by hot work location. 6. Follow Shaw Procedure HS304, Compressed Gas Cylinders.
Heavy Equipment Decontamination Shaw Procedure HS303	1. Wear modified Level D protection, including a face shield and safety goggles. 2. Ensure that other personnel are out of the area prior to decontamination. 3. Secure the area around the decon pad with cones, caution tape, or barricades. 4. Ensure that safe work practices and precautions are taken to minimize the potential for physical injury from high-pressure water spray. 5. The pressure washer wand must be equipped with a safety release handle. 6. Follow Shaw Procedure HS303 for pressure washing. 7. Ensure that the area is clean after equipment is decontaminated. Barricades, cones, or caution tape must be left in place and secured at all times.
Cleaning Equipment Shaw Procedure HS303	1. Wear appropriate PPE to avoid skin and eye contact with isopropyl alcohol, Alconox, or other cleaning materials. 2. Stand upwind to minimize any potential inhalation exposure. 3. Dispose of spent cleaning solutions and rinses accordingly. 4. Follow Shaw Procedure HS303 for pressure washing.

4.0 AIR MONITORING/PPE

4.1 Air Monitoring

No air monitoring will be performed at the site unless site conditions change. If site conditions change contact HSM for guidelines.

All workers on-site must have been properly fitted with PPE (i.e., respirators) and have been trained in their use (i.e., donning and doffing). Similarly, if chemical odors are detected that are a nuisance, bothersome, or irritating, an upgrade in respiratory protection can provide an extra level of comfort or protection when conducting site activities

4.2 PPE

Based upon the hazards that may be encountered during site activities, the minimum level of PPE was selected. Only PPE that meets the following American National Standards Institute (ANSI) standards are to be worn. At a minimum, all workers will wear the following protection while working on the site:

Eye protection - ANSI Z87.1-1989
Head protection - ANSI Z89.1-1986
Foot protection - ANSI Z41-1991
Traffic vest in high traffic areas and around heavy equipment

4.2.1 Respiratory Protection

Air purifying respiratory protection may be used for protection during the course of the project. However, engineering controls and administrative controls must first be evaluated as the primary controls for protection against site respiratory hazards. In the event engineering controls and administrative controls are deemed not feasible, respiratory protection will be required.

Site personnel must also understand the limitations of using air purifying respirators and the requirements for End-of-Service Life cartridge change-out schedule for the particular type of respirator that will be used. Any site personnel requiring respiratory protection must also adhere to the site-specific respiratory protection program in Appendix C. Any questions relative to the site-specific respiratory protection program must be directed to the respective health and safety representative or project manager.

4.2.2 Project Specific Equipment

Personal protective equipment requirements for the site is identified in Table 6 (next page). The task-specific level requirements are listed in Table 7. Level D is the minimum acceptable level for the site. Upgrade to Modified Level D occurs when the possibility of contact to the skin or work uniform can occur from contaminated media. Wear hearing protection when in areas where high noise levels are generated. The following is a general description of levels of protection that may be utilized. Workers must maintain proficiency in the use and care of PPE that is to be worn.

Table 6. PPE

Level	Requirements
Level D	• Work uniform • Steel-toed boots • Approved safety glasses or goggles • Hard hat • Fluorescent vest, when vehicular traffic is on or adjacent to the site
Level D for Sample Preparation	• Work uniform • Steel-toed boots • Approved safety glasses or goggles • Fluorescent vest, when vehicular traffic is on or adjacent to the site • Apron • Hard hat when overhead obstructions are in the area
Modified Level D-1	• Level D • Nitrile gloves. • Latex booties or rubber overboots. • Hearing protection (muffs and/or plugs). • Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jacket or buoyant work vests. • Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet. • At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.
Modified Level D-2	• Level D • PE-coated Tyvek suit. • Nitrile outer and inner liner gloves. • Latex booties or rubber overboots. • Hearing protection (muffs and/or plugs).
Modified Level D-3	• Modified Level D-2 • PE-coated Tyvek suit. • Nitrile outer and inner liner gloves. • Latex booties or rubber overboots. • Faceshield • Faceshield, goggles, metatarsal/leg guards for high pressure washing
Level C	• Level D and Modified Level D-2. • NIOSH/MSHA-approved full-face respirator with organic vapor/acid gas oil proof high efficiency (P100) cartridges.
Level B	• Level D and Modified Level D • NIOSH/MSHA approved full-face positive pressure demand supplied air respirator, either airline or self-contained.
Prior to using, all equipment must be inspected to ensure proper working condition.	

Table 7. Task Specific Air Monitoring/PPE Summary

Job Task	PPE Level	Instrument	Frequency
Drilling/Boring/ Soil Sampling	Modified Level D-1		No air monitoring will be performed unless site conditions change.
General site walks not on boat	Level D		No air monitoring will be performed unless site conditions change.
Sample Preparation	Level D for Sample Preparation		No air monitoring will be performed unless site conditions change.

5.0 DECONTAMINATION

5.1 Decontamination Procedures

Operations conducted at this site have the potential to contaminate field equipment and PPE. To prevent the transfer of contamination to vehicles, administrative offices and personnel, the procedures presented in Table 8 must be followed.

Table 8. Decontamination Procedures

Item	Examples	Procedure
Field Equipment	Bailers, interface probes, hand tools, drill augers, and miscellaneous sampling equipment	Decontaminate with a solution of detergent and water; rinse with water prior to leaving the site. Protect from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.
Disposable PPE	Tyvek suits, inner latex gloves, respirator cartridges	Dispose of according to the requirements of the client and state and federal agencies. Change out respirator cartridges on a daily basis and dispose accordingly.
Non-disposable PPE	Respirators	Wipe out respirator with disinfecting pad prior to donning. Decontaminate on-site at the close of each day with a solution of an approved sanitizing solution.
	Boots and gloves	Decontaminate outside with a solution of detergent and water; rinse with water prior to leaving the site. Protect from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

All water used in decontamination procedures should be stored in portable storage tanks until sufficient amount is stockpiled to facilitate disposal treatment. Disposable sampling and PPE will be placed in plastic bags and temporarily stored in designated drums. These drums shall be disposed of according to regulatory guidelines, if necessary.

6.0 SITE CONTROL/COMMUNICATIONS

6.1 Site Control

To prevent migration of contamination from personnel and equipment, work areas will be clearly specified as designated below prior to beginning operations. Each work area will be clearly identified using signs or physical barriers.

- Exclusion Zone (EZ)
- Contamination Reduction Zone (CRZ)
- Support Zone (SZ)

A log of all personnel visiting, entering or working on the site shall be maintained by the SS/SHSO. No visitor will be allowed in the EZ without showing proof of training and medical certification, per 29 CFR 1910.120(e), (f). Visitors will attend a site orientation given by the SS/SHSO and sign the HASP.

The following are standard safe work practices that apply to all site personnel and will be discussed in the safety briefing prior to initiating work on the site:

- Eating, drinking, chewing gum or tobacco, smoking is prohibited in the EZ/CRZs.
- Hands and face must be washed upon leaving the EZ and before eating, drinking, chewing gum or tobacco and smoking.
- A buddy system will be used. Hand signals will be established to maintain communication.
- During site operations, each worker will consider himself as a safety backup to his partner. Off-site personnel provide emergency assistance.
- Visual contact will be maintained between buddies on site when performing hazardous duties.
- No personnel will be admitted to the site without the proper safety equipment, training, and medical surveillance certification.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, as established by the SS/SHSO, will be immediately dismissed from the site.
- Proper decontamination procedures must be followed before leaving the EZ.
- All employees and visitors must sign in and out of the job site and EZ.

Listed in Table 9 below are general guidelines for developing site security measures for working in a street or roadway and excavations.

Table 9. Site Security and Work Zone Definition

WORKING ON BOAT
• A Competent person should be driving the boat. • Wear Coast Guard approved flotation devices when working on/near water • Boat should be equipped with a horn or any other noise instrument for distress signals. • ABC Fire extinguishers should be on board in case of fire. • Yield to right of way with other floating vessels.
WORKING IN STREET OR ROADWAY
• Wear traffic vest and hardhat when vehicle hazard exists. • Use cones, flag-mounted cones, caution tape, and/or barricades. • Use vehicle strobe light and block area with truck. • Develop traffic flow plan for high traffic situations (as appropriate): - use flag person - use flashing arrow sign - use "MEN WORKING" signs liberally - obtain lane closing permits - engage police details

6.2 Field Communications

Communications at the work site can be accomplished by verbal and/or non-verbal means to ensure contact with all Shaw Environmental, Inc. and subcontractors. Verbal communication can be impacted by the on-site background noise and while wearing respiratory protection. Table 10 lists the type of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to ensure proper operation and all project personnel must be initially briefed on the communication methods prior to starting work and reviewed in Daily Tailgate Safety Meetings as a reminder.

Table 10. Field Communication Methods

Communication Device	Type of Communications	Signal
Telephone On-Site Or Cellular Telephone	Emergency notification	Initiate phone call using applicable emergency numbers
Two-way Radio	Emergency notification among site personnel	Initiate radio communication with Code Red message
Compressed Air Horn	Hailing site personnel for non-emergency	One long blast, one short blast
Compressed Air Horn	Hailing site personnel for emergency evacuation	Three long continuous blasts
Visual	Hailing site personnel for distress, need help	Arms waved in circle overhead
Visual	Hailing site personnel for emergency evacuation	Arms waved in criss-cross over head
Visual	Contaminated air/strong odor	Hands clutching throat
Visual	Break, lunch, end of day	Two hands together, break apart

7.0 EMERGENCY RESPONSE AND CONTINGENCY PLAN

Table 11 presents pre-emergency situations which warrant implementation of the Emergency Response and Contingency Plan (ERCP). In the event of an emergency situation, immediate action must be taken by the first person to recognize the event.

Table 11. Pre-emergency Plan for Site Emergencies

Situation	Action
Evacuation/ Natural Disaster	• Any situation which can potentially cause serious injury or death. • Notification of a facility or plant evacuation. • A rainstorm exceeds the flash flood level. • The facility is in a projected tornado path or a tornado has damaged facility property. • Severe wind gusts are forecasted or have occurred and have caused damage to the facility.
Medical Emergency	• Overexposure to hazardous materials. • Trauma injuries (broken bones, severe lacerations/bleeding, burns). • Eye/skin contact with hazardous materials. • Loss of consciousness. • Heat stress (Heat stroke). • Heart attack. • Respiratory failure. • Allergic reaction.
Fire Emergency	• The potential for human injury exists. • Toxic fumes or vapors are released. • The fire could spread on site or off site and possibly ignite other flammable materials or cause heat-induced explosions. • The use of water and/or chemical fire suppressants could result in contaminated run-off. • An imminent danger of explosion exists.
Spill or Release of Hazardous Materials	• The spill could result in the release of flammable liquids or vapors, thus causing a fire or gas explosion hazard. • The spill could cause the release of toxic liquids or fumes in sufficient quantities or in a manner that is hazardous to or could endanger human health
Spill or Release of High Temperature Liquid or Vapor	• The spill can be contained on site, but the potential exists for groundwater contamination. • The spill cannot be contained on site, resulting in off-site soil contamination and/or ground water or surface water pollution. • The spill quantity is greater than the reportable quantity limit for the material.

PRE-EMERGENCY MEASURES

The following measures will be taken to assure the availability of adequate equipment and manpower resources:

- Sufficient equipment and materials will be kept on site and dedicated for emergencies only. The inventory will be replenished after each use.
- On-site emergency responders will be current in regards to training and medical surveillance programs. Copies of all applicable certificates will be kept on file for on-site personnel required to respond.
- It will be the responsibility of the emergency coordinator to brief the on-site response team on anticipated hazards at the site. The emergency coordinator shall also be responsible for anticipating and requesting equipment that will be needed for response activities.
- Emergency response activities will be coordinated with the Local Emergency Management Agency (EMA) in compliance with SARA Title III requirements.
- Communications will be established prior to commencement of any activities at the remediation site. Communication will be established so that all responders on site have availability to all pertinent information to allow them to conduct their activities in a safe and healthful manner. The primary communication device will be two-way radios. Air horns may be used to alert personnel of emergency conditions. A telephone will be located at the command post to summon assistance in an emergency.
- Primary communication with local responders in the event of an emergency will be accomplished using commercial telephone lines.

Emergency Recognition and Prevention

Because unrecognized hazards may result in emergency incidents, it will be the responsibility of the Site Manager and the Site Safety Officer, through daily site inspections and employee feedback (Safety Observation Program, daily safety meetings, and job safety analyses) to recognize and identify all hazards that are found at the site. These may include:

Chemical Hazards	• Materials at the site • Materials brought to the site
Physical Hazards	• Fire/explosion • Slip/trip/fall • Electrocution • Confined space • IDLH atmospheres • Excessive noise
Mechanical Hazards	• Heavy equipment • Stored energy system • Pinch points • Electrical equipment • Vehicle traffic
Environmental Hazards	• Electrical Storms • High winds • Heavy Rain/Snow • Temperature Extremes (Heat/Cold Stress)Poisonous Plants/Animals

Once a hazard has been recognized, the SS and the SHSO will take immediate action to prevent the hazard

from becoming an emergency. This may be accomplished by the following:

- Daily safety meeting
- Task-specific training prior to commencement of activity
- Personal Protective Equipment (PPE) selection/use
- Written and approved permits for hot work, confined space
- Trenching/shoring procedure
- Air monitoring
- Following all Shaw standard operating procedures
- Practice drills for fire, medical emergency, and hazardous substances spills

Personnel Roles, Lines Of Authority, And Communications

This section of the ERCP describes the various roles, responsibilities, and communication procedures that will be followed by personnel involved in emergency responses.

The primary emergency coordinator for this site is the SS. In the event an emergency occurs and the emergency coordinator is not on site, the SS or the highest-ranking employee on site will serve as the emergency coordinator until he arrives. The emergency coordinator will determine the nature of the emergency and take appropriate action as defined by this ERCP.

The emergency coordinator will implement the ERCP immediately as required. The decision to implement the plan will depend upon whether the actual incident threatens human health or the environment. Immediately after being notified of an emergency incident, the emergency coordinator or his designee will evaluate the situation to determine the appropriate action.

Responsibilities and Duties

This section describes the responsibilities and duties assigned to the emergency coordinator.

It is recognized that the structure of the "Incident Command System" will change as additional response organizations are added. Shaw will follow procedures as directed by the fire department, LEPC, State and Federal Agencies as required. Shaw will defer to the local Fire Department chief to assume the role of Incident Commander upon arriving on site. Additional on-site personnel may be added to the Site Emergency Response Team as required to respond effectively.

On-Site Emergency Coordinator Duties

The on-site emergency coordinator is responsible for implementing and directing the emergency procedures. All emergency personnel and their communications will be coordinated through the emergency coordinator. Specific duties are as follows:

- Identify the source and character of the incident, type and quantity of any release. Assess possible hazards to human health or the environment that may result directly from the problem or its control.
- Discontinue operations in the vicinity of the incident if necessary to ensure that fires, explosions, or spills do not recur or spread to other parts of the site. While operations are dormant, monitor for leaks, pressure build-up, gas generation, or ruptures in valves, pipes, or other equipment, where appropriate.

- Notify local Emergency Response Teams if their help is necessary to control the incident. The Site Emergency Form provides telephone numbers for emergency assistance.
- Direct on-site personnel to control the incident until, if necessary, outside help arrives.
- Ensure that the building or area where the incident occurred and the surrounding area are evacuated and shut off possible ignition sources, if appropriate. The Emergency Response Team is responsible for directing site personnel such that they avoid the area of the incident and leave emergency control procedures unobstructed.
- If fire or explosion is involved, notify facility Fire Department.
- Notify Client Representative
- Notify Shaw Project Manager
- Have protected personnel, in appropriate PPE, on standby for rescue.
- If the incident may threaten human health or the environment outside of the site, the emergency coordinator should immediately determine whether evacuation of area outside of the site may be necessary and, if so, notify the Police Department and the Office of Emergency Management.
- When required, notify the National Response Center. The following information should be provided to the National Response Center:

    - Name and telephone number
    - Name and address of facility
    - Time and type of incident
    - Name and quantity of materials involved, if known
    - Extent of injuries
    - Possible hazards to human health or the environment outside of the facility.

- The emergency telephone number for the National Response Center is 800-424-8802.
- If hazardous waste has been released or produced through control of the incident, ensure that:
- Waste is collected and contained.
- Containers of waste are removed or isolated from the immediate site of the emergency.
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided.
- Ensure that no waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed.
- Ensure that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

Safe Distances And Places Of Refuge

The emergency coordinator for all activities will be the SS. No single recommendation can be made for evacuation or safe distances because of the wide variety of emergencies that could occur. Safe distances can only be determined at the time of an emergency based on a combination of site and incident-specific criteria. However, the following measures are established to serve as general guidelines:

- In the event of minor hazardous materials releases (small spills of low toxicity), workers in the affected area will report initially to the CRZ. Small spills or leaks (generally less than 55 gallons) will require initial evacuation of at least 50 feet in all directions to allow for cleanup and to prevent exposure. After initial assessment of the extent of the release and potential hazards, the emergency coordinator or his

designee will determine the specific boundaries for evacuation. Appropriate steps such as caution tape, rope, traffic cones, barricades, or personal monitors will be used to secure the boundaries.

- In the event of a major hazardous material release (large spills of high toxicity/greater than 55 gallons), workers will be evacuated from the building/site. Workers will assemble at the entrance to the site for a head count by their foremen and to await further instruction.
- If an incident may threaten the health or safety of the surrounding community, the public will be informed and, if necessary, evacuated from the area. The emergency coordinator or his designee will inform the proper agencies in the event that this is necessary. Telephone numbers are listed on the SITE EMERGENCY FORM ON p iv.

- Places of refuge will be established prior to the commencement of activities. These areas must be identified for the following incidents:

    - Chemical release
    - Fire/explosion
    - Power loss
    - Medical emergency
    - Hazardous weather

- In general, evacuation will be made to the crew trailers, unless the emergency coordinator determines otherwise. It is the responsibility of the emergency coordinator to determine when it is necessary to evacuate personnel to off-site locations.
- In the event of an emergency evacuation, all the employees will gather at the entrance to the site until a head count establishes that all are present and accounted for. No one is to leave the site without notifying the emergency coordinator.

Evacuation Routes And Procedures

All emergencies require prompt and deliberate action. In the event of an emergency, it will be necessary to follow an established set of procedures. Such established procedures will be followed as closely as possible. However, in specific emergency situations, the emergency coordinator may deviate from the procedures to provide a more effective plan for bringing the situation under control. The emergency coordinator is responsible for determining which situations require site evacuation.

Evacuation Signals and Routes

Two-way radio communication and an air horn will be used to notify employees of the necessity to evacuate an area or building involved in a release/spill of a hazardous material. Each crew supervisor will have a two-way radio. A base station will be installed in the Shaw office trailer to monitor for emergencies. Only the emergency coordinator will initiate total site evacuation, however, in his absence, decision to preserve the health and safety of employees will take precedence. Evacuation routes will be posted in each outside work area. Signs inside buildings will be posted on walls or other structural element of a building. Periodic drills will be conducted to familiarize each employee with the proper routes and procedures.

Evacuation Procedures

In the event evacuation is necessary, the following actions will be taken:

- The emergency signal will be activated.

- No further entry of visitors, contractors, or trucks will be permitted. Vehicle traffic within the site will cease in order to allow safe exit of personnel and movement of emergency equipment.
- Shut off all machinery if safe to do so.
- ALL on-site personnel, visitors, and contractors in the SZ will assemble at the entrance to the site for a head count and await further instruction from the emergency coordinator.
- ALL persons in the exclusion zone and contamination reduction zone will be accounted for by their immediate crew leaders (e.g., foreman). Leaders will determine the safest exits for employees and will also choose an alternate exit if the first choice is inaccessible.
- During exit, the crew leader should try to keep the group together. Immediately upon exit, the crew leader will account for all employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the emergency coordinator.
- Contract personnel and visitors will also be accounted for.
- The names of emergency response team members involved will be reported to the emergency spill control coordinator.
- The emergency coordinator or designee will make a final tally of persons. No attempt to find persons not accounted for will involve endangering lives of Shaw or other employees by re-entry into emergency areas.
- In all questions of accountability, immediate crew leaders will be held responsible for those persons reporting to them. Visitors will be the responsibility of those employees they are seeing. Contractors and truck drivers are the responsibility of the SS. The security guard will aid in accounting for visitors, contractors, and truckers by reference to sign-in sheets available from the guard shack.
- Personnel will be assigned by the emergency coordinator to be available at the main gate to direct and brief emergency responders.
- Re-entry into the site will be made only after the emergency coordinator gives clearance. At his direction, a signal or other notification will be given for re-entry into the facility.
- Drills will be held periodically to practice all of these procedures and will be treated with the same seriousness as an actual emergency.

Emergency Spill Response Procedures And Equipment

In the event of an emergency involving a hazardous material spill or release, the following general procedures will be used for rapid and safe response and control of the situation. Emergency contacts found the SITE EMERGENCY FORM (p iv), providing a quick reference guide to follow in the event of a major spill.

Notification Procedures

If an employee discovers a chemical spill or process upset resulting in a vapor or material release, he or she will immediately notify the on-site emergency coordinator.

- On-site Emergency Coordinator will obtain information pertaining to the following:
- The material spilled or released.
- Location of the release or spillage of hazardous material.
- An estimate of quantity released and the rate at which it is being released.
- The direction in which the spill, vapor or smoke release is heading.
- Any injuries involved.
- Fire and/or explosion or possibility of these events.

- The area and materials involved and the intensity of the fire or explosion.
- This information will help the on-site emergency coordinator to assess the magnitude and potential seriousness of the spill or release.

Procedure for Containing/Collecting Spills

The initial response to any spill or discharge will be to protect human health and safety, and then the environment. Identification, containment, treatment, and disposal assessment will be the secondary response.

If for some reason a chemical spill is not contained within a dike or sump area, an area of isolation will be established around the spill. The size of the area will generally depend on the size of the spill and the materials involved. If the spill is large (greater than 55 gallons) and involves a tank or a pipeline rupture, an initial isolation of at least 100 ft. in all directions will be used. Small spills (less than or equal to 55 gallons) or leaks from a tank or pipe will require evacuation of at least 50 ft. in all directions to allow cleanup and repair and to prevent exposure. When any spill occurs, only those persons involved in overseeing or performing emergency operations will be allowed within the designated hazard area. If possible the area will be roped or otherwise blocked off.

If the spill results in the formation of a toxic vapor cloud (by reaction with surrounding materials or by outbreak of fire) and its release (due to high vapor pressures under ambient conditions), further evacuation will be enforced. In general an area at least 500 feet wide and 1,000 feet long will be evacuated downwind if volatile materials are spilled. (Consult the DOT Emergency Response Guide for isolation distances for listed hazardous materials.)

If an incident may threaten the health or safety of the surrounding community, the public will be informed and possibly evacuated from the area. The on-site emergency coordinator will inform the proper agencies in the event this is necessary. (Refer to the SITE EMERGENCY FORM-Page iv).

As called for in regulations developed under the Comprehensive Environmental Response Compensation Liability Act of 1980 (Superfund), Shaw's practice is to report a spill of a pound or more of any hazardous material for which a reportable quantity has not been established and which is listed under the Solid Waste Disposal Act, Clean Air Act, Clean Water Act, or TSCA. Shaw also follows the same practice for any substances not listed in the Acts noted above but which can be classified as a hazardous waste under RCRA.

Clean up personnel will take the following measures:

- Make sure all unnecessary persons are removed from the hazard area.
- Put on protective clothing and equipment.
- If a flammable material is involved, remove all ignition sources, and use spark and explosion proof equipment for recovery of material.
- Remove all surrounding materials that could be especially reactive with materials in the waste. Determine the major components in the waste at the time of the spill.
- If wastes reach a storm sewer, try to dam the outfall by using sand, earth, sandbags, etc. If this is done, pump this material out into a temporary holding tank or drums as soon as possible.

- Place all small quantities of recovered liquid wastes (55 gallons or less) and contaminated soil into drums for incineration or removal to an approved disposal site.
- Spray the spill area with foam, if available, if volatile emissions may occur.
- Apply appropriate spill control media (e.g. clay, sand, lime, etc.) to absorb discharged liquids.
- For large spills, establish diking around leading edge of spill using booms, sand, clay or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank.

Emergency Response Equipment

The following equipment will be staged in the support zone and throughout the site, as needed, to provide for safety and first aid during emergency responses (Emergency eyewash equipment meets ANSI Standard):

- ABC-type fire extinguisher
- First-aid kit, industrial size
- Eyewash/safety shower
- Emergency signal horn

In addition to the equipment listed above, Shaw maintains direct reading instrumentation that may be used in emergency situations to assess the degree of environmental hazard. This equipment will only be used by the SHSO or other specially trained personnel. This equipment will be stored, charged and ready for immediate use in evaluating hazardous chemical concentrations. The equipment will be located at the Shaw office trailer.

EQUIPMENT NAME	APPLICATION
PID	Measures volatile organic compounds
LEL/O2	Measures for potential flammable and oxygen (enriched/deficient) atmospheres

Emergency Spill Response Clean-Up Materials and Equipment

A sufficient supply of appropriate emergency response clean-up and personal protective equipment will be inventoried and inspected, visually, on a weekly basis.

The materials listed below may be kept on site for spill control, depending on the types of hazardous materials present on site. The majority of this material will be located in the support zone, in a supply trailer or storage area. Small amounts will be placed on pallets and located in the active work areas.

Appropriate solvents, e.g., CITRIKLEEN, for decontamination of structures or equipment.
Sand or clay to solidify/absorb liquid spills.
The following equipment will be kept on site and dedicated for spill cleanup:

- Plastic shovels for recovering corrosive and flammable materials.
- Sausage-shaped absorbent booms for diking liquid spills, drains, or sewers.
- Sorbent sheets (diapers) for absorbing liquid spills.
- Overpack drums for containerizing leaking drums.

- 55-gallon open-top drums for containerization of waste materials.

NOTE: All contaminated soils, absorbent materials, solvents and other materials resulting from the clean-up of spilled or discharged substances shall be properly stored, labeled, and disposed of off-site.

EMERGENCY CONTINGENCY PLAN

This section of the ERCP details the contingency measures Shaw will take to prepare for and respond to fires, explosions, spills and releases of hazardous materials, hazardous weather, and medical emergencies.

Medical Emergency Contingency Measures

The procedures listed below will be used to respond to medical emergencies. The SHSO will contact the local hospital and inform them of the site hazards and potential emergency situations. A minimum of two First-Aid/CPR trained personnel will be maintained on site.

Response

The nearest workers will immediately assist a person who shows signs of medical distress or who is involved in an accident. The work crew supervisor will be summoned.

The work crew supervisor will immediately make radio contact with the on-site emergency coordinator to alert him of a medical emergency situation. The supervisor will advise the following information:

- Location of the victim at the work site
- Nature of the emergency
- Whether the victim is conscious
- Specific conditions contributing to the emergency, if known

The Emergency Coordinator will notify the SHSO. The following actions will then be taken depending on the severity of the incident:

Life-Threatening Incident

If an apparent life-threatening condition exists, the crew supervisor will inform the emergency coordinator by radio, and the local Emergency Response Services (EMS) will be immediately called. An on-site person will be appointed who will meet the EMS and have him/her quickly taken to the victim. Any injury within the EZ will be evacuated by Shaw personnel to a clean area for treatment by (EMS) personnel. No one will be able to enter the EZ without showing proof of training, medical surveillance and site orientation.

Non Life-Threatening Incident

If it is determined that no threat to life is present, the SS will direct the injured person through decontamination procedures (see below) appropriate to the nature of the illness or accident. Appropriate first aid or medical attention will then be administered.

*NOTE: The area surrounding an accident site must not be disturbed until the scene has been cleared by the SS.

Any personnel requiring emergency medical attention will be evacuated from exclusion and contamination reduction zones if doing so would not endanger the life of the injured person or otherwise aggravate the injury. Personnel will not enter the area to attempt a rescue if their own lives would be threatened. The decision whether or not to decontaminate a victim prior to evacuation is based on the type and severity of

the illness or injury and the nature of the contaminant. For some emergency victims, immediate decontamination may be an essential part of life-saving first aid. For others, decontamination may aggravate the injury or delay life-saving first aid. Decontamination will be performed if it does not interfere with essential treatment.

If decontamination can be performed, observe the following procedures:

- Wash external clothing and cut it away.
- If decontamination cannot be performed, observe the following procedures.
- Wrap the victim in blankets or plastic to reduce contamination of other personnel.
- Alert emergency and off-site medical personnel to potential contamination, instruct them about specific decontamination procedures.
- Send site personnel familiar with the incident and chemical safety information, e.g. MSDS, with the affected person.
- All injuries, no matter how small, will be reported to the SS and SHSO. An accident/injury/illness report will be completely and properly filled out and submitted to the Health and Safety Director/Project CIH, in accordance with Shaw's reporting procedures.
- A list of emergency telephone numbers is given on the SITE EMERGENCY FORM (p iv).

Notification

The following personnel/agencies will be notified in the event of a medical emergency:

- Local Fire Department or EMS
- On-site Emergency Coordinator
- Workers in the affected areas
- Client Representative

Fire Contingency Measures

Shaw personnel and subcontractors are not trained professional firefighters. Therefore, if there is any doubt that a fire can be quickly contained and extinguished, personnel will notify the emergency coordinator by radio and vacate the structure or area. The emergency coordinator will immediately notify the local Fire Department.

The following procedures will be used to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be kept away from where flammable materials are handled or stored.
- The air will be monitored for explosivity before and during hot work and periodically where flammable materials are present. Hot work permits will be required for all such work.
- "No smoking" signs will be conspicuously posted in areas where flammable materials are present.
- Fire extinguishers will be placed in all areas where a fire hazard may exist.
- Before workers begin operations in an area the foreman will give instruction on egress procedures and assembly points. Egress routes will be posted in work areas and exit points clearly marked.

Response

The following procedures will be used in the event of a fire:

- Anyone who sees a fire will notify his or her supervisor who will then contact the Emergency Coordinator by radio. The emergency coordinator will activate the emergency air horns and contact the local Fire Department.
- When the emergency siren sounds, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will be comprised of pairs of workers (buddy system) who join each other immediately after hearing the fire alarm and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count.
- When a worker has extinguished a small fire, the emergency coordinator will be notified.

Hazardous Weather Contingency Measures

Operations will not be started or continued when the following hazardous weather conditions are present:

- Lightning
- Heavy Rains/Snow
- High Winds

Response

- Excavation/soil stockpiles will be covered with plastic liner.
- All equipment will be shut down and secured to prevent damage.
- Personnel will be moved to safe refuge, initially crew trailers. The emergency coordinator will determine when it is necessary to evacuate personnel to off-site locations and will coordinate efforts with fire, police and other agencies.

Notification

The emergency coordinator will be responsible for assessing hazardous weather conditions and notifying personnel of specific contingency measures. Notifications will include:

- Shaw employees and subcontractors
- Client Representative
- Local Emergency Management Agency

Spill/Release Contingency Measures

In the event of release or spill of a hazardous material the following measures will be taken:

Response

Any person observing a spill or release will act to remove and/or protect injured/contaminated persons from any life-threatening situation. First aid and/or decontamination procedures will be implemented as appropriate.

First aid will be administered to injured/contaminated personnel. Unsuspecting persons/vehicles will be warned of the hazard. All personnel will act to prevent any unsuspecting persons from coming in contact with spilled materials by alerting other nearby persons. Attempt to stop the spill at the source, if possible.

Without taking unnecessary risks, personnel will attempt to stop the spill at the source. This may involve activities such as uprighting a drum, closing a valve or temporarily sealing a hole with a plug.

Utilizing radio communications, the emergency coordinator will be notified of the spill/release, including information on material spilled, quantity, personnel injuries and immediate life threatening hazards. Air monitoring will be implemented by the emergency coordinator and SHSO to determine the potential impact on the surrounding community. Notification procedures will be followed to inform on-site personnel and off-site agencies. The emergency coordinator will make a rapid assessment of the spill/release and direct confinement, containment and control measures. Depending upon the nature of the spill, measures may include:

- Construction of a temporary containment berm utilizing on-site clay absorbent earth
- Digging a sump, installing a polyethylene liner and
- Diverting the spill material into the sump placing drums under the leak to collect the spilling material before it flows over the ground
- Transferring the material from its original container to another container

The emergency coordinator will notify the client representative of the spill and steps taken to institute clean up. Emergency response personnel will clean up all spills following the spill clean-up plan developed by the emergency coordinator. Supplies necessary to clean up a spill will be immediately available on-site. Such items may include, but are not limited to:

- Shovel, rake
- Clay absorbent
- Polyethylene liner
- Personal safety equipment
- Steel drums
- Pumps and miscellaneous hand tools

The major supply of material and equipment will be located in the Support Zone. Smaller supplies will kept at active work locations. The emergency coordinator will inspect the spill site to determine that the spill has been cleaned up to the satisfaction of the client representative. If necessary, soil, water or air samples may be taken and analyzed to demonstrate the effectiveness of the spill clean-up effort. The emergency coordinator will determine the cause of the spill and determine remedial steps to ensure that recurrence is prevented. The emergency coordinator will review the cause with the client representative and obtain his concurrence

APPENDICES

APPENDIX A

SAFETY PLAN ACKNOWLEDGEMENT

WORKER ACKNOWLEDGEMENT TO HEALTH-AND-SAFETY PLAN

I HAVE READ THE SITE-SAFETY PLAN FOR THIS SITE AND FULLY UNDERSTAND ITS CONTENTS.

DATE	NAME	COMPANY

APPENDIX A
SAFETY PLAN ACKNOWLEDGEMENT
WORKER ACKNOWLEDGEMENT TO HEALTH-AND-SAFETY PLAN

I HAVE READ THE SITE-SAFETY PLAN FOR THIS SITE AND FULLY UNDERSTAND ITS CONTENTS.

DATE	NAME	COMPANY

APPENDIX B

H&S SITE LOGS AND FORMS

SHAW ENVIRONMENTAL, INC.
HASP AMENDMENT

Project Name:

Project Number:

PM:

Location:

Changes in field activities or hazards:

Approved by:

Project Manager:_____ Date:_____

Health and Safety:_____ Date:_____
Representative

DRILLING SAFETY CHECKLIST

Site Name_____ Project #_____

Your Name_____ Drilling Co._____

Signature_____ Signature_____

Do not proceed with today's work until this checklist is completed

_____Are your subcontractors wearing the correct PPE?

_____Hard Hats _____Ear Protection _____Safety Glasses

_____Chemical Protection _____Steel-toed Boots

_____Have you designated a smoking and eating area?

_____Have you completed a Tailgate Safety Meeting?

_____Has the Health and Safety Plan been reviewed and signed?

_____Do you have a cell phone or know the location of the nearest pay phone?

_____Do you know the emergency procedures and where first aid kit is?

_____Is someone CPR/First Aid trained with current certifications?

_____Did you complete the underground/overhead utility checklist and reviewed/followed requirements?

_____Have the utilities been marked out?

_____Have you contacted the Project Manager or Site Manager if the utilities have not been marked?

_____Pink: temporary survey markings _____green: sewer

_____Yellow: natural gas, oil, steam _____blue: water

_____Orange: communications _____red: electric

_____White: proposed boring locations

Are your borings:

_____10/20 feet away from overhead lines (shielded and unshielded respectively)?

_____5 feet away from non-natural gas utilities?

_____10 feet away from natural gas lines?

_____3 feet away from concrete/asphalt scars/joints or repaved areas?

_____Are you prepared to hand dig to 5 feet?

_____Have any fiber optic lines been identified on site?

_____If so, did you complete a fiber optics plan? (see Appendix F of HASP Appendix for form)

_____Do you have enough barricades/cones to delineate the work zone?

_____Is there spill control equipment at the site?

_____Are your borings a minimum of 15 feet away from the fiber optic line mark outs?

_____Do you have a copy of all access agreements?

_____Did you give a copy of the drill rig inspection checklist to the subcontractor to complete?

_____Did the subcontractor lead driller perform the daily inspection and complete the checklist?

_____Are the kill switches working properly?

_____Have you eliminated tripping hazards to best of your ability?

_____Has your driller and driller's helper removed all of their jewelry and there is no loose clothing?

_____Are you prepared to perform air monitoring?

_____Have you calibrated your monitoring instruments and documented it on the air monitoring forms?

_____Do your drillers have all the supplies that they need and do they have the labor required?

_____Remember, the field geologist or field representative do not perform driller's tasks.

CONTACT YOUR HEALTH AND SAFETY REPRESENTATIVE IN THE EVENT OF PROBLEMS, NON COMPLIANCE ISSUES, AND ANY INCIDENTS, ACCIDENTS, OR NEAR MISSES.

DRILL RIG INSPECTION CHECKLIST
(DRILLING SUBCONTRACTOR TO COMPLETE)

ITEMS TO CHECK	OK	ACTION NEEDED
Kill switches installed by the manufacturer are in operable condition and all workers at the drill site are familiar with their location and how to activate them?		
Kill switches are accessible to workers on both sides of the rotating stem? NOTE: Optional based on location and number of switches provided by the manufacturer.		
Cables on drill rig are free of kinks, frayed wires, bird cages and worn or missing sections?		
Cables are terminated at the working end with a proper eye splice, either swaged Coupling or using cable clamps?		
Cable clamps are installed with the saddle on the live or load side? Clamps should not be alternated and should be of the correct size and number for the cable size to which it is installed. Clamps are complete with no missing parts?		
Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation?		
Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load?		
Drive shafts, belts, chain drives and universal joints shall be guarded to prevent accidental insertion of hands and fingers or tools.		
Outriggers shall be extended prior to and whenever the boom is raised off its cradle. Hydraulic outriggers must maintain pressure to continuously support and stabilize the drill rig even while unattended.		
Outriggers shall be properly supported on the ground surface to prevent settling into the soil.		
Controls are properly labeled and have freedom of movement? Controls should not be blocked or locked in an action position.		
Safeties on any device shall not be bypassed or neutralized.		

Controls shall be operated smoothly and cables and lifting devices shall not be jerked or operated erratically to overcome resistance.		
Slings, chokers and lifting devices are inspected before using and are in proper working order? Damaged units are removed from service and are properly tagged?		
Shackles and clevises are in proper working order and pins and screws are fully inserted before placing under a load?		
High pressure hoses have a safety (chain, cable or strap) at each end of the Hose section to prevent whipping in the event of a failure?		
Rotating parts of the drill string shall be free of sharp projections or hooks which could entrap clothing or foreign objects?		
Wire ropes should not be allowed to bend around sharp edges without cushion material.		
The exclusion zone is centered over the borehole and the radius is equal or greater than the boom height?		
The work area around the borehole shall be kept clear of trip hazards and walking surfaces should be free of slippery material.		
Workers shall not proceed higher than the drilling deck without a fall restraining device and must attach the device in a manner to restrict fall to less than 6 feet.		
A fire extinguisher of appropriate size shall be immediately available to the drill crew. The drill crew shall have received annual training on proper use of the fire extinguisher.		
29 CFR 1910.333 (3) Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to, under, by, or near power lines only in accordance with the following: .333 (3) (ii) 50KV or less -minimum clearance is 10 ft. For 50 KV or over, add 0.4 inches for every KV over 50 KV. If voltage is unknown, maintain at least 20 feet clearance.		
29 CFR 1910.333 (3) (iii) While the rig is in transit with the boom in the down position, clearance from energized power lines will be maintained as follows: Less than 50 KV - 4 feet 50 thru 365 KV - 10 feet 365 thru 720 KV - 16 feet		

REAL TIME AIR MONITORING LOG
(PID/FID/LEL/O2)

PROJECT NAME _____PROJECT LOCATION_____PROJECT No._____

Date	Analyst	Time	**Manufacturer** Model/Serial No.	Concentration (Units)	Location/Activity

PID/FID DETECTOR
CALIBRATION LOG

Project Name_____ Project No._____ Date_____

Calibrated by_____ Instrument: Mfg/Model/SerialNo._____

Time	Probe Type	Battery Charged (Y/N)	Calibration Standard	Calibration Standard Concentration (ppm)	Span Setting	Meter Scale Setting	Zeroed (Y/N)	Expected Meter Reading (ppm)	Actual Meter Reading (ppm)

COMBUSTIBLE GAS/OXYGEN METER CALIBRATION LOG

Project Name_____ Project_____

Date_____ Calibrated by_____

Instrument: Mfg/Model/Serial No._____

Time	Battery Charged (Y/N)	Audible Alarm Check (Y/N)		Zero Checked (Y/N)		Calibration Standard	Calibration Standard (%)		Actual Meter Reading (%)		Ambient Air Rezero Check	
		LEL	O_2	LEL (0%)	O_2 (20.8%)		LEL	O_2	LEL	O_2	LEL (0%)	O_2 (20.8%)

COLORIMETRIC DETECTOR TUBE LOG

Project Name_____ Project No. _____ Date_____

Pump Type, Mfg/Model/Serial No._____Sampled by_____

Time	Detector Tube Type/ (Expiration Date)	Measurable Range	Pump Leak Test (Y/N)	Pump Strokes	Measured Concentration	Comments

REAL TIME AEROSOL MONITORING LOG

Project Name_____ Project No._____

Date_____

Sampled By	Instrument Type (Mfg/Model/Serial No.)	Battery Charged (Y/N)	Zeroed (Y/N)	Sample Time		Sample Readings (mg/m^3)			Comments
				Start	Finish	TWA	Shift Average	Direct	

General Weather Conditions:_____

_____

NOISE SURVEY RECORD

COMPANY LOCATION_____ SURVEY DATE_____

SURVEYOR_____ FACTORY CAL DATE_____

SURVEY INSTRUMENT_____ SERIAL NO./UNIT_____CALIB._____

Start of Day:

Turn unit on
Check battery
Calibrate: record data
Place unit on Employee, or in work area
Turn on unit & record time

End of Day:

1. Record time off
2. Check battery
3. Read unit, record dB or dose
4. Recalibrate: record data

WORK AREA	EMPLOYEE NAME	CALIBRATION/ READING START/FINISH		TIME ON	TIME OFF	DURATION OF TEST	READING %/dB	FULL WORKDAY EXPOSURE %	EQUIV. SOUND LEVEL	COMMENTS TYPICAL DUTIES, WORK LOAD, ETC.

H&Sform/NoiseSurvey/JCP/April99

SHAW ENVIRONMENTAL, INC.
UNDERGROUND UTILITY CONTACT PREVENTION AND MANAGEMENT PLAN

Check Off Each Section When Complete. Check list Must be Placed into the Project File

STEPS	TASK DESCRIPTION	RESPONSIBLE EMPLOYEE
1	Obtain site blueprints or as built drawings from client, if available, to show buried utilities (Electric Power Line, Natural Gas Line, Telephone Line, Water Line, Product Line, Steam Line, Sewer Line, Drain Line, Underground Tank, Overhead Power Line, Overhead Product Line, Septic Tank or /Drain lines). If site blueprints are not available other methods must be employed to identify subsurface conduits in the field. Examples include private contracted utility locators (capable of finding the types of suspected on-site utilities such as PVC piping, fiber optics, etc.), a hand-held utility location device, visual observations (cut pavement or concrete, signs and overhead lights, water, electric, and gas meters, etc.), and customer personnel with knowledge of utility locations. As many tools as practicable must be used to attempt to find all known/suspect utilities. Mark out any proposed digging locations with white survey paint.	PM PM and/or field personnel
2	Contact underground utility locating services service at least a minimum of 48 or 72 hours before the scheduled site work. (Check with the state for notification requirements). Give service proposed dates of drilling/excavation, dates, and location. If possible, arrange a site visit with the client, facilities maintenance manager, or other site-knowledgeable people to verify, utility and drilling/excavation locations. Note: At a minimum, excavation subcontractors will be required to supply sufficient labor to complete all requested installation tasks.	PM Assistant for contacting appropriate local utility locating service and/or field personnel PM

STEPS	TASK DESCRIPTION	RESPONSIBLE EMPLOYEE
3	The Health and Safety Plan (HASP) must be amended to include any emergency telephone numbers for all utility companies identified during the notification process.	PM will provide updated information to the safety coordinator.
4	On the day that on-site activities are scheduled to begin, at the first tailgate safety meeting, the locations of all known/suspect utilities (subgrade and overhead) must be reviewed with all field personnel (Shaw and all subcontractors). Make sure that all underground utility locator markings are visible for each noted utility, etc. Note any discrepancies. Visually inspect for undocumented trenches, laterals, etc. that may be visible as discolored areas, patched pavement, etc. and not marked accordingly. Complete the Underground/Overhead Utility checklist.	PM and/or field personnel PM and/or field personnel
5	Pre-screen each drilling/digging location by hand auguring and/or post hole digging to a depth of at least 3 to 5 feet using a clam-shell style post hole digger and/or hand auger that is at least as large as the OD of the drill bit or other drilling devices. As appropriate use a fiberglass pointed probe, insulated line-men's gloves, or other similar material in soils capable of probe utilization. As applicable use the Shaw lockout/tagout procedure when there are electrical utilities suspected on the site. Inspect excavation periodically with a flashlight to check for visual obstructions. Stop immediately upon encountering any substantial resistance to hand auger and/or post hole digger.	Subcontractors to conduct hand auguring and/or post hole digging under Shaw oversight.
6	During excavation/trenching activities, pavement/concrete work, use barricades and place cones with flags to mark a 10-foot distance from a located utility.	Field personnel

STEPS	TASK DESCRIPTION	RESPONSIBLE EMPLOYEE
7 Encounter	In the event that a subsurface or overhead utility is encountered, immediately stop all operations and secure the area. Try to determine the source (i.e.,electric power line, natural gas line, telephone line, water line, product line, steam line, sewer line, drain line, underground tank, overhead power line, overhead product line, septic tank or /drain lines, etc.)	Shaw field personnel secures area and contacts PM immediately.
	Contact the emergency numbers for that utility and the PM immediately so they can shut off the utility. Take the necessary safety precautions that all personnel are kept away from the area.	PM contacts client, etc., to discuss appropriate actions.
	Monitor the area using the LEL, O_2, and PID for other substances that may be present as appropriate for that utility encounter (i.e., gas line).	Shaw field personnel contacts local emergency officials as necessary (i.e., fire, police, EPA, public works, etc.).
	Complete a property damage assessment report by close of business on day of incident.	
	PM submits Incident Investigation Report (final in 72 hours, begun as soon as incident is under control) to appropriate Shaw management where a follow-up report. Report is prepared and issued	

UNDERGROUND/OVERHEAD UTILITY CHECKLIST

Project Name/Number: _____ **Date:** _____

Location: _____

This checklist must be completed for any intrusive subsurface work such as trenching, excavating, pavement or concrete work, or drilling. It records the fact that all underground and overhead structures and utilities in the work area are identified and found. The Project Manager must request utility markouts before the start of field operations to allow the client and utility companies time to complete them. If complete information is not available, a magnetometer survey must be performed to find obstacles before trenching, excavating, or drilling.

Procedure

A diagram of the project area depicting the proposed location of trenching, excavation, or drilling sites must be attached to this HASP. The diagram must clearly indicate the areas checked for underground structures/utilities, and overhead power lines. This form and the diagram must be signed by the Project Manager, the Field Supervisor, and the client representative (if applicable).

TYPE OF STRUCTURE	Color	PRESENT	NOT PRESENT	METHOD OF MARKOUT
Electric Power Line	Red			
Natural Gas Line	Yellow			
Telephone Line/Cable	Orange			
Water Line	Blue			
Product Line				
Steam Line				
Sewer Line	Green			
Drain Line				
Underground Tank				
Overhead Power Line	Red			
Overhead Product Line				
Septic Tank				

Client Representative _____

(If applicable) (Signature) (Date)

Project Manager _____

_____

(Signature) (Date)

Field Supervisor _____

_____

(Signature) (Date)

Procedure for Investigating Sites containing Fiber Optics Cables

Because of the sensitivity and costs associated with the damage of fiber optic cables, the following process, effective immediately, will be adopted as mandatory and as a minimum effort.

1. When a Shaw Project Manager or staff person becomes aware that a site requiring subsurface work contains a fiber optic cable within 50 feet of the outside working boundary, he/she will immediately notify the PM/BLM. The BLM, or if no BLM is in place the PM, will immediately notify the Area Manager and the Area Health and Safety Representative. The Project Manager and the Area Health and Safety Representative will develop a work plan designed to address the accomplishment of site activities while guaranteeing with certainty no impact to the fiber optic cable.

2. Any subsurface activities conducted at a site as described in item 1, will require the on-site presence of the Area Health and Safety Representative or a designee as affirmed in writing by the Area Health and Safety Representative.

3. No subsurface work will occur at a site as referenced in item 1, without the owner of the fiber optic cable being present.

4. The fiber optic cable will not be considered located unless a representative of the owner of the fiber optic cable has visited the site, confirmed the location of the cable, and signed the work plan which shall contain a site plan indicating the locations(s) of the subsurface work and location of the fiber optic cable.

5. Deviation from any of the above points, items 1 through 4, must be approved by the Area Manager.

SHAW FIBER Optic Contingency Plan

Project Location: Fina Station #1701, 1525 Inwood Road, Dallas, TX
Project No.: 05020.1263
Field Activity Date: August 4, 1999
Project Manager: PM Name
Site Manager: SM Name
Site Safety Officer: SSO Name

Site Description:
This location is an active retail service station. The site is located at the intersection of Inwood Road and Interstate 35 (Stemmons Freeway). Inwood Road (running roughly N-S) borders the site to the east, the Stemmons Freeway access road (running roughly E-W) borders the site to the north, and commercial property borders the property to the south and west.

Fiber Optic Cable and Location of Subsurface Work:
A Southwestern Bell Telephone (SWBT) fiber optic cable runs parallel to Inwood Road on the east side. The SWBT cable is under some overhead electric and telephone lines, and curves to the east to enter the bank building east of the subject site across Inwood. Three soil borings (SB) will be drilled on the site, and one monitoring well (MW) will be drilled on the commercial property south of the Fina site. These borings/wells are on the opposite side of the street from the fiber optic cable and are not a threat to it. Two additional MWs will be installed west of Inwood Road in the city easement. Field measurements, based on SWBT markings, indicate that a distance of approximately 18 to 20 feet can be maintained between the proposed MW locations and the fiber optic cable. **See the attached site map.**

EXHIBIT

Contingency Plan:
A phone conversation with a locator for SWBT confirmed that no other cables run in the area. An on-site meeting between the SWBT locator and the Site Manger is scheduled on the day of the drilling prior to the start of work. No drilling within 50 feet of the fiber optic cables will occur until the Site Manger and the SWBT locator have marked the locations of the proposed drill sites and the cable location. Should the SWBT locator not be able to remain on site for the duration of the intrusive activities he will still sign this plan.

Shaw will have a designated health and safety representative on site to ensure safety protocol is observed.

Approval:

Signature	**Date**	**Signature**	**Date**
Area Manager		**Area Health & Safety Manager**	

Acknowledgement:

Signature	**Date**	**Signature**	**Date**
Project Manager		**Site Manager**	

Fiber Optic Cable Owner's Representative:

Company Name

Representatives Name	**Signature**	**Date**

HEAT/COLD STRESS PROCEDURES

1.0 HEAT STRESS

1.1 Definitions

- **Acclimatization** - Series of physiological and psychological adjustments that occur in an employee during initial exposures to hot environmental conditions.
- **Company** - All wholly-owned subsidiaries of The Shaw Group, Inc.
- **Maximum Heart Rate** - Amount of work (beats) per minute a healthy person's heart can be expected to safely deliver. Maximum heart rate (MHR) is calculated by subtracting an employee's age from 200.

1.2 Signs, Symptoms, and Treatment

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, increased accident probability, etc., to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn, since these garments prevent evaporative body cooling. Wearing personal protective equipment places employees at considerable risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses, regular monitoring and other preventive precautions are vital.

1.2.1 Heat Rash

Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat soaked clothing.

Signs and Symptoms: The condition is characterized by a localized red skin rash and reduced sweating. Aside from being a nuisance, the ability to tolerate heat is reduced.

Treatment: Keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.

1.2.2 Heat Cramps

- Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood which can cause painful muscle spasms and pain.
- Signs and Symptoms: Muscle spasms and pain in the extremities and abdomen.
- Treatment: Remove employee to a cool place and give sips of water or an electrolytic drink. Watch for signs of heat exhaustion or stroke.

1.2.3 Heat Exhaustion

- Heat exhaustion is a mild form of shock caused by increased stress on various organs to meet increased demand to cool the body. Onset is gradual and symptoms should subside within one hour.

- Signs and Symptoms: Weak pulse; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; fatigue.

- Treatment: Remove employee to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continually to remove heat by convection. CAUTION: Do not allow the affected person to become chilled—treat for shock if necessary.

1.2.4 Heat Stroke

- Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. THIS IS A MEDICAL EMERGENCY!!

- Signs and Symptoms: Red, hot, dry skin; body temperature of 105 degrees Fahrenheit (EF) or higher; no perspiration; nausea; dizziness and confusion; strong, rapid pulse.

- Treatment: Heat stroke is a true medical emergency. Transportation of the victim to a medical facility must not be delayed. Prior to transport, remove as much clothing as possible and wrap the victim in a sheet soaked with water. Fan vigorously while transporting to help reduce body temperature. Apply cold packs, if available; place under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing victim in a cool water bath (however, be careful not to over-chill the victim once body temperature is reduced below 102°F). If this is not possible, keep victim wrapped in a sheet and continuously douse with water and fan.

1.3 Prevention

The implementation of preventative measures is the most effective way to limit the effects of heat-related illnesses. During periods of high heat, adequate liquids must be provided to replace lost body fluids. Replacement fluids can be a 0.1 percent salt water solution, a commercial mix such as Gatorade, or a combination of these with fresh water. The replacement fluid temperature should be kept cool, 50° F to 60° F, and should be placed close to the work area. Employees must be encouraged to drink more than the amount required to satisfy thirst. Employees should also be encouraged to salt their foods more heavily during hot times of the year.

Cooling devices such as vortex tubes or cooling vests can be worn beneath impermeable clothing. If cooling devices are worn, only physiological monitoring will be used to determine work activity.
All workers are to rest when any symptoms of heat stress are noticed. Rest breaks are to be taken in a cool, shaded rest area. Employees shall remove chemical protective garments during rest periods and

will not be assigned other tasks.

All employees shall be informed of the importance of adequate rest and proper diet in the prevention of heat stress and the harmful effects of excessive alcohol and caffeine consumption.

1.4 Monitoring

The initiation of heat stress monitoring will be required when employees are working in environments exceeding 90EF ambient air temperature. If employees are wearing impermeable clothing, this monitoring will begin at 78EF. There are two general types of monitoring that the health and safety representative can designate to be used: wet bulb globe temperature (WBGT) and physiological. Attachment 2 will be used to record the results of heat stress monitoring.

1.4.1 Wet Bulb Globe Temperature (WBGT)

The WBGT index is the simplest and most suitable technique to measure the environmental factors which most nearly correlate with core body temperature and other physiological responses to heat. When WBGT exceeds 25.9° C (78° F), the work regiment in Table 1 and Figure 1 of the section Heat Stress in the latest edition of the American Conference of Governmental Industrial Hygiene (ACGIH) Threshold Limit Value (TLV) Booklet should be followed.

1.4.2 Physiological

Physiological monitoring can be used in lieu of, or in addition to, WBGT. It is anticipated that this monitoring can be self-performed once the health and safety representative demonstrates appropriate techniques to affected employees. Since individuals vary in their susceptibility to heat, this type of monitoring has its advantages. The two parameters that are to be monitored at the beginning of each rest period are:

1.4.2.1 Heart Rate

Each individual will count his/her radial (wrist) pulse as early as possible during each rest period. If the heart rate of any individual exceeds 75 percent of their calculated maximum heart rate (MHR = 200 - age) at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work until his/her sustained heart rate is below 75 percent of their calculated maximum heart rate.

1.4.2.2 Temperature

Each individual will measure his/her temperature with a thermometer for one minute as early as possible in the first rest period. If the temperature exceeds 99.6° F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same.

An individual is not permitted to return to work if his/her temperature exceeds 100.4° F

1.5 **Training** Employees potentially exposed to heat stress conditions will be instructed on the contents of this procedure. This training can be conducted during daily tailgate safety meetings.

ATTACHMENT 2
HEAT STRESS MONITORING RECORD

Project/Location _____ Date _____

Employee Name	Initial Reading Time	First Work Period Time		Second Work Period Time		Third Work Period Time		Fourth Work Period Time		Fifth Work Period Time		Sixth Work Period Time	
	WBGT (?F)	WBGT (?F)		WBGT (?F)		WBGT (?F)		WBGT (?F)		WBGT (?F)		WBGT (?F)	
	Air Temp. (?F)	Air Temp. (?F)		Air Temp. (?F)		Air Temp. (?F)		Air Temp. (?F)		Air Temp. (?F)		Air Temp. (?F)	
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.

JOB SAFETY ANALYSIS FORM

Operation/Location: _____ Date: _____
Person Doing JSA: _____ Project: _____
SSHO: _____ Project Supervisor: _____

Job Steps	Job Hazards	Safeguards and Precautions

PROJECT SAFETY INSPECTION REPORT

PROJECT: _____ DATE: _____

BUSINESS LINE: _____ PROJECT NAME/NUMBER: _____
PROGRAM MANAGER: _____ PROJECT MANAGER: _____
GENERAL PROJECT DESCRIPTION: _____
_____
_____
SITE ACTIVITIES AT TIME OF INSPECTION: _____
_____
_____

INTERVIEWED EMPLOYEE: _____
SAFETY ISSUE: _____
_____
_____
CORRECTIVE ACTION: _____
_____
_____
_____
ASSIGNED TO: _____ FOLLOW-UP DATE: _____
CORRECTION VERIFIED BY: _____ DATE: _____

INTERVIEWED EMPLOYEE: _____
SAFETY ISSUE: _____
_____
_____
CORRECTIVE ACTION: _____
_____
_____
_____
ASSIGNED TO: _____ FOLLOW-UP DATE: _____
CORRECTION VERIFIED BY: _____ DATE: _____

INSPECTION COMPLETED BY: _____ DATE: _____

HEALTH AND SAFETY REVIEW BY: _____ DATE: _____

PROJECT SAFETY INSPECTION REPORT

PROJECT _____ **DATE** _____

	YES	NO	N/A
FIRST AID			
1. Are first aid kit locations identified and accessible?			
2. Are emergency eye wash/safety showers available and inspected monthly?			
3. Are first aid kits inspected weekly?			
4. Is a qualified first aid/CPR provider on site?			
PERSONAL PROTECTIVE EQUIPMENT			
1. Have levels of personnel protection been established?			
2. Are respirators decontaminated, inspected, and stored according to standard procedures?			
3. Have employees been fit-tested?			
4. Is defective personal protective equipment tagged and taken out of service?			
5. Does compressed breathing air meet CGA Grade "D" minimum?			
6. Are there sufficient sizes and quantities of protective equipment?			
7. At a minimum, are employees utilizing safety glasses, hard hats, and steel toe boots?			
FIRE PREVENTION			
1. Are employees smoking only in designated outdoor areas?			
2. Are fire lanes established and maintained?			
3. Are flammable liquid dispensing systems bonded?			
4. Are approved safety cans available for storage of flammable liquids?			
5. Has the local fire department been contacted?			
6. Are fire extinguishers available and inspected monthly?			
7. Are flammables and combustibles properly stored?			
8. Are flammable storage cabinets available and used when needed?			
AIR MONITORING			
1. Is required air monitoring being conducted?			
2. Are air monitoring instruments calibrated daily?			
3. Are air monitoring logs up to date?			
4. Are instrument user manuals available?			
5. Are instruments being maintained?			
6. Are employees notified of personal sampling results within 5 days of receipt?			

PROJECT SAFETY INSPECTION REPORT

PROJECT _____ **DATE** _____

	YES	NO	N/A
WELDING AND CUTTING			
1. Are fire extinguishers present at welding and cutting operations?			
2. Are confined spaces evaluated prior to and during cutting and welding operations?			
3. Have Hot Work Permits been completed?			
4. Are proper helmets, goggles, aprons, and gloves available for welding and cutting operations?			
5. Are welding machines properly grounded?			
6. Are oxygen and fuel gas cylinders stored a minimum of 20 feet apart?			
7. Are only trained personnel permitted to operate welding and cutting equipment?			
8. Are gas cylinders transported in a secured vertical position with caps in place?			
HAND AND POWER TOOLS			
1. Are defective hand and power tools tagged and taken out of service?			
2. Is eye protection available and used when operating power tools?			
3. Are guards and safety devices in place on power tools?			
4. Are power tools inspected before each use?			
5. Are nonsparking tools available when necessary?			
6. Is the correct tool being used for the job?			
MOTOR VEHICLES			
1. Are vehicles regularly inspected?			
2. Are personnel licensed for the vehicles they operate?			
3. Are unsafe vehicles tagged and reported to supervision?			
4. Is vehicle=s safety equipment operating properly?			
5. Are loads secure?			
6. Are vehicle occupants using safety belts?			
7. Are current insurance cards and blank accident report forms located in vehicles?			
EMERGENCY PLANS			
1. Are emergency telephone numbers posted?			
2. Have emergency escape routes been designated?			
3. Are employees familiar with the emergency signal?			
4. Has the emergency route to the hospital been established and posted?			
5. Is a vehicle on site that can transport injured employees to the hospital?			

PROJECT SAFETY INSPECTION REPORT

PROJECT _____ **DATE** _____

	YES	NO	N/A
MATERIALS HANDLING			
1. Are materials stacked and stored to prevent sliding or collapsing?			
2. Are tripping hazards identified?			
3. Are semi-trailers chocked?			
4. Are fixed jacks used under semi-trailers?			
5. Are riders prohibited on materials handling equipment?			
6. Are approved manlifts provided for the lifting of personnel?			
7. Are personnel in manlifts wearing approved fall protection devices?			
FIRE PROTECTION			
1. Has a fire alarm system been established?			
2. Do employees know the location and use of all fire extinguishers?			
3. Are fire extinguisher locations posted?			
4. Are combustible materials segregated from open flames?			
5. Have fire extinguishers been professionally inspected during the last year?			
6. Are fire extinguishers visually inspected monthly?			
ELECTRICAL			
1. Is electrical equipment and wiring properly guarded and maintained in good condition?			
2. Are extension cords kept out of wet areas?			
3. Is damaged electrical equipment tagged and taken out of service?			
4. Have underground electrical lines been identified by proper authorities?			
5. Has a lockout/tagout system been established?			
6. Are GFCIs being used on all temporary electrical systems and as needed?			
7. Are extension cords being inspected daily (i.e., group pin in place, no unapproved splices)?			
8. Are warning signs exhibited on high voltage equipment (250V or greater)?			
9. Is adequate distance maintained from overhead electrical lines?			
10. Are switches, circuit breakers, and switchboards installed in wet locations enclosed in weatherproof enclosures?			
CRANES AND RIGGING			
1. Are cranes inspected daily prior to use?			
2. Are crane swing areas barricaded or demarked?			

PROJECT SAFETY INSPECTION REPORT

PROJECT _____ **DATE** _____

	YES	NO	N/A
3. Is all rigging equipment tagged with an identification number and rated capacity?			
4. Is rigging equipment inspection documented?			
5. Are slings, chains, and rigging inspected before each use?			
6. Are damaged slings, chains, and rigging tagged and taken out of service?			
7. Are slings padded or protected from sharp corners?			
8. Do employees keep clear of suspended loads?			
9. Are rated load capacities and special hazard warnings posted on crane?			
10. Are the records of annual crane inspection available?			
11. Has accessible areas within the swing radius of the rear of the crane been barricaded?			
12. Do crane operators have required training/certification?			

COMPRESSED GAS CYLINDERS

1. Are breathing air cylinders charged only to prescribed pressures?			
2. Are like cylinders segregated and stored in well ventilated areas?			
3. Is smoking prohibited in cylinder storage areas?			
4. Are cylinders stored secure and upright?			
5. Are cylinders protected from snow, rain, etc.?			
6. Are cylinder caps in place before cylinders are moved?			
7. Are fuel gas and oxygen cylinders stored a minimum of 20 feet apart?			
8. Are propane cylinders stored and used only outside of buildings?			

SCAFFOLDING

1. Is scaffolding placed on a flat, firm surface?			
2. Are scaffold planks free of mud, ice, grease, etc.?			
3. Is scaffolding inspected before each use?			
4. Are defective scaffold parts taken out of service?			
5. Have employees completed scaffold user training?			
6. On scaffolds where platforms are overlapped, is planking overlapped a minimum of 12 inches?			
7. Does scaffold planking extend over end supports between 6 to 18 inches (dependent upon platform length)?			
8. Are employees restricted from working on scaffolds during storms and high winds?			
9. Are all pins in place and wheels locked?			
10. Is required perimeter guarding (top rail, mid rail, and toe board) present?			
11. Has a competent person been designated to oversee scaffold construction?			
12. Are employees prohibited from moving mobile scaffold horizontally while			

PROJECT SAFETY INSPECTION REPORT

PROJECT _____ **DATE** _____

	YES	NO	N/A
employees are on them?			
13. Are all scaffold components manufactured by the same company?			

WALKING AND WORKING SURFACES

1. Are ladders regularly inspected?			
2. Are accessways, stairways, ramps, and ladders clean of ice, mud, snow, or debris?			
3. Are ladders being used in a safe manner?			
4. Are ladders kept out of passageways, doors, or driveways?			
5. Are broken or damaged ladders tagged and taken out of service?			
6. Are metal ladders prohibited in electrical service?			
7. Are stairways and floor openings guarded?			
8. Are safety feet installed on straight and extension ladders?			
9. Is general housekeeping being maintained?			
10. Are ladders tied off?			
11. Are handrails and siderails installed along the unprotected sides of stairways having 4 or more risers or rising more than 30 inches?			

SITE SAFETY PLAN

1. Is a site safety plan available on site or accessible to all employees?			
2. Does the safety plan accurately reflect site conditions and tasks?			
3. Have potential hazards been described to employees on site?			
4. Is there a designated safety official on site?			
5. Have all employees signed the safety plan acknowledgment form?			

SITE POSTERS

1. Are the following posters displayed in a prominent and accessible area?

A. Minimum Wage		
B. OSHA Job Protection		
C. Equal Employment Opportunity		

2. Are all required state-specific posters displayed?		

SITE CONTROL

1. Are work zones clearly marked?			

PROJECT SAFETY INSPECTION REPORT

PROJECT _____ **DATE** _____

	YES	NO	N/A
2. Are support trailers located to minimize exposure from a potential release?			
3. Are support trailers accessible for approach by emergency vehicles?			
4. Is the site properly secured during and after work hours?			
5. Is an exclusion zone sign-in/sign-out log maintained?			
6. Are only employees with current training and physicals permitted in exclusion zone?			

HEAVY EQUIPMENT

1. Is heavy equipment inspected as prescribed by the manufacturer?			
2. Is defective heavy equipment tagged and taken out of service?			
3. Are project roads and structures inspected for load capacities and proper clearances?			
4. Is heavy equipment shut down for fueling and maintenance?			
5. Are backup alarms installed and working on mobile equipment?			
6. Have qualified equipment operators been designated?			
7. Are riders prohibited on heavy equipment?			
8. Are guards and safety appliances in place and used?			
9. Are operators using the "three point" system when mounting/dismounting equipment?			

EXCAVATION

1. Has a "competent person" been designated to oversee excavation activities?			
2. Prior to opening excavations, are utilities located and marked?			
3. Has a professional engineer evaluated all excavations greater than 20 feet deep?			
4. Is there rescue equipment on site and accessible to the excavation area?			
5. Is excavated material placed a minimum of 24 inches from the excavation?			
6. Are the sides of excavations sloped or shored to prevent cave ins?			
7. Have excavations greater than 4 feet deep been monitored for hazardous atmospheres (i.e., LEL/O_2)?			
8. *Are ladders or ramps used in excavations over 4 feet deep?*			
9. Are means of egress available so as to require no more than 25 feet of lateral travel?			
10. Are barriers, i.e., guardrails or fences, placed around excavations near pedestrian or vehicle thoroughfares?			
11. Is excavation inspected <u>daily</u> by competent persons and documented?			

CONFINED SPACES

PROJECT SAFETY INSPECTION REPORT

PROJECT _____ **DATE** _____

	YES	NO	N/A
1. Have employees been trained in the hazards of confined spaces?			
2. Are confined space permits posted at entrance to confined space?			
3. Is a copy of the confined space entry procedure available?			
4. Has a rescue plan been established?			
5. Is an entry supervisor present at each permit-required entry?			
6. Are required extraction/fall protection devices being used?			
DECONTAMINATION			
1. Are decontamination stations set up on site?			
2. Is decontamination water properly contained and disposed of?			
3. Are all pieces of equipment inspected for proper decontamination before leaving the site?			
4. Are shin/metatarsal guards being used during power washing activities?			
HAZARD COMMUNICATION			
1. Is there a copy of the HAZCOM procedure on site?			
2. Are there MSDSs for required materials/chemicals present on site?			
3. Are all containers properly labeled, as to content, hazard?			
4. Have employees been trained in accordance with the HAZCOM procedure?			
5. Do employees (including subcontractors) know and understand the effects of exposure from the chemicals on site?			
6. Have all personnel signed the HAZCOM acknowledgment form?			
7. Is there an updated list of chemicals maintained on site?			
TRAINING			
1. Are tailgate safety meetings being conducted daily?			
2. Are current training/medical records maintained on site?			
DOCUMENTATION			
1. Is an OSHA 200 Log maintained on site and posted during the month of February?			
2. Are accident report forms available?			
3. Is a copy of health and safety policy and procedures available on site?			

PROJECT SAFETY INSPECTION REPORT

PROJECT: _____ **DATE:** _____

ALL NEGATIVE RESPONSES	CORRECTIVE ACTION	ASSIGNED TO	DATE ASSIGNED	DATE COMPLETED	VERIFIED BY

DESCRIBE POSITIVE SAFETY OBSERVATIONS IN THE SPACE PROVIDED BELOW

DAILY SAFETY MEETING

Project Name: _____ **Date:** _____

Project Number: _____ **Presented by:** _____

Check the Topics/Information Reviewed:

__safety glasses, hard hat, safety boots
__site safety plan review and location
__equipment and machinery familiarization
__employee Right-To-Know/MSDS location
__slips, trips, and falls
__directions to hospital
__anticipated visitors
__electrical ground fault
__daily work scope
__emergency protocol
__parking and laydown
__hot work permits
__open pits, excavations, and site hazards
__public safety and fences
__strains and sprains
__vehicle safety and driving/road conditions
__excavator swing and loading
__noise hazards
__portable tool safety and awareness
__orderly site and housekeeping
__no horseplay
__overhead utility locations and clearance
__smoking in designated areas
__heat and cold stress
__first aid, safety, and PPE location
__leather gloves for protection
__backing up hazards
__sharp object, rebar, and scrap metal hazards
__effects of the night before
__accidents are costly
__safety is everyone's responsibility
__vibration related injuries
__dust and vapor control
__latex gloves inner/nitrile gloves outer
__fire extinguisher locations
__refueling procedures
__excavation/trenching inspections/documentation
__eye wash station locations
__confined space entry
__full face respirators with proper cartridges
__decontamination procedures
__flying debris hazards
__upgrade to level c at: PID (___ eV) >___ ppm
__work stoppage at: PID(___ eV) >___ ppm, % LEL > 10%

Tasks: _____

_____

Discussion/Comments/Follow-up Actions: _____

_____

_____

Note: Use the back of this sheet if necessary for daily task description and discussion

NAME	SIGNATURE	COMPANY

Instructions: Conduct a daily safety meeting prior to beginning each day's site activities. Complete form, obtain signatures, and file with the Daily Summary. Follow-up on any noted items and document resolution of any action items.

APPENDIX C

REQUIRED SHAW ENVIRONMENTAL, INC. H&S PROCEDURES

TO BE ON-SITE

SOP NO. HS001	SAFETY POLICY
SOP NO. HS010	EMPLOYEE SAFETY AND HEALTH WORK RULES
SOP NO. HS011	CONTRACTOR SAFETY AND HEALTH RULES
SOP NO. HS018	SAFETY COUNCILS
SOP NO. HS019	INJURY AND ILLNESS PREVENTION PROGRAM
SOP NO. HS020	REPORTING, INVESTIGATION, AND REVIEW
SOP NO. HS021	MANAGEMENT SAFETY REVIEWS
SOP NO. HS023	SAFETY INCENTIVE AWARD PROGRAM
SOP NO. HS040	STOP WORK AUTHORITY
SOP NO. HS051	TAILGATE SAFETY MEETINGS
SOP NO. HS060	HAZARD COMMUNICATION
SOP NO. HS090	OSHA REGULATORY INSPECTIONS
SOP NO. HS091	REPORTING OF FATALITY OR MULTIPLE HOSPITALIZATION INCIDENTS]
SOP NO. HS300	CONFINED SPACES
SOP NO. HS 302	LADDER SAFETY
SOP NO. HS303	PRESSURIZED WATER CLEANING AND CUTTING (IF NECESSARY)
SOP NO HS304	COMPRESSED GAS CYLINDERS
SOP NO. HS307	EXCAVATION AND TRENCHING
SOP NO. HS314	HOT WORK IN HAZARDOUS LOCATIONS
SOP NO. HS315	CONTROL OF HAZARDOUS ENERGY SOURCES
SOP NO. HS 316	DRILL RIG OPERATIONS
SOP NO. HS400	WORKING IN HOT ENVIRONMENTS (IF NEEDED)
SOP NO. HS401	COLD STRESS
SOP NO. HS600	PERSONAL PROTECTIVE EQUIPMENT
SOP NO. HS601	RESPIRATORY PROTECTION PROGRAM
SOP NO. HS800/810	MOTOR VEHICLE/COMMERCIAL VEHICLE OPERATION AND MANAGEMENT PROCEDURES
SOP NO. HS820	FORKLIFT OPERATION
SOP NO. HS822	CRANE OPERATIONS

APPENDIX D

MSDS DEFINITIONS
MATERIAL DATA SAFETY SHEETS (MSDS)

POLYCHLORINATED BIPHENYL (AROCLOR 1254)

0939

October 1999

CAS No: 11097-69-1
RTECS No: TQ1360000
UN No: 2315
EC No: 602-039-00-4

Chlorobiphenyl (54% chlorine)
Chlorodiphenyl (54% chlorine)
PCB
Molecular mass: 327 (average)

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		Powder, carbon dioxide.
EXPLOSION			

EXPOSURE		**PREVENT GENERATION OF MISTS! STRICT HYGIENE!**	
Inhalation		Ventilation.	Fresh air, rest. Refer for medical attention.
Skin	MAY BE ABSORBED! Dry skin. Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
Eyes		Safety goggles, face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Headache. Numbness.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	**PACKAGING & LABELLING**	
Consult an expert! Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: complete protective clothing including self-contained breathing apparatus).	Xn Symbol R: 33-50/53 S: (2-)35-60-61 Note: C UN Hazard Class: 9 UN Pack Group: II	Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. Severe marine pollutant.

EMERGENCY RESPONSE	**STORAGE**
Transport Emergency Card: TEC (R)-914	Separated from food and feedstuffs. Cool. Dry. Keep in a well-ventilated room.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission
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SEE IMPORTANT INFORMATION ON THE BACK.

IMPORTANT DATA

Physical State; Appearance
LIGHT YELLOW VISCOUS LIQUID.

Chemical dangers
The substance decomposes in a fire producing irritating and toxic gases.

Occupational exposure limits
TLV: 0.5 mg/m^3 A3 (skin) (ACGIH 1999).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.

Inhalation risk
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis. Chloracne is the most visible effect. The substance may have effects on the liver. Animal tests show that this substance possibly causes toxic effects upon human reproduction.

PHYSICAL PROPERTIES

Relative density (water = 1): 1.5
Solubility in water: none
Vapour pressure, Pa at 25°C: 0.01
Octanol/water partition coefficient as log Pow: 6.30 (estimated)

ENVIRONMENTAL DATA

In the food chain important to humans, bioaccumulation takes place, specifically in water organisms. It is strongly advised not to let the chemical enter into the environment.

NOTES

Changes into a resinous state (pour point) at 10°C.
Distillation range: 365-390°C.

ADDITIONAL INFORMATION

LEGAL NOTICE Neither the EC nor the IPCS nor any person acting on behalf of the EC or the IPCS is responsible for the use which might be made of this information

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APPENDIX E

SITE MAPS

MAPQUEST

Send To Printer Back To Directions

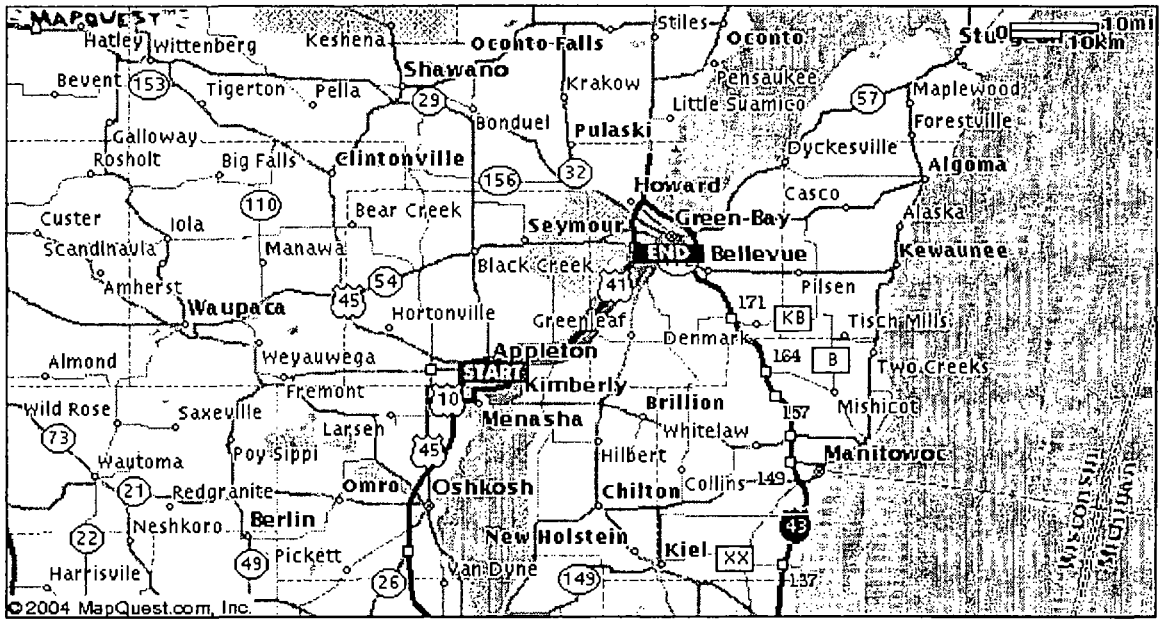
Start: 1506 S Oneida St
Appleton, WI
54915-1305 US

End: 835 S Van Buren St
Green Bay, WI
54302-1049 US

Distance: 33.25 miles

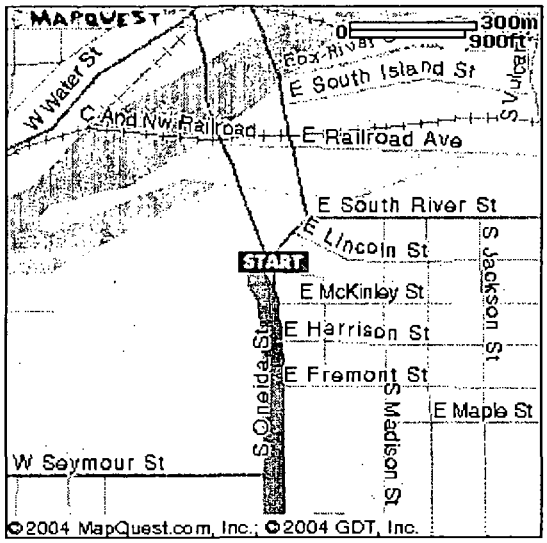
Total Estimated Time: 39 minutes

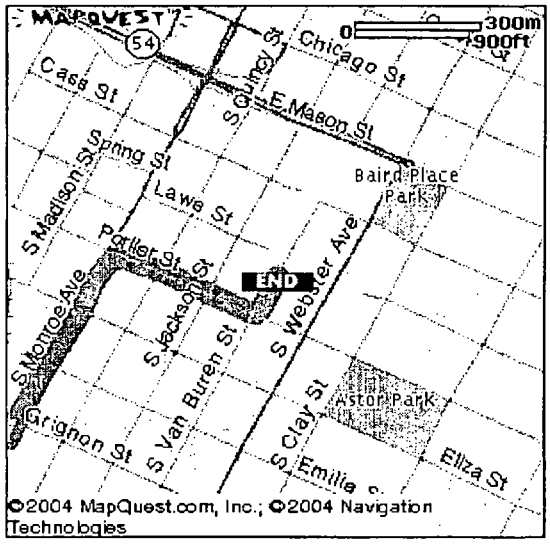
Directions	Distance
1. Start out going South on S ONEIDA ST toward E MCKINLEY ST.	1.3 miles
2. Merge onto WI-441 N via the ramp - on the left - toward GREEN BAY.	6.1 miles
3. Merge onto US-41 N.	20.4 miles
4. Merge onto WI-172 E via exit number 165 toward I-43.	2.3 miles
5. Take the WI-57/RIVERSIDE DR exit.	0.3 miles
6. Turn RIGHT onto WI-57 N/RIVERSIDE DR. Continue to follow WI -57 N.	2.2 miles
7. Turn RIGHT onto PORLIER ST.	0.2 miles
8. Turn LEFT onto S VAN BUREN ST.	<0.1 miles
End at 835 S Van Buren St, Green Bay, WI 54302 -1049 US	



Start:
1506 S Oneida St
Appleton, WI
54915-1305 US

End:
835 S Van Buren St
Green Bay, WI
54302-1049 US





NAVTECH ON BOARD

Notes:

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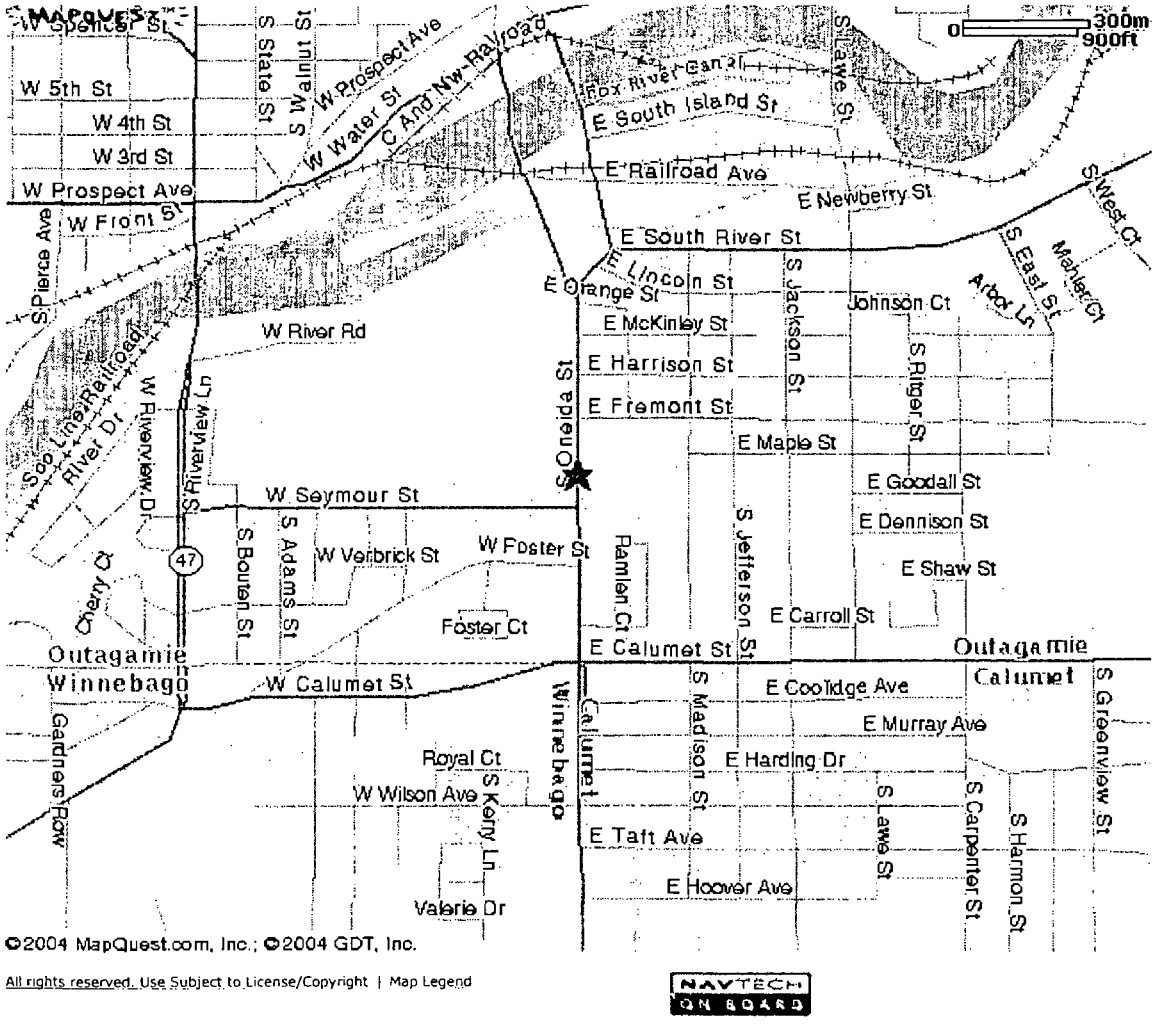
These directions are informational only. No representation is made or warranty given as to their content, road conditions or route usability or expeditiousness. User assumes all risk of use. MapQuest and its suppliers assume no responsibility for any loss or delay resulting from such use.

MAPQUEST.

Send To Printer Back to Map

1506 S Oneida St
Appleton WI
54915-1305 US

Notes:



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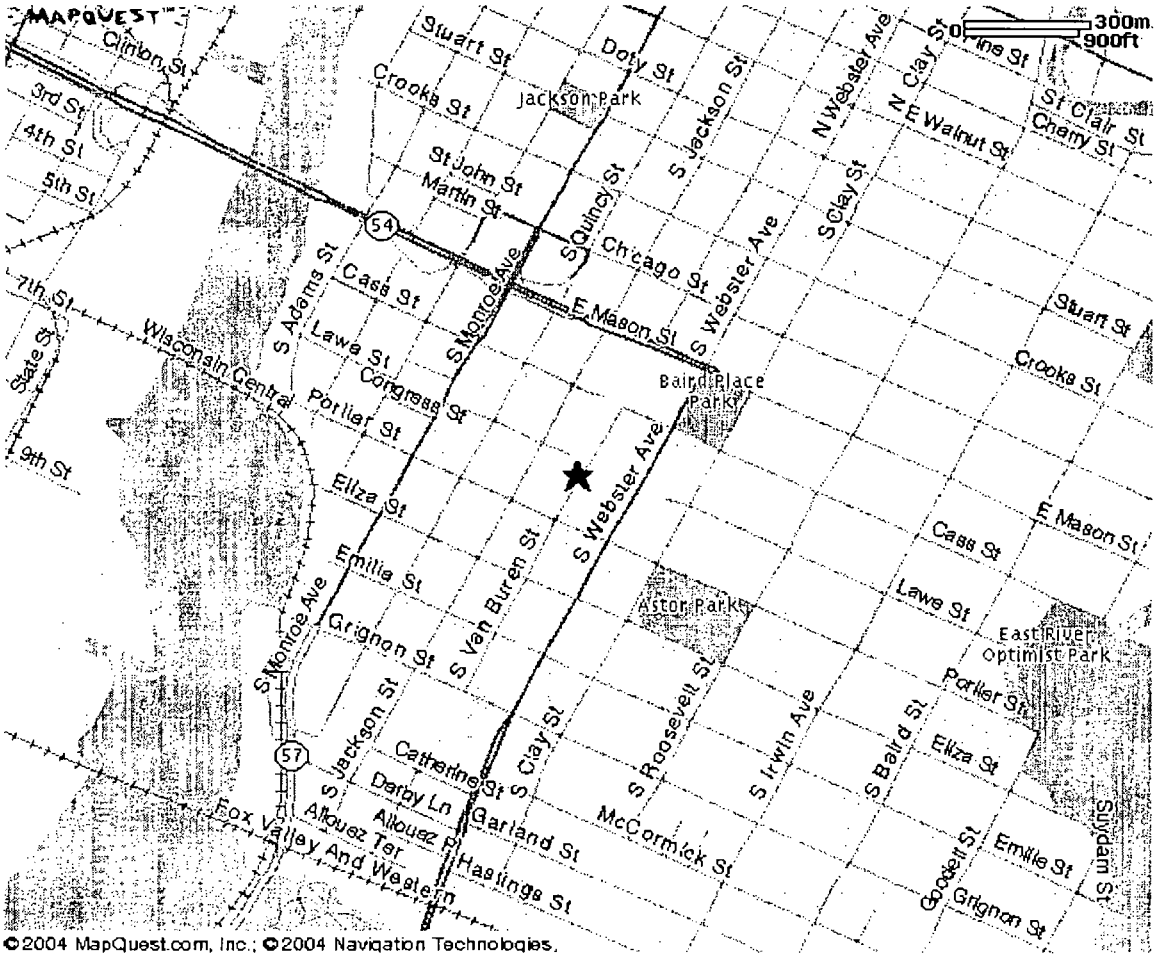
MAPQUEST.

Send To Printer Back to Map

835 S VAN BUREN ST
GREEN BAY WI
54302-1049 US

Notes:



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NAVTECH ON BOARD

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MAPQUEST

Send To Printer Back To Directions

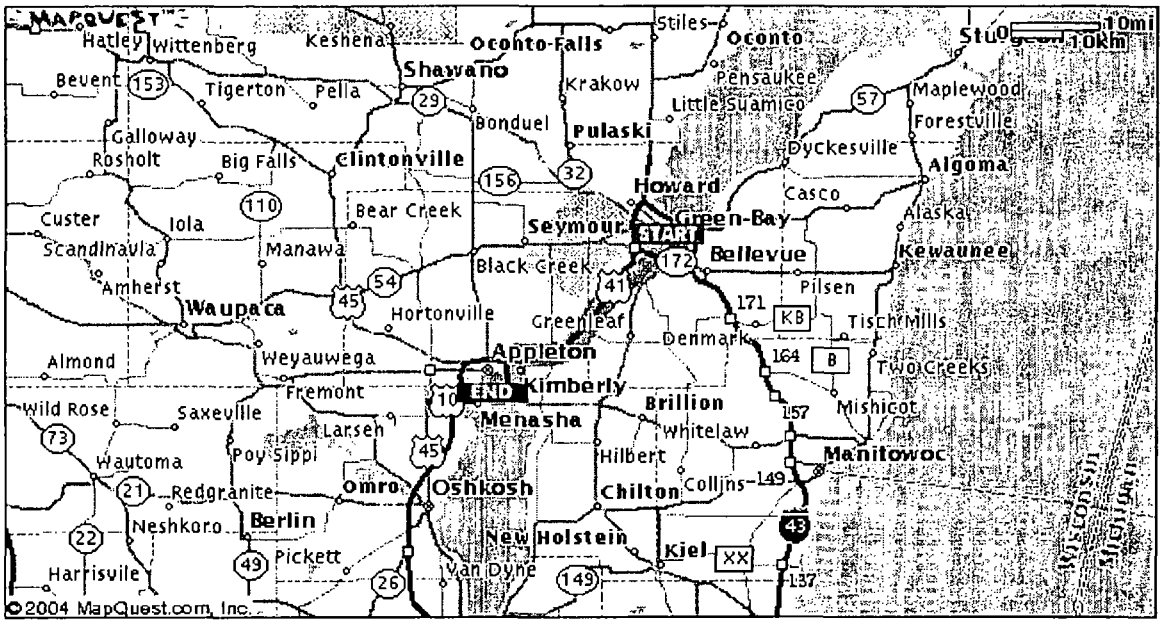
Start: 835 S Van Buren St
Green Bay, WI
54302-1049 US

End: 1506 S Oneida St
Appleton, WI
54915-1305 US

Distance: 33.06 miles

Total Estimated Time: *40 minutes*

Directions		Distance
START	**1.** Start out going Southwest on S VAN BUREN ST toward PORLIER ST.	<0.1 miles
	2. Turn RIGHT onto PORLIER ST.	0.2 miles
SOUTH 57	**3.** Turn LEFT onto S MONROE AVE/WI -57. Continue to follow WI -57 S.	4.3 miles
	4. Turn RIGHT onto CR -G/WI-32/GEORGE ST. Continue to follow CR -G W.	1.6 miles
SOUTH 41	**5.** Merge onto US-41 S toward APPLETON/OSHKOSH.	18.6 miles
SOUTH 441	**6.** Merge onto WI-441 S via exit number 145.	6.6 miles
EXIT	**7.** Take the US-10/ONEIDA ST exit.	0.2 miles
	8. Turn RIGHT onto US -10 W/S ONEIDA ST. Continue to follow S ONEIDA ST.	1.2 miles
END	**End at 1506 S Oneida St, Appleton, WI 54915 -1305 US**	



Start:
835 S Van Buren St
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54302-1049 US

End:
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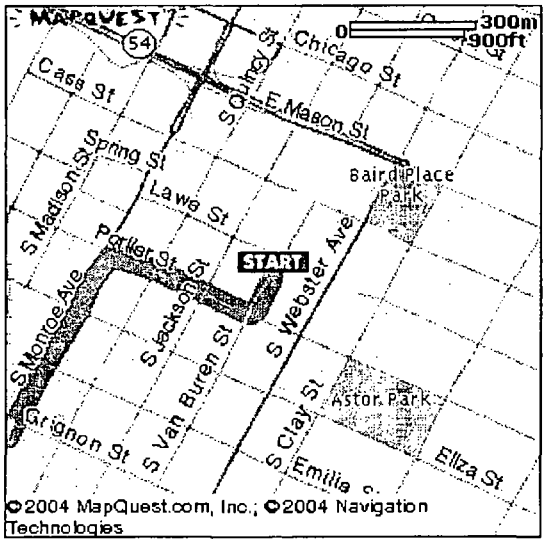
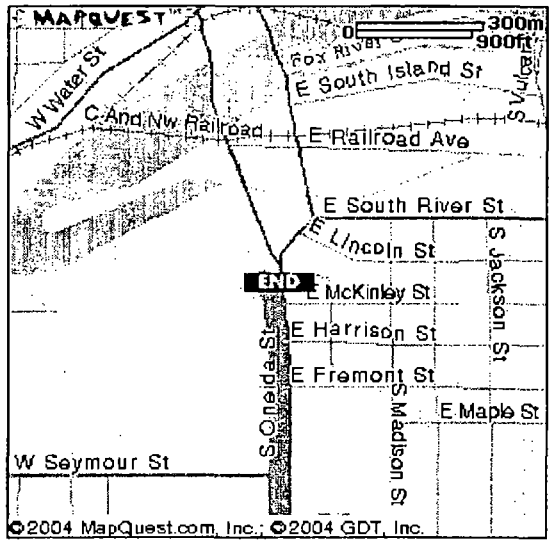
54915-1305 US





NAVTECH ON BOARD

Notes:

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APPENDIX F

JOB SAFETY ANALYSES (JSA)

JOB SAFETY ANALYSIS FOR VEHICLE OPERATION ALWAYS EXPECT THE UNEXPECTED! ANTICIPATE AND ADJUST!				
Task Breakdown	**Potential Hazards & Contributing Factors**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Vehicle Operation	Backing	• Back into parking spaces upon arrival, whenever possible. • Perform 360 degree walk around the vehicle before backing to identify any new conditions or obstructions. • Use a spotter when backing whenever possible. • Understand hand signals. • Sound horn prior to backing. • Check the rear-view and side mirrors prior to backing (Note: All vehicles, other than automobiles, must have small convex mirrors attached to the side mirrors.) • Back slowly in areas of obstructed vision. • Anticipate others who may be backing out into your pathway and adjust accordingly	Seatbelt	
	Unfamiliar with the vehicle	• Familiarize yourself with the vehicle before moving. • Review the dashboard controls, steering radius, overhead and side clearances. • Properly adjust mirrors and seat. • Locate windshield wipers and lights.		
	Speed	• Obey all posted speed limits. • Radar detectors are prohibited in all company owned, leased or rented vehicles. • Reduce travel speed during hazardous conditions (i.e. rain, fog, snow). • Identify if your vehicle has Anti-Lock Brakes (ABS). If it does, DO NOT pump the brakes to stop when the vehicle has begun to skid. Apply steady pressure to the brakes. If the vehicle does not have ALB, you will want to pump the brakes to stop during slippery conditions. • Fasten and properly adjust seat belt.	Seatbelt	

JOB SAFETY ANALYSIS FOR VEHICLE OPERATION ALWAYS EXPECT THE UNEXPECTED! ANTICIPATE AND ADJUST!				
Task Breakdown	**Potential Hazards & Contributing Factors**	**Critical Safety Practices**	**Personal Protective Clothing and**	**Monitoring Devices**
	Distances/Spacing °	• Continually check your rear/side view mirrors. • Use the 3 second rule to assure safe distance between vehicles. • Increase the 3 second rule as necessary during hazardous travel conditions. • Regularly scan the area you will be entering in the next 10 to 12 seconds. • Always leave yourself an "out" during travel. • When stopping, make sure that you leave enough distance between you and the car in front of you. You should be able to see the rear tires of the vehicle in front, when stopped. (Tire Concept) • Obey speed limit and traffic regulations. • When at a red light, and it turns green, use the "delayed start" technique, by counting to three before you take your foot off the brake. • DO NOT TAILGATE • Keep headlights (running lights) on for maximum visibility.	Seatbelt	
	Skids	• If the vehicle has begun to skid out of control, turn the steering wheel in the direction of the skid and re-adjust the wheel, as necessary. • Reduce speed during hazardous travel conditions. • Use 4-wheel drive, if available, when driving vehicles off road, on steep inclines, muddy conditions, etc. • Do not take vehicles "off road" if they can not be operated safely.	Seatbelt	

JOB SAFETY ANALYSIS FOR VEHICLE OPERATION ALWAYS EXPECT THE UNEXPECTED! ANTICIPATE AND ADJUST!				
Task Breakdown	**Potential Hazards & Contributing Factors**	**Critical Safety Practices**	**Personal Protective Clothing and**	**Monitoring Devices**
	Blind Spots	• Become familiar with any blind spots associated with your vehicle. • Adjust mirrors to give maximum viewing area. • Use your directional devices to signal all turns and when changing lanes; check rear/side view mirror and glance over shoulder to assure the lane is clear. • Avoid other driver's blind spots; slow down and let other vehicle pass.		
	Distractions e.g. Cellular Phones, Reading Maps/Directions, Eating, etc.	• Use speaker phone, not handheld cellular phones while driving • Pull over to the side of the road when making a call or checking directions.		
	Accidents	• In the event of an accident: Stop; call for medical assistance; notify police; complete Vehicle Accident Report and submit to you supervisor. • If an IT employee is injured, the Health Resource forms, Return to Work, Medical Release and Treatment of Injury/Illness, must completed at the health clinic or Emergency Room.	Seatbelt	
	Equipment failure	• Perform daily inspections of your vehicle. • Maintain vehicle safety equipment, e.g., mirrors, alarms, horns, wipers, lights, brakes. • Maintain vehicle, e.g., tire pressure, fluid levels. • Any vehicle with mechanical defects that may endanger the safety of the driver, passengers or the public shall not be used. • Ensure safety equipment is in the vehicle. Safety equipment should include a spare tire, jack, first-aid kit, fire extinguisher and flashlight. Flares and/or reflective triangles should be available in larger trucks.		Tire Pressure Gauge

JOB SAFETY ANALYSIS FOR VEHICLE OPERATION ALWAYS EXPECT THE UNEXPECTED! ANTICIPATE AND ADJUST!				
Task Breakdown	**Potential Hazards & Contributing Factors**	**Critical Safety Practices**	**Personal Protective Clothing and**	**Monitoring Devices**
		• Ensure the proper documentation is in the vehicle. Documentation should include an operations manual for the vehicle, insurance card, vehicle registration and IT Accident forms.		
	Influenced by drug and alcohol	• NEVER DRIVE UNDER THE INFLUENCE OF DRUGS OR ALCOHOL. • Disciplinary action, including termination, will be taken against anyone who is convicted of or pleads no-contest to the charges of driving under the influence in accordance with IT Health and Safety Procedure HS800 • Project-assigned hourly employees are not permitted to operate company owned, leased or rented vehicles after 10:00 p.m. without written authorization from their supervisor.	Seatbelt	
	Driver attitude / Road Rage	• Do not operate any vehicle when abnormally tired, temporarily disabled or under the influence of drugs or alcohol. • Keep an even temper when driving. Do not let the actions of others affect your attitude. Do not allow yourself to become frustrated, rushed, distracted or drowsy.	Seatbelt	
	Fatigue	• Stop and rest if fatigued. Exit road and enter a safe area. Rest until fully refreshed. (No employee may drive for more than 12 ours in a single on-duty period). • No employee is authorized to operate a company vehicle (including rentals) after having been on-duty for a period of 16 hours. • Do not use medication, e.g. cold/allergy medicines, when driving a vehicle.		

JOB SAFETY ANALYSIS FOR VEHICLE OPERATION ALWAYS EXPECT THE UNEXPECTED! ANTICIPATE AND ADJUST!				
Task Breakdown	**Potential Hazards & Contributing Factors**	**Critical Safety Practices**	**Personal Protective Clothing and**	**Monitoring Devices**
	Vehicle Loading	• DO NOT OVERLOAD the vehicle • Secure all equipment and supplies within the body of the vehicle using proper tie downs. • Do not block side view mirrors with load • Do not transport DOT manifested hazardous materials without a commercial driver's license (CDL) • Dispatch all equipment and personnel with proper forms and identification		
EQUIPMENT TO BE USED		**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**	
• Valid drivers license • Seatbelt • A spare tire and jack, • First-aid kit, fire extinguisher, and flashlight • Operations manual for the vehicle • Insurance card, vehicle registration and IT Accident forms.		• Inspect vehicles daily	• Review JSA with all site personnel • Review IT Health and Safety Procedure HS800	

ACTIVITY HAZARD ANALYSIS FOR SMALL CRAFT TRANSPORT AND DEPLOYMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Boat Mobilization /Launching	Load Shift in Transit	• Follow trailer/boat manufacturer's instructions for securing boat to trailer • Follow trailer/boat manufacturer's instructions for securing boat trailer to towing vehicle • Prohibit loading of heavy objects in boat during transport		
	Caught In/ Between Objects or Pinch Points	• Prohibit workers from moving into trailer/vehicle pinch points without advising vehicle operator • Use experienced operators when backing trailers on boat ramps • Wear proper work gloves when the possibility of pinching, or other injury may be caused by moving/ handling large or heavy objects • Maintain all equipment in a safe condition		
	Struck By/ Against Heavy Equipment	• Wear reflective warning vests when exposed to vehicular traffic • Launch boats one at a time to avoid collisions • Use a spotter for vehicles backing boats to launch area • Understand and review hand signals	Warning vests, hard hat, safety glasses, steel toe work boots	
	Slips, Trips, Falls	• Wear boots with non-slip soles when launching boats • Wear USCG approved flotation devices when working on/near water • Keep ropes and lines coiled and stowed to eliminate trip hazards • Maintain 3 point contact on dock/pier ladders		
	Drowning	• Wear USCG Approved personal flotation devices for work activities on or near water • Provide a floating ring buoy with at least 90 feet in the immediate boat launch/land areas • Place ring buoys not more than 200 feet apart • Maintain two Jon boats (minimum) during on water activities	USCG approved flotation device	

ACTIVITY HAZARD ANALYSIS FOR SMALL CRAFT TRANSPORT AND DEPLOYMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Boat Mobilization (Continued)	Capsizing (Slips, Trips, Falls)	• Step into the center of the boat • Keep your weight low when moving in the boat • Move slowly and deliberately • Steer directly across other boat wakes at 90 degree angle to avoid capsizing • Steer boat facing forward • Watch for floating objects in the water • Right-of-way is yielded to vessels on your boat's right (and vessels with limited ability to maneuver) • Cleanup spills immediately on docks, piers and ladders		
On-Water Boat Operations	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (pulleys, winches) to move large, awkward loads		
	Sprains and Strains (Overexertion)	• Use mechanical means to lift large/heavy objects from the water • Use even strokes when pull starting outboard engines		
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all equipment in a safe condition • Keep guards in place during use	Leather gloves	
	Insect Bites	• Avoid insect nests areas, likely habitats along shore lines • Use insect repellant, wear PPE to protect against sting/bite injuries	Tyvek coveralls, duct tape bottom of coveralls to boots or latex boot covers	
	Contact Dermatitis	• Wear PPE to avoid skin contact with contaminated materials • Change socks and/or gloves to avoid water borne bacteria/contamination	Rain/splash suit (See Section 5.0 HASP)	

ACTIVITY HAZARD ANALYSIS FOR SMALL CRAFT TRANSPORT AND DEPLOYMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
On-Water Boat Operations (Continued)	Drowning	• Wear USCG Approved personal flotation devices for work activities on or near water • Provide a floating ring buoy with at least 90 feet in the immediate boat launch/land areas • Place ring buoys not more than 200 feet apart • Maintain two Jon boats (minimum) during on water activities	USCG approved flotation device	
	Capsizing (Slips, Trips, Falls)	• Step into the center of the boat • Keep your weight low when moving in the boat • Move slowly and deliberately • Steer directly across other boat wakes at 90 degree angle to avoid capsizing • Cleanup spills immediately on docks, piers and ladders • Maintain at least one powered craft in reserve to assist vessels adrift or swamped		
	Boat Adrift/Survival	• Maintain a minimum of 2 flares in the boat • Maintain a minimum of 1 air horn • Maintain a minimum of 2 flash lights • Maintain a minimum of 1 anchor with rope • Maintain a minimum of 75 feet of rope attached to a ring buoy • Maintain a minimum of 1 2 lb. ABC fire extinguisher • Maintain a minimum of 2 gas tanks • Maintain a minimum of 1 boat plug • Maintain a minimum of 2 oars • Maintain a minimum of 1 two-way radio • Maintain one set of rain gear for each person • Maintain one first aid kit • Keep at least one person on shore to facilitate on shore emergency services when needed		

ACTIVITY HAZARD ANALYSIS FOR SMALL CRAFT TRANSPORT AND DEPLOYMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
	Allergic Reaction	• Provide workers proper skin protection to prevent skin allergic reaction from exposure boom material, spill contaminants, or other skin irritants	latex or nitrile gloves	
On-Water Boat Operations (Continued)	Caught In/ Between Objects	• Keep hands inside boat in proximity to other boats, on- water objects, piers • Wear proper work gloves when the possibility of pinching, or other injury may be caused by moving/ handling large or heavy objects • Maintain all equipment in a safe condition		
	Struck by/ Against Heavy Objects, Splashes, Hand Tools	• Yield right-of-way to larger vessels • Steer directly across boat wakes at 90 degree angle to avoid capsizing • Wear splash goggles when handling boom when visible contamination is present • Understand and review hand signals		
	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Monitor breathing zone air to determine levels of contaminants	Tyvek coveralls, nitrile gloves, latex or neoprene boots (see Section 5.0 HASP)	PID
	Severe Weather	• Halt all on water operations for lightening, high winds, severe weather		
	Fires	• Provide ABC (or equivalent) fire extinguishers for fuel (gas/diesel) powered boats • Prohibit storage, transfer of flammable liquids in plastic containers • Enforce use of approved flammable liquid safety cans • Prohibit smoking in fueling/fuel storage areas • Inspect fuel lines and tanks for leaks • Prohibit smoking in the boat • Provide oars for manual maneuvering	Portable fire extinguishers	LEL/O_2

ACTIVITY HAZARD ANALYSIS FOR SMALL CRAFT TRANSPORT AND DEPLOYMENT				
			Personal Protective Clothing and	**Monitoring**
On-Water Boat Operations (Continued)	High/Low Ambient Temperature	• Monitor for Heat/Cold stress in accordance with IT Health and Safety Procedures # HS400, HS401 • Provide fluids to prevent worker dehydration • Follow work/rest schedule in Section 3.3.1/3.3.2 of the HASP	Insulated Clothing (subject to ambient temperature)	Meteorological Equipment

Shaw E & I
HASP AMENDMENT

Project Name: Fox River Remedial Design OU2-5
Baseline Monitoring Plan

Project Number: 108876

PM: George Hicks

Location: Lower Fox River OU2-OU5, Green Bay, WI

Changes in field activities or hazards: Fish Tissue Monitoring-Fish Collection

1 ELECTROSHOCKING

Prior to electrofishing all crew members will have reviewed and be familiar with the site Health and Safety Plan in regards to boat and electrofisher operations. At all times that the boat is actively electrofishing, all crew members will wear rubber boots and the netters will wear rubber gloves rated for 5,000 volt protection.

Electrofishing activities will be conducted by a crew of three. A Field Supervisor will be in charge of all sampling activities. Two additional crew members will participate in the boat operation and/or dipnetting activities.

1.1 Equipment

Fish will be collected using an 18-ft boat fitted with a Smith-Root Type VI-A electrofisher modified to collect fish from shoreline habitats and shallow water shoals (generally less than 10 ft deep) in areas adjacent to deep water or the main channel. A standard Smith-Root Type VI-A can be set to 60 and 120 pulses per second (pps) DC, whereas the modified unit can be set at 15, 30, 60, and 120 pps. Specifications of the boat and electrofishing equipment are presented in Table 1.

All vessels will have up to date U.S. Coast Guard-approved and required safety equipment, personal floatation devices (PFDs), fire extinguishers, fixed marine 25-watt output VHF communications equipment, and other equipment as described in the Health and Safety Plan. All personnel onboard vessels engaged in nighttime activities will wear attached strobe lights to their PFDs.

Prior to each water deployment, the Field Leader will confirm adequate cell phone signal and confirm the appropriate way to contact emergency personnel. Additionally, prior to the inception of work, Field Leader will coordinate with onsite Project Manager or designee via cell phone or hand-held radio the location and duration of planned activities and confirm the Project Manager or designee is available for assistance in an emergency situation.

Prior to electrofishing the Field Leader will check through the materials and equipment check list to ensure that all gear is accounted for and in good working order and that all boat equipment required by the Health and Safety Plan are on board the vessel. The boat and electrofisher specifications are provided in Table 1.

Table 1.
Boat and Electrofishing Equipment Specifications

BOAT	ELECTROFISHER	OTHER EQUIPMENT
Grumman 1988 aluminum johnboat	Smith-Root Type VI-A	Bow & stern-mounted safety switches
Length: 18 ft / 5.5 m	Volts DC: 168-1008	Wisconsin ring & dropper electrodes:
Beam: 71 in / 1.8 m	Volts AC: 120-720	Bow & stern mounted collection lights
Depth: 21 in / .53 m	Pulse/second:15,30,60, & 120	Navigation lights
Max capacity: 1250 lb /568 kg	Pulse width: 1-7 ms	Deck work lights
Bare hull weight: 277 lb / 126 kg	Generator: 5000 watt	Fiberglass-insulated scapping nets
Engine: 1996 Evinrude 25 hp		USGS-required safety equipment
VHF marine radio 25 watt output		50-g aerated live well
WAAS GPS Garmin model 128		

Specific electrofishing equipment will include:

- (1) Smith-Root Electrofisher with extra fuses
- (1) Generator rated at least 4,500 watts output
- (1) Generator to electrofisher power cord
- (2) Foot operated voltage cut-off safety switches
- (1) Electrofisher output power cord
- (1) Electrode array
- (2) Fiberglass handle dip nets
- (2) Sets of rubber gloves rated for 5,000 volts
- (2) Pairs of rubber boots

- (1) 50 gallon live well
- (2) Headlamps
- Extra lights for night electrofishing
- (1) Hand-held spotlight

1.1.1 Collection Procedures

Electrofishing may be conducted during the day or night to obtain the necessary sample sizes of each target fish species. At the outset of sampling, electrofishing will be conducted during the day, because daytime sampling provides fewer logistical and health and safety issues than nighttime sampling. If daytime catch-per-unit effort is unacceptably low for one or more of the target fish species, extended daytime electrofishing or nighttime electrofishing may be conducted at the discretion of the Field Supervisor. Nighttime sampling may be conducted if the sampling area is determined to provide safe nighttime working conditions; daytime site reconnaissance is strongly encouraged.

The electrofishing unit will be fished in a downstream direction, where appropriate. Collection procedures are as follows:

- Position the boat upstream (or downstream if needed) of the station.
- Adjust electrofisher volts, pulse rate, and pulse width settings to maintain an average 4-5 amp output.
- Record water temperature, air temperature, weather conditions, conductivity, and the electrical output of the electrofishing unit.
- Record the starting location of electrofishing station using a Differential Global Positioning System (GPS) unit capable of delivering accuracy within 10 m.
- Place the boat in gear, turn on the electrofishing unit and collection lights, record the start time, and proceed at a slow speed along the collection area. Use the boat to position the electrode array near any instream cover such as overhanging vegetation, instream trees, rocky substates, etc.
- All target species within reach of the netter will be captured and placed in a 50-gallon holding tank.
- At the end of electrofishing, place the boat in neutral, turn off the electrofisher and collection lights, record the stop time and the end location from the GPS.

Process the fish according to the protocols described in Section 3 – Field Processing.

1.1.2 Sampling Locations

Fish sampling stations include an upstream reference site (Lake Winnebago), six stations in the Lower Fox River, and one station in Green Bay (eight stations total). One sampling station is assigned to each OU, except OU 2 which has three sampling stations. The monitoring stations will be consistent, to the extent possible, with stations occupied during past monitoring programs. Exact locations will be determined in the field based on species availability, habitat, and seasonal migration patterns. Because of these variables, different species will be collected from different parts of the OUs. Electrofishing will be conducted at the following locations:

- Lake Winnebago (upstream reference station).
- OU-1. Little Lake Butte de Morts.
- OU-2. Three sampling reaches:
  - OU-2A. Reach between Lock 4 and Cedars Lock.
  - OU-2B. Reach between Lock 5 and Rapid Croche Lock.
  - OU-2C. Above Little Rapids Dam.
- OU-3. Reach above DePere Dam.
- OU-4. Reach below DePere Dam, preferably at least 1,000 meters upstream from the mouth, beyond the influence of bay water.
- OU-5 (Green Bay). Zone II/Zone III

1.1.3 Collection Procedures

Electrofishing will be conducted at night to maximize the catch-per-unit-effort. Nighttime will be defined as the period from 1/2 hour after sunset until 1/2 hour before sunrise. A two person crew (one netter and a driver) will be onboard at all times during electrofishing activities. The electrofishing unit will be fished in a downstream direction, where appropriate. Collection procedures are as follows:

- Position the boat upstream (or downstream if needed) of the station.
- Adjust electrofisher volts, pulse rate, and pulse width settings to maintain an average 4-5 amp output.

- Record water temperature, air temperature, weather conditions, conductivity, and the electrical output of the electrofishing unit.

- Record the starting location of electrofishing station using a Real-time Differential or WASS enabled GPS unit capable of delivering accuracy within 10 m.

- Place the boat in gear, turn on the electrofishing unit and collection lights, record the start time, and proceed at a slow speed along the collection area. Use the boat to position the electrode array near any instream cover such as overhanging vegetation, instream trees, larger substates, etc.

- All target species within reach of the netter will be captured and placed in a 50-g holding tank. Target fish species are summarized in Table 2.

- At the end of electrofishing, place the boat in neutral, turn off the electrofisher and collection lights, record the stop time and the location from the GPS.

- Process the fish according to the protocols described in Section 1.1.4.

Electrofishing will be conducted from August 15 to October 15, 2005. Collections will be conducted over the course of five nights each week (i.e., one stations per night) until the number of target species are met.

Table 2. Target Fish Species and Size Ranges

SPECIES	SIZE RANGE	Skin-On Fillet (HH)	Whole Fish (Eco)	# Individuals	# Composites[1]	# Fish/Composite
Walleye	12 to 22 inches	X		15		
Carp	10 to 20 inches		X	25	5	5
Gizzard Shad	< 3 inches		X	125	5	25
White/Sm Bass	6 to 16 inches	X		15		
White Sucker	10 to 20 inches		X	25	5	5

(1) Walleye and bass will be analyzed as individuals, not composites

2 FYKE NETTING

Fyke net sampling activities will be conducted by a crew of three. A Field Supervisor will be in charge of all sampling activities. Two additional crew members will participate in the sampling activities.

Prior to fyke netting all crew members will have reviewed and be familiar with the site Health and Safety Plan in regards to boat operations. Fyke nets will be used to sample in water depths up to approximately 20 feet, primarily in areas with slow to moderate current adjacent to deep water or the main river channel.

2.1 Equipment

Indiana style fyke nets will have the following specifications:

- Front Box - two 1.83 m wide by 0.91 m high steel frames with center braces;
- Net Body - four 76.3 cm hoops with two 20.3 cm throats;
- Trap Length – 4.88 m;
- Netting - No. 105 knotless, 1.27 cm square mesh throughout;
- Lead – 22.86 m long by 0.91 m high;
- Wings – 12.19 m by 0.91 m high.

Netting will be treated with a black UV protectant and algaecide. Net will be anchored at the lead, wings, and cod end (back of the net body). All anchors will have an attached float with the name and address of the group deploying the nets along with the Scientific Collectors License number.

All vessels will have up to date U.S. Coast Guard-approved and required safety equipment, personal floatation devices (PFDs), fire extinguishers, fixed marine 25-watt output VHF communications equipment, and other equipment as described in the Health and Safety Plan. All personnel onboard vessels engaged in nighttime activities will wear attached strobe lights to their PFDs.

Prior to fyke netting the Field Leader will check through the materials and equipment check list to ensure that all gear is accounted for and in good working order and that all boat equipment required by the Health and Safety Plan are on board the vessel.

2.2 Sampling Locations

Fish sampling stations include an upstream reference site (Lake Winnebago), six stations in the Lower Fox River, and one station in Green Bay (eight stations total). One sampling station is assigned to each OU, except OU 2 which has three sampling stations. The monitoring stations will be consistent, to the extent possible, with stations occupied during past monitoring programs. Exact locations will be determined in the field based on species availability, habitat, and seasonal migration patterns. Because of these variables, different species will be collected from different parts of the OUs. Fyke netting will be conducted at the following locations:

- Lake Winnebago (upstream reference station).
- OU-1. Little Lake Butte de Morts.
- OU-2. Three sampling reaches:
  - OU-2A. Reach between Lock 4 and Cedars Lock.
  - OU-2B. Reach between Lock 5 and Rapid Croche Lock.
  - OU-2C. Above Little Rapids Dam.
- OU-3. Reach above DePere Dam.
- OU-4. Reach below DePere Dam, preferably at least 1,000 meters upstream from the mouth, beyond the influence of bay water.
- OU-5 (Green Bay). Zone II/Zone III

2.3 Collection Procedures

Fyke nets are designed to capture fish that travel parallel to the shoreline by blocking their passage with the lead net. As the fish encounter the lead they typically will turn out to deeper water following the lead net where they become entrapped within the body of the net. The wings act to further guide the fish into the body of the net. Fyke nets are typically set perpendicular to the shore. The following procedures will be conducted to deploy the fyke nets:

- Fyke nets will be set during daylight hours and fished overnight
- Attach or anchor the lead net to shore then back the boat out so the net is deployed perpendicular to the shore. Ensure that the cod end (the back of the net body) is securely fastened.
- Set both fyke net's wings at an approximately 45° angle to the lead line.
- Use the boat to tighten the net by pulling on the back anchor attached to the cod end.

- The location of each net will be documented with a the GPS.

Fyke nets will be checked within 24 hours after they are set. The following procedures will be conducted to retrieve the fyke nets:

- Maneuver the boat to retrieve the anchor attached to the cod end of the net and pull the net into the boat.
- Remove the fish from the net by untying the cod end and using a dip net to remove the fish.
- Separate the target species and place them in a 50 gallon holding tank for processing. All other fish will be released alive at the point of capture.
- Check the net for holes or rips and patch any that are found in the body of the net. Net can be patched using twine or cable ties.
- After the net has been emptied, retie the cod end and reset the net by using the boat to pull cod end's anchor perpendicular to shore until the net is tight.

3 ACTIVITY ANALYSIS ADDENDUM

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Electrofishing	Electrocution	• Any employee who operates or assists in the operation of an electrofishing unit must be familiar with the unit and understand the risks involved. • At least two personnel are required for electrofishing • An electrofishing unit must be inspected by the team leader prior to each use to ensure all connections are in good repair and that the unit is safe to operate • All onboard personnel wear rubber boots and the netter wear rubber gloves rated for 5,000 volt protection • Electrofishing shall not be conducted if people, livestock, or pets are in the water or near the water's edge within 100 meters of where the electrofishing is to occur • Electrofishing will not be conducted under conditions of heavy rainfall or thunderstorms and under rough water conditions	5000 volt protection rated gloves Rubber boots
	Falling overboard	• While electrofishing the boat will maintain a slow steady speed. Do not use the boat to rapidly chase after fish that have escaped • Netters will refrain from "lunging" after fish at the extreme range of the net • All personnel will wear PFDs with attached strobe lights for night work	PFD Strobe lights
	Hearing	• Netter and boat operator will be familiar with hand signals to communicate simple commands over the generator noise • All personnel will wear hearing protection devices	Ear plugs or head phones

4 HASP AMENDMENT ATTACHMENTS

4.1 H-1 Hand Signals Description Sheet

4.2 H-2 Electroshocker Manufacturer's Recommended Health & Safety Equipment

4.3 H-3 Resume of Qualified Pilot

4.4 H-4 Resume of Qualified Electroshocker

Approved by:
Project Manager:_____ Date:_____

Health and Safety:_____ Date:_____
Representative

APPENDIX
G

Appendix G –

Field Sampling Details

Document List

1. Fishing Hotspot Details
2. Lake Winnebago Water Sampling Transect Cross Section
3. OU1 Water Sampling Transect Cross Section
4. OU2A Water Sampling Transect Cross Section
5. OU2B Water Sampling Transect Cross Section
6. OU2C Water Sampling Transect Cross Section
7. OU3 Water Sampling Transect Cross Section
8. OU4 Water Sampling Transect Cross Section
9. OU5A Water Sampling Transect Cross Section
10. OU5B Water Sampling Transect Cross Section
11. OU5C Water Sampling Transect Cross Section

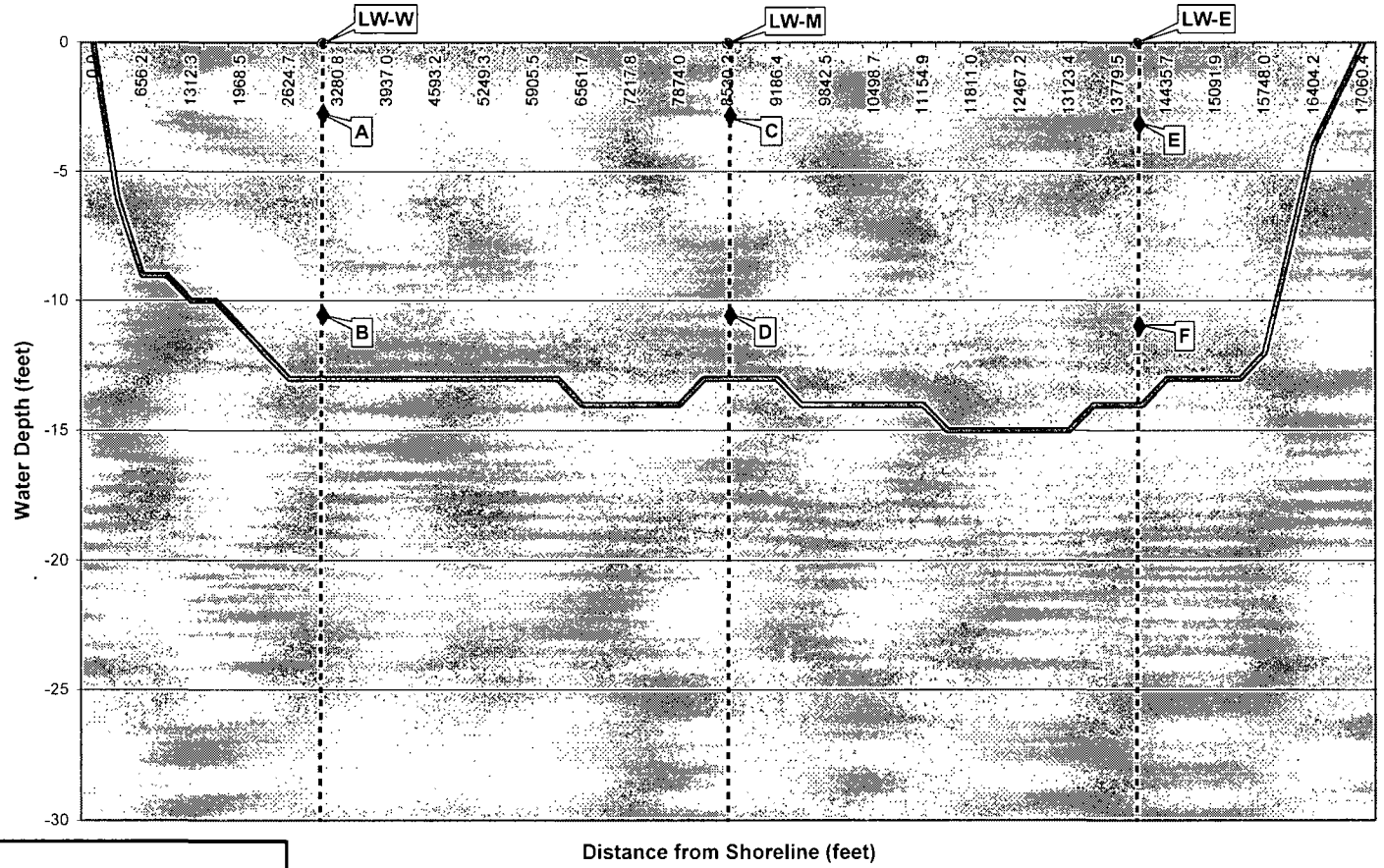
Lower Fox River Baseline Monitoring Plan
Fishing Hotspot Details

MAP_CODE	FISH_AREA	NOTES	SOURCE
DNR-1		Below dam (walleye, carp, gizzard shad, white bass, white sucker)	WDNR
DNR-10		Below dam (walleye, carp, gizzard shad, white bass, white sucker)	WDNR
DNR-11		Shallow flats (carp)	WDNR
DNR-12		Below dam (walleye, carp, gizzard shad, white bass, white sucker)	WDNR
DNR-13		Shallow flats (carp)	WDNR
DNR-14		gizzard shad	WDNR
DNR-15		walleye	WDNR
DNR-16		smallmouth bass	WDNR
DNR-17		carp	WDNR
DNR-18		carp	WDNR
DNR-19		smallmouth bass	WDNR
DNR-2		Shallow flats (carp)	WDNR
DNR-20		walleye	WDNR
DNR-21		gizzard shad	WDNR
DNR-22		gizzard shad	WDNR
DNR-23		carp	WDNR
DNR-24		smallmouth bass	WDNR
DNR-25		Weeds and rock bars (walleye, gizzard shad); shallow flats (carp)	WDNR
DNR-26		Shallow flats (carp); shallow close to shore (gizzard shad)	WDNR
DNR-27		Around Kidney Island (smallmouth bass)	WDNR
DNR-28		Rock bars (smallmouth bass); weeds (walleye)	WDNR
DNR-29		West Side of Grassy Island (smallmouth bass)	WDNR
DNR-3		Below dam (walleye, carp, gizzard shad, white bass, white sucker)	WDNR
DNR-30		All around Frying Pan Schoal (walleye, smallmouth bass)	WDNR
DNR-31		Gizzard shad	WDNR
DNR-4		Shallow flats (carp)	WDNR
DNR-5		Shallow flats (carp, gizzard shad)	WDNR
DNR-6		Shallow flats (carp)	WDNR
DNR-7		Below dam (walleye, carp, gizzard shad, white bass, white sucker)	WDNR
DNR-8		Near discharge (walleye, carp, gizzard shad, white bass, white sucker)	WDNR
DNR-9		Shallow flats (carp)	WDNR
FR-1	FISHING AREA 36	Small troughs in shallows from current break	FHS, Inc
FR-10	FISHING AREA 31	6 - 14 foot channel break	FHS, Inc
FR-11	FISHING AREA 28	East corner of railroad bridge, riprap	FHS, Inc
FR-12	FISHING AREA 27	Hoist ramp channel, riprap	FHS, Inc
FR-13	FISHING AREA 26	East side - railroad bridge	FHS, Inc
FR-14	FISHING AREA 26	West side - railroad bridge	FHS, Inc
FR-15	FISHING AREA 25	Submerged pilings	FHS, Inc
FR-16	FISHING AREA 24	Shallow food shelves, riprap	FHS, Inc
FR-17	FISHING AREA 23	East side - Main Street Bridge pillars, riprap	FHS, Inc
FR-18	FISHING AREA 23	West side - Main Street Bridge pillars, riprap	FHS, Inc
FR-19	FISHING AREA 22	Sandbar, under certain conditions	FHS, Inc
FR-2	FISHING AREA 34	Voyager Park, shore fishing, riprap	FHS, Inc
FR-20	FISHING AREA 21	West side - riprap and wood pilings	FHS, Inc
FR-21	FISHING AREA 21	East side - riprap upstream from railroad bridge	FHS, Inc
FR-22	FISHING AREA 20	Two warm-water discharge culverts	FHS, Inc
FR-23	FISHING AREA 19	East side stretch of submerged pilings	FHS, Inc
FR-24	FISHING AREA 17	Point just off the fuel tanks	FHS, Inc
FR-25	FISHING AREA 18	Canal	FHS, Inc
FR-26	FISHING AREA 16	Warm-water power plant discharge	FHS, Inc
FR-3	FISHING AREA 35	Deep washout hole	FHS, Inc
FR-4	FISHING AREA 33	East side - Protruding point with small underwater cut on upstream side	FHS, Inc
FR-5	FISHING AREA 33	West side	FHS, Inc
FR-6	FISHING AREA 32		FHS, Inc
FR-7	FISHING AREA 31	6 - 14 foot channel break	FHS, Inc
FR-8	FISHING AREA 30	Riprap	FHS, Inc
FR-9	FISHING AREA 29	Washout hole from two discharges from Fort Howard Paper Company	FHS, Inc
GB-1	FISHING AREA 10	Vokes Reef region (walleye from spring to fall; small mouth bass, northern	FHS, Inc
GB-10	FISHING AREA 38	Dead Horse Bay (ice fishing for yellow perch and northern pike)	FHS, Inc
GB-11	FISHING AREA 39	Suamico River (yellow perch in spring)	FHS, Inc
GB-12	FISHING AREA 39	Suamico River (yellow perch in spring)	FHS, Inc
GB-13	FISHING AREA 40	Weed beds at Little Tail Point (walleye in summer)	FHS, Inc

Lower Fox River Baseline Monitoring Plan
Fishing Hotspot Details

GB-2	FISHING AREA 11	Weed beds off Point Sable (northern pike in summer)	FHS, Inc
GB-3	FISHING AREA 13	(walleye in summer)	FHS, Inc
GB-4	FISHING AREA 12	Electrofish surveys (high concentrations of walleye)	FHS, Inc
GB-5	FISHING AREA 13	(walleye in summer)	FHS, Inc
GB-6	FISHING AREA 12	Electrofish surveys (high concentrations of walleye)	FHS, Inc
GB-7	FISHING AREA 14	Kidney Island (Walleye in summer and fall)	FHS, Inc
GB-8	FISHING AREA 15	Grassy Island (walleye in midsummer)	FHS, Inc
GB-9	FISHING AREA 37	Duck Bay/Duck Creek (yellow perch in spring and late winter; crappie in spr	FHS, Inc
LW-1	FISHING AREA 12	Deep water area (walleye)	FHS, Inc
LW-10	FISHING AREA 3	Breakline (walleye)	FHS, Inc
LW-11	FISHING AREA 1	Break north of Supple Marsh (walleye, yellow perch)	FHS, Inc
LW-12	FISHING AREA 2	Reef edges (walleye, yellow perch)	FHS, Inc
LW-13	FISHING AREA 2	Reef edges (walleye, yellow perch)	FHS, Inc
LW-14	FISHING AREA 2	Reef edges (walleye, yellow perch)	FHS, Inc
LW-15	FISHING AREA 2	Reef edges (walleye, yellow perch)	FHS, Inc
LW-16	FISHING AREA 46	Shallow rocks reefs off Fraction Island and Kelly's Point (walleye)	FHS, Inc
LW-17	FISHING AREA 46	Shallow rocks reefs off Fraction Island and Kelly's Point (walleye)	FHS, Inc
LW-18	FISHING AREA 43	Long Point Reef (walleye, yellow perch)	FHS, Inc
LW-19	FISHING AREA 41	Weedy bays, rocky shoreline, offshore reefs (largemouth bass, walleye, nort	FHS, Inc
LW-2	FISHING AREA 12	Deep water area (walleye)	FHS, Inc
LW-20	FISHING AREA 43	Long Point Reef (walleye, yellow perch)	FHS, Inc
LW-21	FISHING AREA 41	Weedy bays, rocky shoreline, offshore reefs (largemouth bass, walleye, nort	FHS, Inc
LW-22	FISHING AREA 41	Weedy bays, rocky shoreline, offshore reefs (largemouth bass, walleye, nort	FHS, Inc
LW-23	FISHING AREA 41	Weedy bays, rocky shoreline, offshore reefs (largemouth bass, walleye, nort	FHS, Inc
LW-24	FISHING AREA 41	Weedy bays, rocky shoreline, offshore reefs (largemouth bass, walleye, nort	FHS, Inc
LW-25	FISHING AREA 40	Weed beds, shoreline rocks, reef (crappie, bluegill, northern pike, largem	FHS, Inc
LW-26	FISHING AREA 40	Weed beds, shoreline rocks, reef (crappie, bluegill, northern pike, largem	FHS, Inc
LW-27	FISHING AREA 39	Rock humps, breaks (walleye, yellow perch)	FHS, Inc
LW-28	FISHING AREA 39	Rock humps, breaks (walleye, yellow perch)	FHS, Inc
LW-29	FISHING AREA 38	Riprap and weeds (walleye)	FHS, Inc
LW-3	FISHING AREA 7	Long, rocky point (walleye, yellow perch)	FHS, Inc
LW-30	FISHING AREA 38	Riprap and weeds (walleye)	FHS, Inc
LW-31	FISHING AREA 37	Rock pile (walleye)	FHS, Inc
LW-32	FISHING AREA 36	Rocks and weed beds (walleye, yellow perch, white bass in May)	FHS, Inc
LW-33	FISHING AREA 36	Rocks and weed beds (walleye, yellow perch, white bass in May)	FHS, Inc
LW-34	FISHING AREA 35	Rasmussen's Reef and Horseshoe Reef (walleye, yellow perch)	FHS, Inc
LW-35	FISHING AREA 34	Weed beds (northern pike, blue gill, crappie, largemouth bass)	FHS, Inc
LW-36	FISHING AREA 32	Sharp break (walleye, yellow perch)	FHS, Inc
LW-37	FISHING AREA 31	Boat channels and weed beds (crappie, bluegill, largemouth bass, northern	FHS, Inc
LW-38	FISHING AREA 31	Boat channels and weed beds (crappie, bluegill, largemouth bass, northern	FHS, Inc
LW-39	FISHING AREA 30	Shoreline rocks (walleye, smallmouth bass, yellow perch)	FHS, Inc
LW-4	FISHING AREA 4	Shallow rock reefs (walleye)	FHS, Inc
LW-40	FISHING AREA 27	Weed beds west of Perkins Point (walleye, northern pike)	FHS, Inc
LW-41	FISHING AREA 26	Dredge channels west of Perkins Point (crappie, largemouth bass, northern p	FHS, Inc
LW-42	FISHING AREA 28	Reefs SE of Garlic Island (yellow perch, walleye)	FHS, Inc
LW-43	FISHING AREA 24	Blackbird Reef (yellow perch, walleye)	FHS, Inc
LW-44	FISHING AREA 22	Reef (walleye, yellow perch, smallmouth bass)	FHS, Inc
LW-45	FISHING AREA 23	Shoreline rocks around Payne Point (walleye, smallmouth bass)	FHS, Inc
LW-46	FISHING AREA 22	Reef (walleye, yellow perch, smallmouth bass)	FHS, Inc
LW-47	FISHING AREA 22	Reef (walleye, yellow perch, smallmouth bass)	FHS, Inc
LW-48	FISHING AREA 21	Shoreline rocks (walleye, smallmouth bass)	FHS, Inc
LW-49	FISHING AREA 20	Outer bar and two small rock humps (walleye, yellow perch)	FHS, Inc
LW-5	FISHING AREA 4	Shallow rock reefs (walleye)	FHS, Inc
LW-50	FISHING AREA 20	Outer bar and two small rock humps (walleye, yellow perch)	FHS, Inc
LW-51	FISHING AREA 17	West side of Lighthouse Reef (yellow perch in late summer)	FHS, Inc
LW-52	FISHING AREA 16	Jefferson Park shoreline (white bass in spring, northern pike, bluegill; la	FHS, Inc
LW-6	FISHING AREA 4	Shallow rock reefs (walleye)	FHS, Inc
LW-7	FISHING AREA 3	Breakline (walleye)	FHS, Inc
LW-8	FISHING AREA 3	Breakline (walleye)	FHS, Inc
LW-9	FISHING AREA 3	Breakline (walleye)	FHS, Inc

Lake Winnebago Cross Section



Legend

- Water Sampling Location
- Water Sample
- Water Depth

Scale and Vertical Exaggeration:
1 inch = approximately 5 feet in water depth, and approximately 1500 feet in distance from shoreline

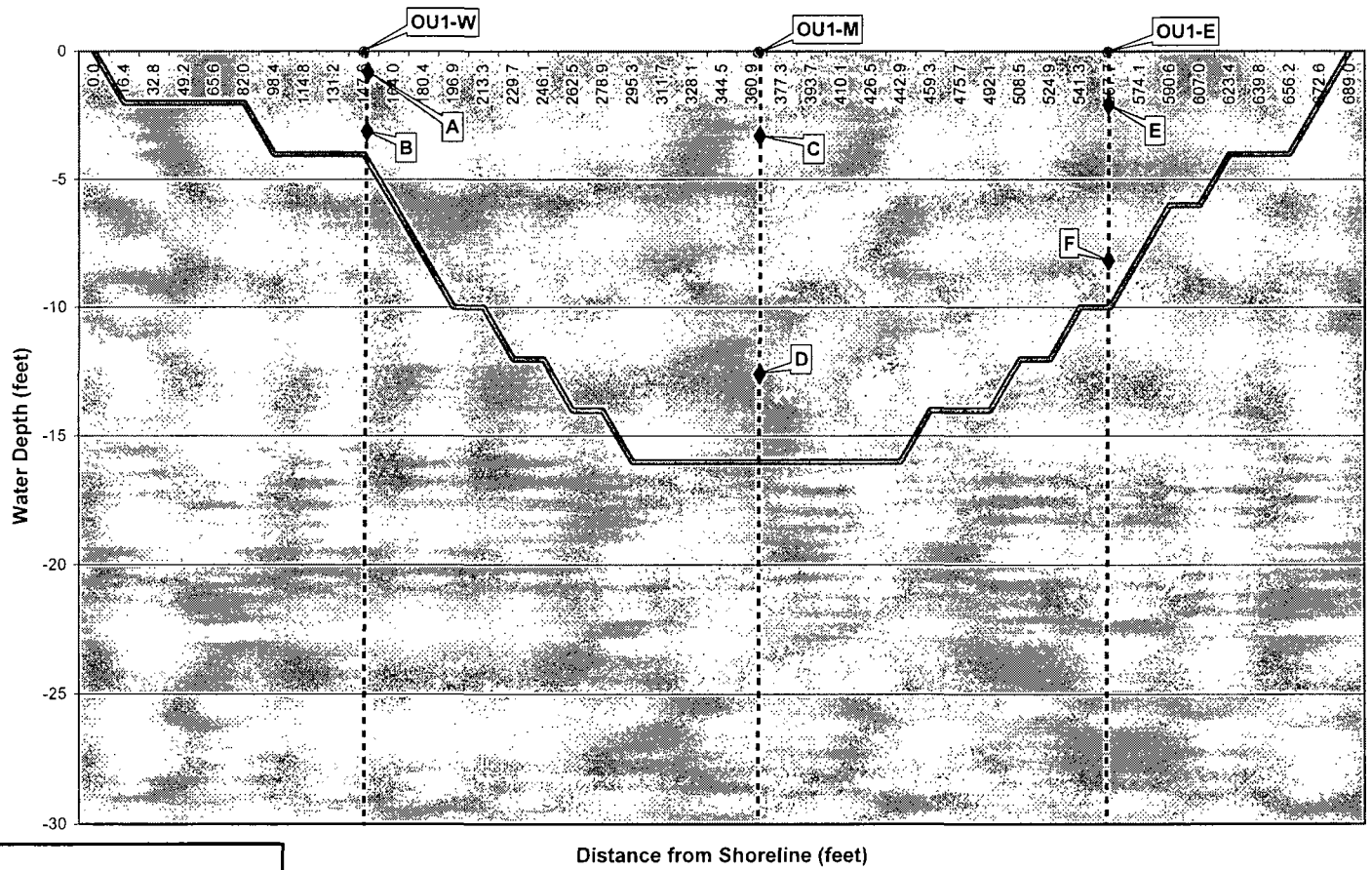
DRAFT

Lake Winnebago
Water Sampling Transect
Cross-Section

Shaw Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

OU 1 Cross Section



Legend

- Water Sampling Location
- Water Sample
- Water Depth

Scale and Vertical Exaggeration:
1 inch = approximately 5 feet in water depth, and approximately 65 feet in distance from shoreline

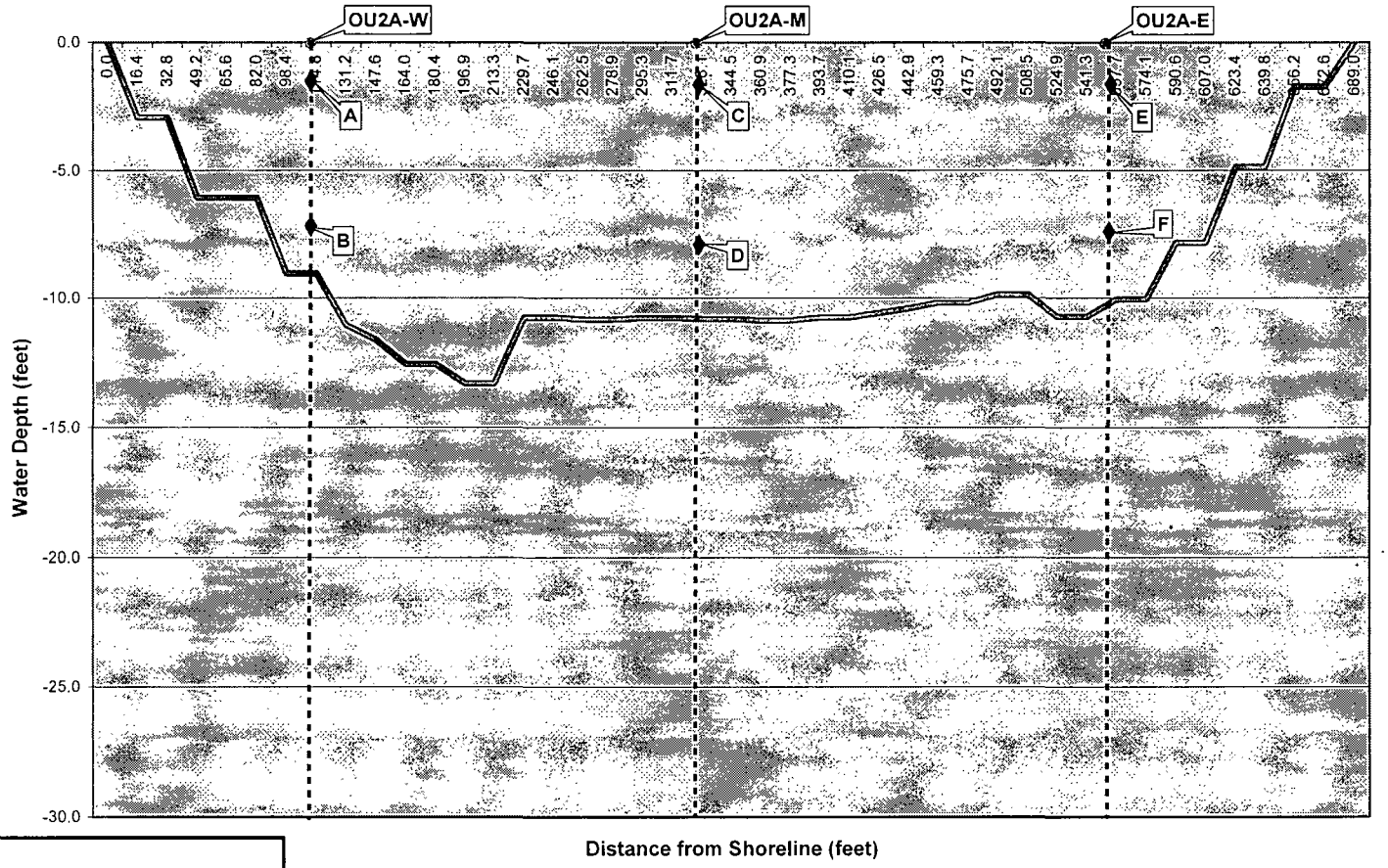
DRAFT

Operable Unit 1
Water Sampling Transect
Cross-Section

Shaw · Shaw Environmental, Inc

ANCHOR ENVIRONMENTAL, L.L.C

OU 2A Cross Section



Legend

- Water Sampling Location
- Water Sample
- Water Depth

Scale and Vertical Exaggeration:
1 inch = approximately 5 feet in water depth, and approximately 65 feet in distance from shoreline

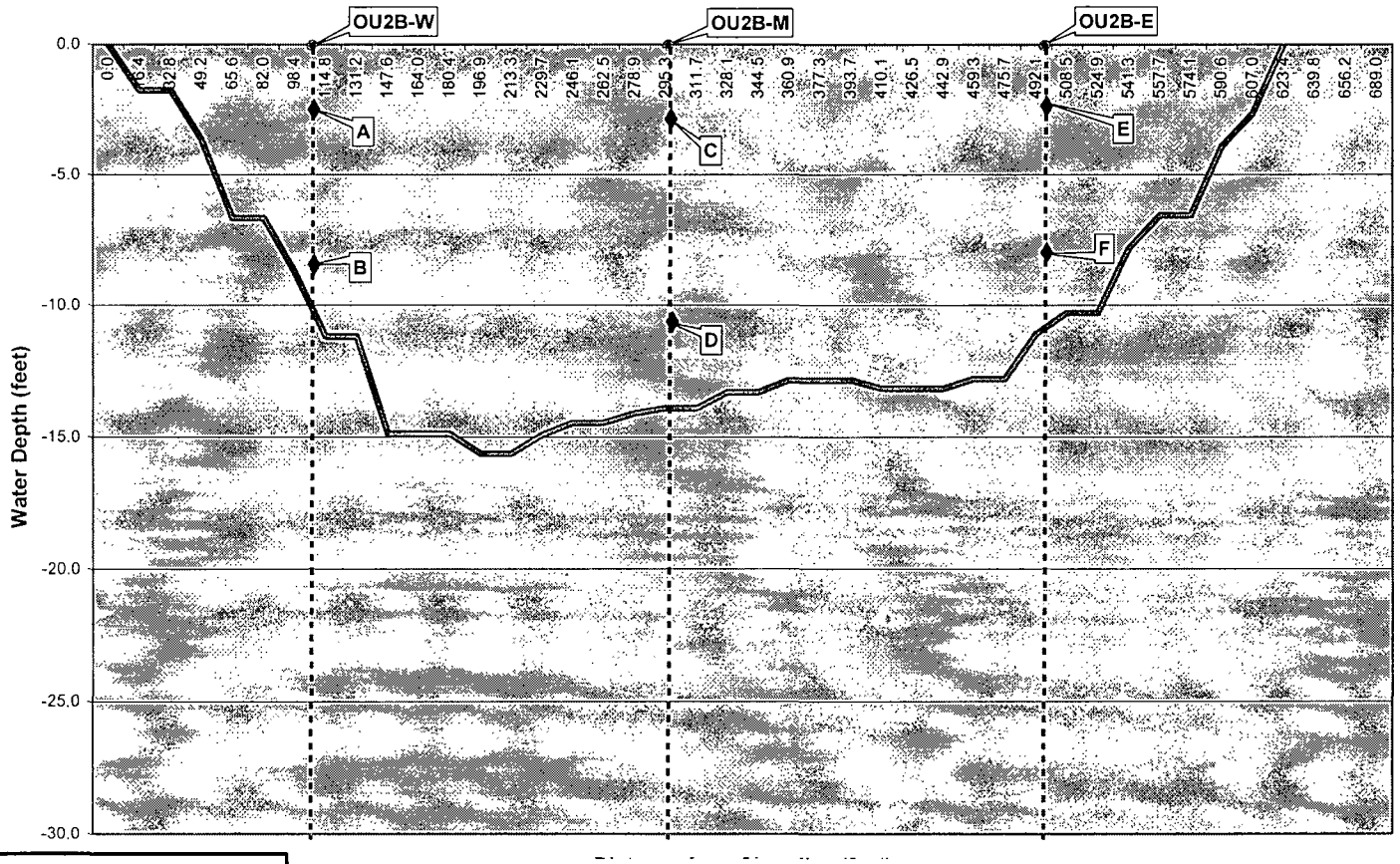
DRAFT

Operable Unit 2A
Water Sampling Transect
Cross-Section

Shaw - Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

OU 2B Cross Section



Legend

- Water Sampling Location
- Water Sample
- Water Depth

Scale and Vertical Exaggeration:
1 inch = approximately 5 feet in water depth, and approximately 65 feet in distance from shoreline

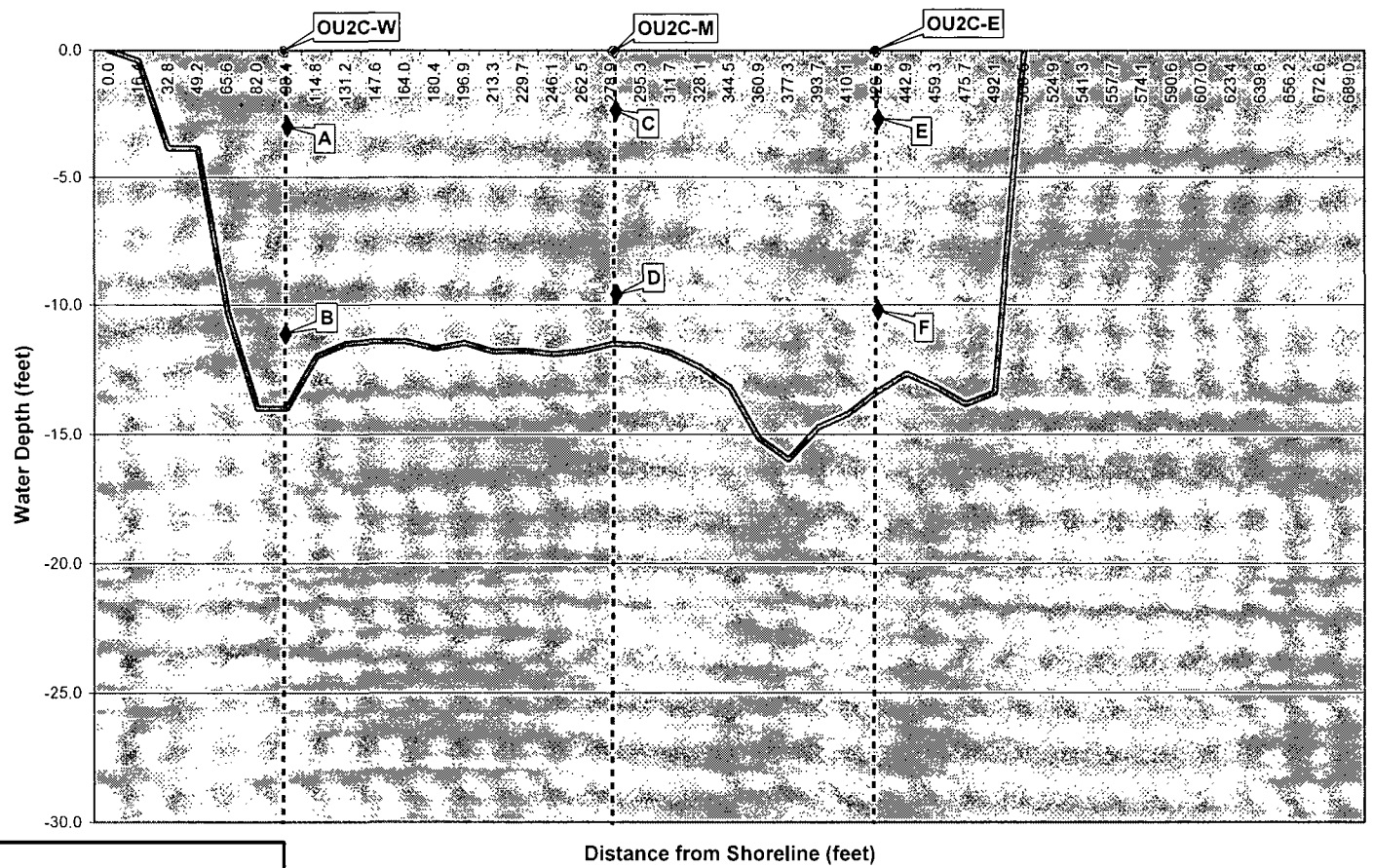
DRAFT

Operable Unit 2B
Water Sampling Transect
Cross-Section

Shaw · Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L L C.

OU 2C Cross Section



Legend

- Water Sampling Location
- Water Sample
- Water Depth

Scale and Vertical Exaggeration:
1 inch = approximately 5 feet in water depth, and approximately 65 feet in distance from shoreline

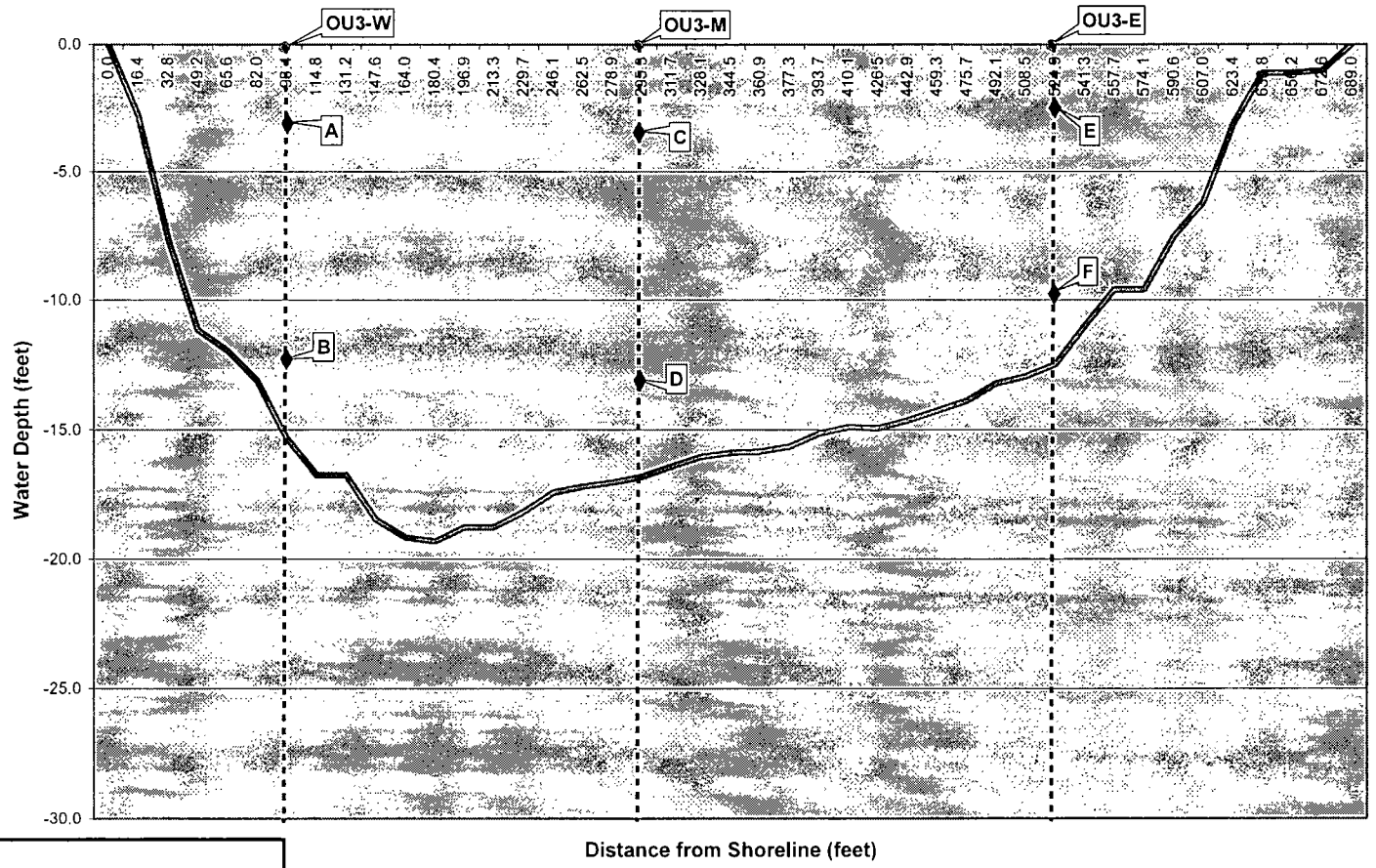
DRAFT

Operable Unit 2C
Water Sampling Transect
Cross-Section

Shaw - Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C

OU 3 Cross Section



Legend

- Water Sampling Location
- Water Sample
- Water Depth

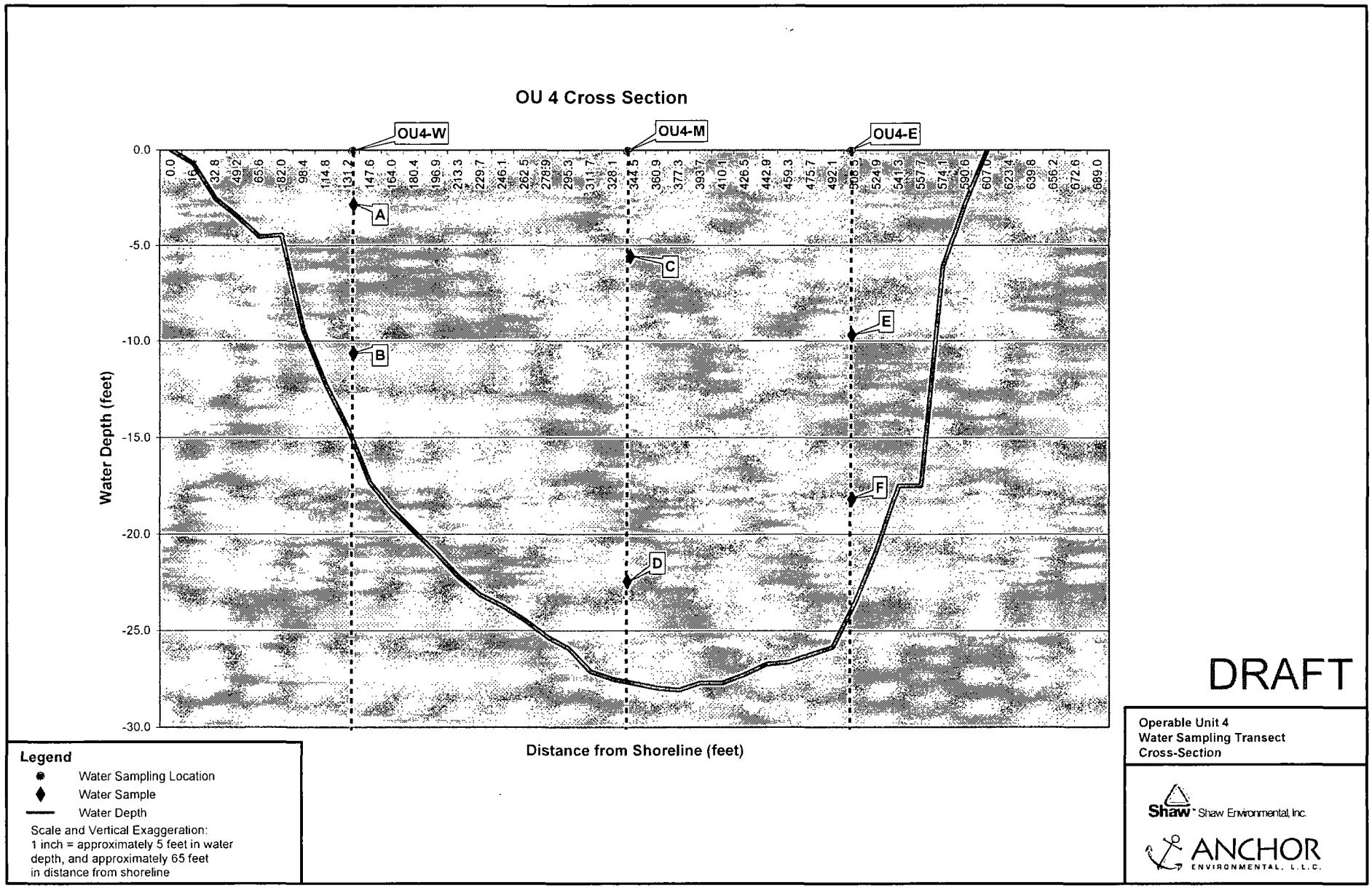
Scale and Vertical Exaggeration:
1 inch = approximately 5 feet in water depth, and approximately 65 feet in distance from shoreline

DRAFT

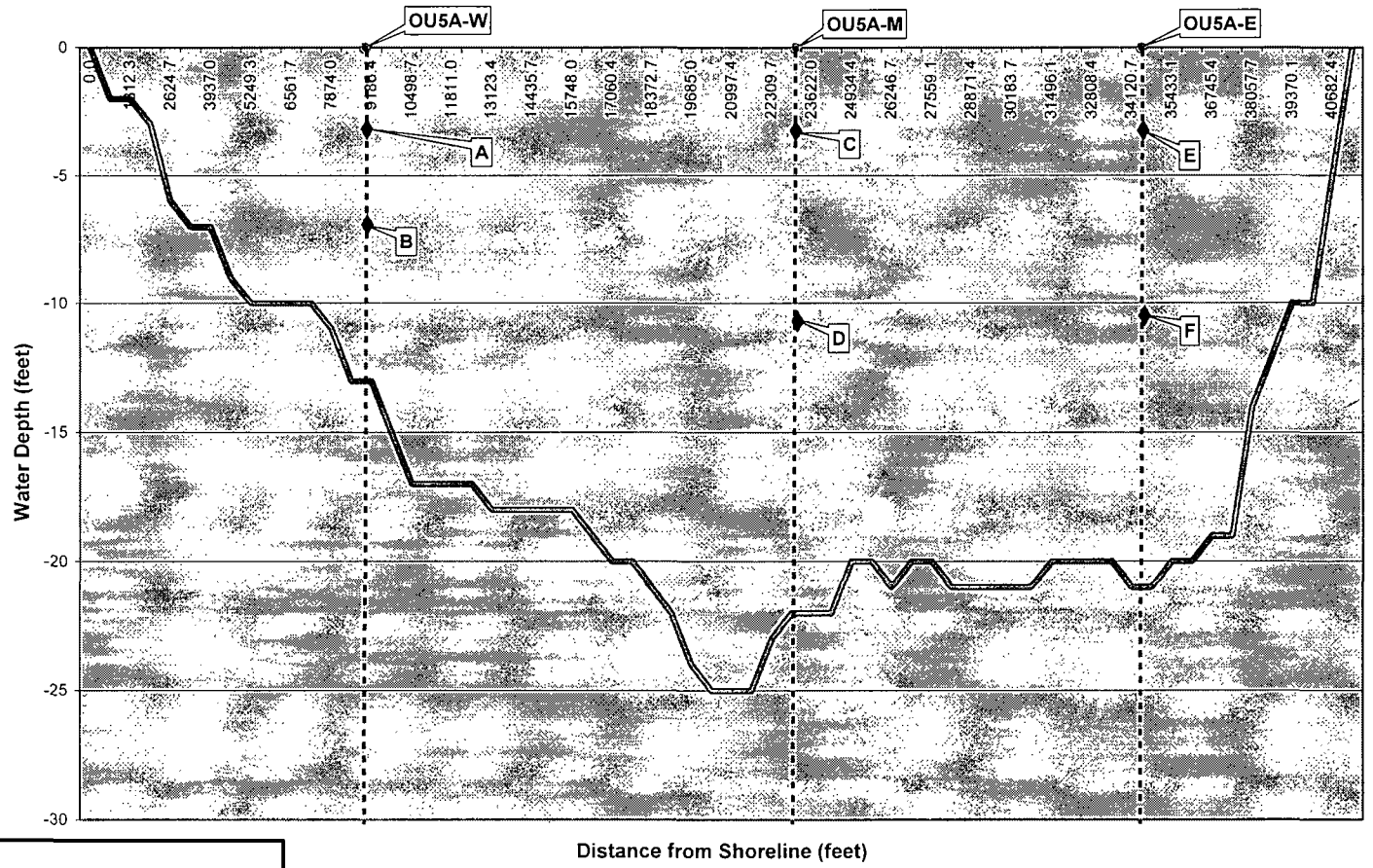
Operable Unit 3
Water Sampling Transect
Cross-Section

Shaw Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.


OU 4 Cross Section
OU4-W
OU4-M
OU4-E
A
B
C
D
E
F
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
Water Depth (feet)
Distance from Shoreline (feet)
Legend
Water Sampling Location
Water Sample
Water Depth
Scale and Vertical Exaggeration:
1 inch = approximately 5 feet in water depth, and approximately 65 feet in distance from shoreline
DRAFT
Operable Unit 4
Water Sampling Transect
Cross-Section
Shaw Shaw Environmental, Inc.
ANCHOR ENVIRONMENTAL, L.L.C.

OU 5A Cross Section



Distance from Shoreline (feet)

Legend

- Water Sampling Location
- Water Sample
- Water Depth

Scale and Vertical Exaggeration:
1 inch = approximately 5 feet in water depth, and approximately 3900 feet in distance from shoreline

Exact sampling depths to be determined, based on temperature surveys and depth to thermocline during field sampling; see text for details

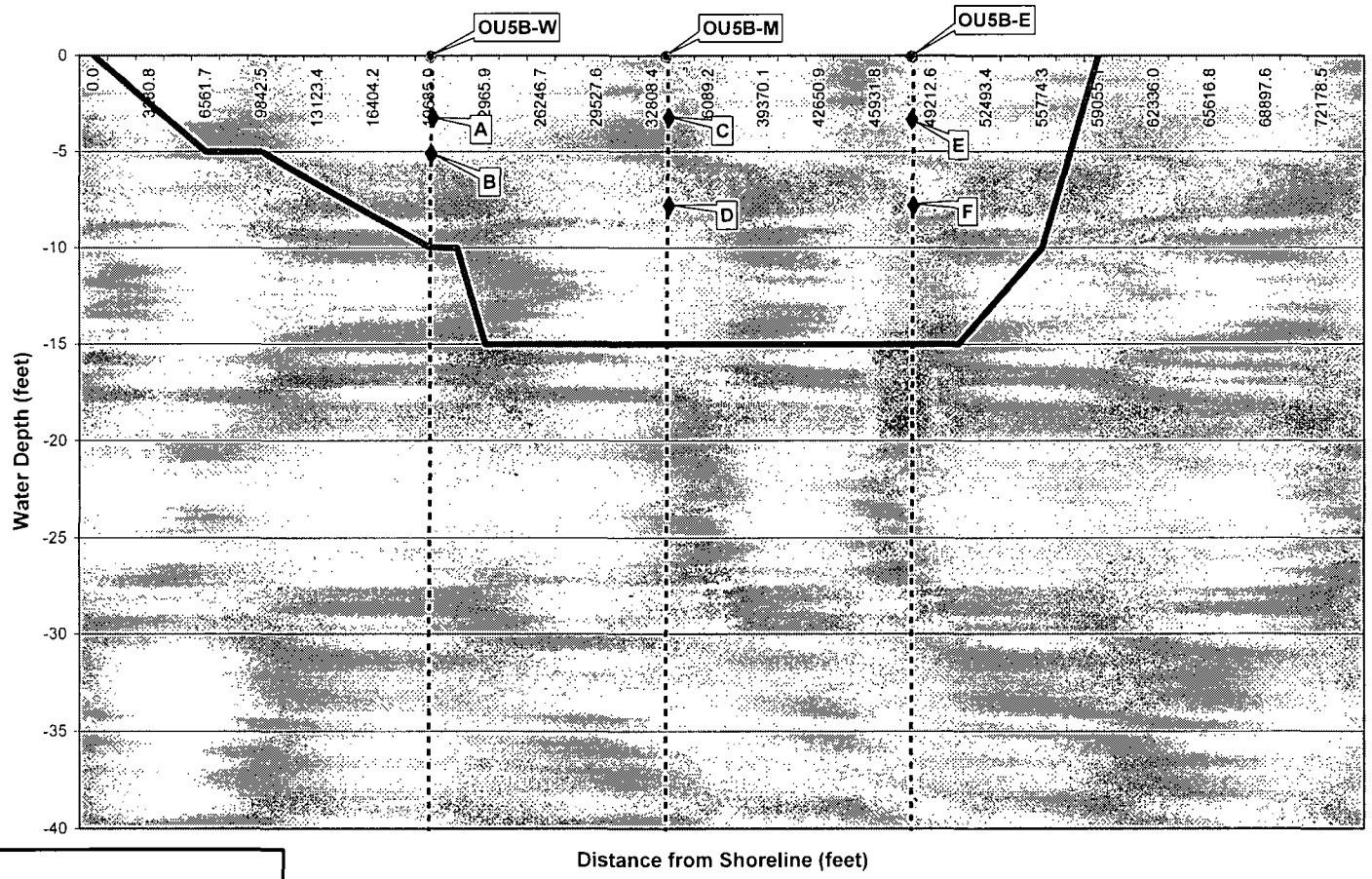
DRAFT

Operable Unit 5A
Water Sampling Transect
Cross-Section

Shaw · Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C

OU 5B Cross Section



Legend

- Water Sampling Location
- Water Sample
- Water Depth

Scale and Vertical Exaggeration:
1 inch = approximately 6.5 feet in water depth, and approximately 6600 feet in distance from shoreline

Exact sampling depths to be determined, based on temperature surveys and depth to thermocline during field sampling; see text for details

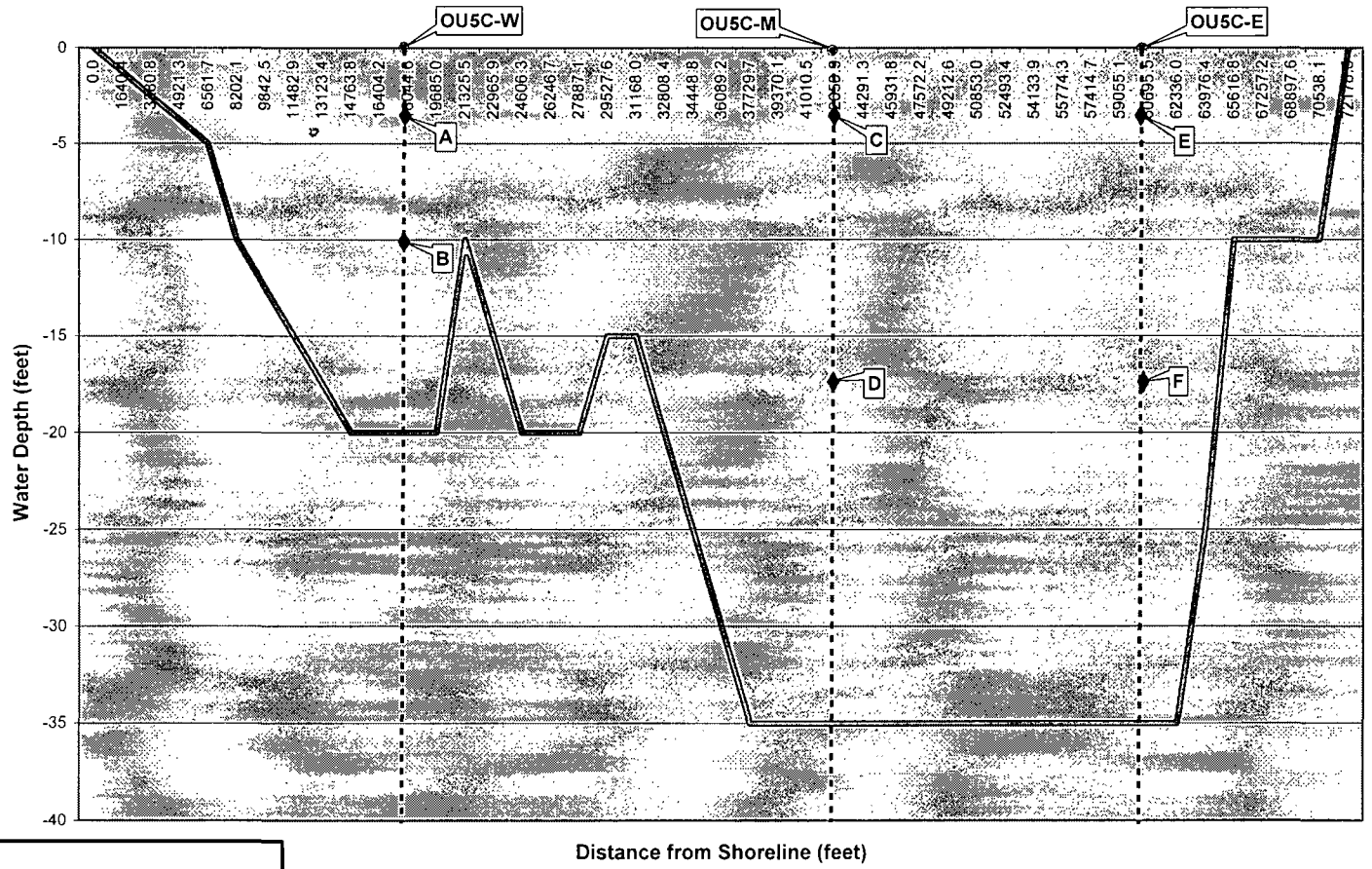
DRAFT

Operable Unit 5B
Water Sampling Transect
Cross-Section

Shaw Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

OU 5C Cross Section



Legend

- Water Sampling Location
- Water Sample
- Water Depth

Scale and Vertical Exaggeration:
1 inch = approximately 6.5 feet in water depth, and approximately 6600 feet in distance from shoreline

Exact sampling depths to be determined, based on temperature surveys and depth to thermocline during field sampling; see text for details

DRAFT

Operable Unit 5C
Water Sampling Transect
Cross-Section

Shaw Shaw Environmental, Inc.

ANCHOR ENVIRONMENTAL, L.L.C.

APPENDIX
H

Appendix H –

Historic PCB Congener Data

Document List

1. Table H-1 - 2004 Lake Winnebago Congener Data
2. Table H-2 - Summary of Lower Fox River Total PCB Data
3. Table H-3 - Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study
4. Table H-4 - Lower Fox River Historic Water Column Congener Data for OU1 (Suspended and Dissolved)
5. Table H-5 - Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)
6. Table H-6 - Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)
7. Table H-7 - Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)
8. Table H-8 - Lower Fox River Historic Water Column Congener Data for OU3 (Suspended and Dissolved, HRGC/MS Method)
9. Table H-9 - Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)
10. Table H-10 - Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)
11. Table H-11 - Lower Fox River Historic Water Column Congener Data for OU4 (Suspended and Dissolved, HRGC/MS Method)
12. Table H-12 - Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
13. Table H-13 - Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)

Table H-1. 2004 Lake Winnebago Congener Data

LOCATION CODE		LK-WINN		LK-WINN		LK-WINN		LK-WINN	
SAMPLE NO		FR-LK-WINN01		FR-LK-WINN01		FR-LK-WINN01X		FR-LK-WINN01X	
SAMPLE DATE		11-Nov-04		11-Nov-04		11-Nov-04		11-Nov-04	
SAMPLE PURPOSE		REG		REG		FD		FD	
		UNFILTERED		FILTERED		UNFILTERED		FILTERED	
Parameter	Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Total Organic Carbon	mg/L	9.9	NJ	10		11		10	
Total Suspended Solids	mg/L	33				33			
PCB 1 (BZ)	ng/L	0.017	U	0.0108	U	0.0132	U	0.01	U
PCB 10 (BZ)	ng/L	0.137	U	0.115	U	0.132	U	0.104	U
PCB 100 (BZ)	ng/L	0.0444	U	0.0358	U	0.0403	U	0.0338	U
PCB 101 (BZ)	ng/L	0.038	U	0.0306	U	0.0345	U	0.0289	U
PCB 102 (BZ)	ng/L	0.0452	U	0.0364	U	0.041	U	0.0344	U
PCB 103 (BZ)	ng/L	0.0416	U	0.0335	U	0.0378	U	0.0316	U
PCB 104 (BZ)	ng/L	0.0328	U	0.0264	U	0.0298	U	0.0249	U
PCB 105 (BZ)	ng/L	0.0203	U	0.0166	U	0.0191	U	0.0154	U
PCB 106 (BZ)	ng/L	0.0222	U	0.0179	U	0.0202	U	0.0169	U
PCB 107 (BZ)/109 (IUPAC)	ng/L	0.0197	U	0.0158	U	0.0178	U	0.0149	U
PCB 108 (BZ)/107 (IUPAC)	ng/L	0.0219	U	0.0176	U	0.0199	U	0.0166	U
PCB 109 (BZ)/108 (IUPAC)	ng/L	0.0365	U	0.0294	U	0.0331	U	0.0277	U
PCB 11 (BZ)	ng/L	0.132	U	0.111	U	0.127	U	0.1	U
PCB 110 (BZ)	ng/L	0.0322	U	0.0259	U	**0.0604**	J	0.0245	U
PCB 111 (BZ)	ng/L	0.031	U	0.0249	U	0.0281	U	0.0235	U
PCB 112 (BZ)	ng/L	0.0362	U	0.0291	U	0.0328	U	0.0275	U
PCB 113 (BZ)	ng/L	0.038	U	0.0306	U	0.0345	U	0.0289	U
PCB 114 (BZ)	ng/L	0.0166	U	0.0144	U	0.0165	U	0.0131	U
PCB 115 (BZ)	ng/L	0.0322	U	0.0259	U	**0.0604**	J	0.0245	U
PCB 116 (BZ)	ng/L	0.0364	U	0.0293	U	0.033	U	0.0277	U
PCB 117 (BZ)	ng/L	0.0364	U	0.0293	U	0.033	U	0.0277	U
PCB 118 (BZ)	ng/L	0.0179	U	0.0136	U	**0.0199**	J	0.0142	U
PCB 119 (BZ)	ng/L	0.0365	U	0.0294	U	0.0331	U	0.0277	U
PCB 12 (BZ)	ng/L	**0.0915**	J	0.107	U	**0.111**	J	0.097	U
PCB 120 (BZ)	ng/L	0.0298	U	0.024	U	0.0271	U	0.0227	U
PCB 121 (BZ)	ng/L	0.0324	U	0.0261	U	0.0295	U	0.0247	U
PCB 122 (BZ)	ng/L	0.023	U	0.0185	U	0.0209	U	0.0175	U
PCB 123 (BZ)	ng/L	0.0179	U	0.0143	U	0.0157	U	0.0137	U
PCB 124 (BZ)	ng/L	0.0219	U	0.0176	U	0.0199	U	0.0166	U
PCB 125 (BZ)	ng/L	0.0365	U	0.0294	U	0.0331	U	0.0277	U
PCB 126 (BZ)	ng/L	0.0258	U	0.0204	U	0.021	U	0.0177	U
PCB 127 (BZ)	ng/L	0.0203	U	0.0164	U	0.0185	U	0.0155	U
PCB 128 (BZ)	ng/L	0.0302	U	0.0248	U	0.0286	U	0.024	U
PCB 129 (BZ)	ng/L	1	UJ	0.0254	U	0.0293	U	0.0246	U
PCB 13 (BZ)	ng/L	**0.0915**	J	0.107	U	**0.111**	J	0.097	U
PCB 130 (BZ)	ng/L	0.0393	U	0.0323	U	0.0372	U	0.0312	U
PCB 131 (BZ)	ng/L	0.0395	U	0.0325	U	0.0375	U	0.0314	U
PCB 132 (BZ)	ng/L	0.0385	U	0.0317	U	0.0365	U	0.0306	U
PCB 133 (BZ)	ng/L	0.0363	U	0.0298	U	0.0344	U	0.0289	U
PCB 134 (BZ)	ng/L	0.0395	U	0.0325	U	0.0375	U	0.0314	U
PCB 135 (BZ)	ng/L	0.0557	U	0.0457	U	0.0527	U	0.0443	U
PCB 136 (BZ)	ng/L	0.0413	U	0.0339	U	0.0391	U	0.0328	U
PCB 137 (BZ)	ng/L	0.0295	U	0.0243	U	0.028	U	0.0235	U
PCB 138 (BZ)	ng/L	0.043	UJ	0.0254	U	0.0293	U	0.0246	U
PCB 139 (BZ)	ng/L	0.0332	U	0.0273	U	0.0314	U	0.0264	U
PCB 14 (BZ)	ng/L	0.126	U	0.106	U	0.122	U	0.096	U
PCB 140 (BZ)	ng/L	0.0332	U	0.0273	U	0.0314	U	0.0264	U
PCB 141 (BZ)	ng/L	0.0352	U	0.0289	U	0.0333	U	0.028	U
PCB 142 (BZ)	ng/L	0.0389	U	0.032	U	0.0368	U	0.0309	U
PCB 143 (BZ)	ng/L	0.0395	U	0.0325	U	0.0375	U	0.0314	U
PCB 144 (BZ)	ng/L	0.0544	U	0.0447	U	0.0515	U	0.0432	U
PCB 145 (BZ)	ng/L	0.0421	U	0.0346	U	0.0399	U	0.0335	U
PCB 146 (BZ)	ng/L	0.0318	U	0.0262	U	0.0301	U	0.0253	U
PCB 147 (BZ)	ng/L	0.0319	U	0.0263	U	0.0303	U	0.0254	U
PCB 148 (BZ)	ng/L	0.0554	U	0.0455	U	0.0525	U	0.044	U
PCB 149 (BZ)	ng/L	0.0319	U	0.0263	U	0.0303	U	0.0254	U
PCB 15 (BZ)	ng/L	0.102	U	**0.0468**	J	**0.0615**	J	**0.057**	J
PCB 150 (BZ)	ng/L	0.0404	U	0.0332	U	0.0382	U	0.0321	U
PCB 151 (BZ)	ng/L	0.0557	U	0.0457	U	0.0527	U	0.0443	U
PCB 152 (BZ)	ng/L	0.0399	U	0.0328	U	0.0378	U	0.0317	U
PCB 153 (BZ)	ng/L	**0.0382**	J	0.0223	U	**0.0399**	J	0.0216	U
PCB 154 (BZ)	ng/L	0.0476	U	0.0391	U	0.0451	U	0.0379	U
PCB 155 (BZ)	ng/L	0.0386	U	0.0317	U	0.0366	U	0.0307	U
PCB 156 (BZ)	ng/L	0.024	U	0.0187	U	0.0225	U	0.0193	U
PCB 157 (BZ)	ng/L	0.024	U	0.0187	U	0.0225	U	0.0193	U
PCB 158 (BZ)	ng/L	0.0237	U	0.0194	U	0.0224	U	0.0188	U
PCB 159 (BZ)	ng/L	0.0248	U	0.0204	U	0.0235	U	0.0197	U
PCB 16 (BZ)	ng/L	0.0857	U	0.0728	U	0.0869	U	0.0696	U
PCB 160 (BZ)	ng/L	0.0276	U	0.0227	U	0.0262	U	0.022	U
PCB 161 (BZ)	ng/L	0.0258	U	0.0212	U	0.0244	U	0.0205	U
PCB 162 (BZ)	ng/L	0.0248	U	0.0204	U	0.0235	U	0.0197	U

Table H-1. 2004 Lake Winnebago Congener Data

LOCATION_CODE		LK-WINN		LK-WINN		LK-WINN		LK-WINN	
SAMPLE_NO		FR-LK-WINN01		FR-LK-WINN01		FR-LK-WINN01X		FR-LK-WINN01X	
SAMPLE_DATE		11-Nov-04		11-Nov-04		11-Nov-04		11-Nov-04	
SAMPLE_PURPOSE		REG		REG		FD		FD	
		UNFILTERED		FILTERED		UNFILTERED		FILTERED	
Parameter	Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PCB 163 (BZ)	ng/L	0.043	U	0.0254	U	0.0293	U	0.0246	U
PCB 164 (BZ)	ng/L	0.0295	U	0.0243	U	0.028	U	0.0235	U
PCB 165 (BZ)	ng/L	0.0282	U	0.0232	U	0.0267	U	0.0224	U
PCB 166 (BZ)	ng/L	0.0302	U	0.0248	U	0.0286	U	0.024	U
PCB 167 (BZ)	ng/L	0.0188	U	0.017	U	0.0198	U	0.0163	U
PCB 168 (BZ)	ng/L	**0.0382**	J	0.0223	U	**0.0399**	J	0.0216	U
PCB 169 (BZ)	ng/L	0.0283	U	0.0229	U	0.0235	U	0.0195	U
PCB 17 (BZ)	ng/L	0.0691	U	0.0588	U	0.0701	U	0.0562	U
PCB 170 (BZ)	ng/L	0.0276	U	0.0218	U	0.03	U	0.0223	U
PCB 171 (BZ)	ng/L	0.0352	U	0.0275	U	0.0354	U	0.0254	U
PCB 172 (BZ)	ng/L	0.0356	U	0.0279	U	0.0358	U	0.0258	U
PCB 173 (BZ)	ng/L	0.0352	U	0.0275	U	0.0354	U	0.0254	U
PCB 174 (BZ)	ng/L	0.033	U	0.0258	U	0.0332	U	0.0239	U
PCB 175 (BZ)	ng/L	0.0316	U	0.0247	U	0.0318	U	0.0229	U
PCB 176 (BZ)	ng/L	0.0251	U	0.0196	U	0.0252	U	0.0181	U
PCB 177 (BZ)	ng/L	0.0353	U	0.0276	U	0.0355	U	0.0255	U
PCB 178 (BZ)	ng/L	0.0339	U	0.0266	U	0.0341	U	0.0246	U
PCB 179 (BZ)	ng/L	0.0248	U	0.0194	U	0.0249	U	0.0179	U
PCB 18 (BZ)	ng/L	0.0571	U	0.0486	U	0.0579	U	0.0464	U
PCB 180 (BZ)	ng/L	0.0244	U	0.0188	U	0.0244	U	0.0172	U
PCB 181 (BZ)	ng/L	0.033	U	0.0258	U	0.0331	U	0.0238	U
PCB 182 (BZ)	ng/L	0.032	U	0.025	U	0.0321	U	0.0231	U
PCB 183 (BZ)	ng/L	0.0316	U	0.0247	U	0.0317	U	0.0229	U
PCB 184 (BZ)	ng/L	0.0233	U	0.0182	U	0.0234	U	0.0168	U
PCB 185 (BZ)	ng/L	0.0316	U	0.0247	U	0.0317	U	0.0229	U
PCB 186 (BZ)	ng/L	0.0253	U	0.0198	U	0.0255	U	0.0183	U
PCB 187 (BZ)	ng/L	0.0298	U	0.0234	U	0.03	U	0.0216	U
PCB 188 (BZ)	ng/L	0.0242	U	0.019	U	0.0243	U	0.0175	U
PCB 189 (BZ)	ng/L	0.0209	U	0.0164	U	0.0202	U	0.0145	U
PCB 19 (BZ)	ng/L	0.0746	U	0.0634	U	0.0756	U	0.0606	U
PCB 190 (BZ)	ng/L	0.0254	U	0.0199	U	0.0255	U	0.0184	U
PCB 191 (BZ)	ng/L	0.0248	U	0.0195	U	0.025	U	0.018	U
PCB 192 (BZ)	ng/L	0.0268	U	0.021	U	0.027	U	0.0194	U
PCB 193 (BZ)	ng/L	0.0269	U	0.021	U	0.027	U	0.0194	U
PCB 194 (BZ)	ng/L	0.0272	U	0.0208	U	0.024	U	0.0187	U
PCB 195 (BZ)	ng/L	0.0298	U	0.0228	U	0.0263	U	0.0205	U
PCB 196 (BZ)	ng/L	0.0408	U	0.0312	U	0.036	U	0.0281	U
PCB 197 (BZ)	ng/L	0.0298	U	0.0228	U	0.0263	U	0.0205	U
PCB 198 (BZ)	ng/L	0.0406	U	0.031	U	0.0358	U	0.0279	U
PCB 199 (BZ)/200 (IUPAC)	ng/L	0.0298	U	0.0228	U	0.0263	U	0.0205	U
PCB 2 (BZ)	ng/L	0.0156	U	0.00984	U	0.0121	U	0.00917	U
PCB 20 (BZ)	ng/L	**0.0337**	J	0.0215	U	**0.0421**	J	0.0206	U
PCB 200 (BZ)/201 (IUPAC)	ng/L	0.0297	U	0.0227	U	0.0262	U	0.0204	U
PCB 201 (BZ)/199 (IUPAC)	ng/L	0.0406	U	0.031	U	0.0358	U	0.0279	U
PCB 202 (BZ)	ng/L	0.0314	U	0.024	U	0.0277	U	0.0216	U
PCB 203 (BZ)	ng/L	0.0374	U	0.0286	U	0.033	U	0.0257	U
PCB 204 (BZ)	ng/L	0.0306	U	0.0234	U	0.027	U	0.0211	U
PCB 205 (BZ)	ng/L	0.019	U	0.0145	U	0.0167	U	0.013	U
PCB 206 (BZ)	ng/L	0.0254	U	0.0136	U	0.0193	U	0.0115	U
PCB 207 (BZ)	ng/L	0.023	U	0.0123	U	0.0174	U	0.0104	U
PCB 208 (BZ)	ng/L	0.0221	U	0.0118	U	0.0168	U	0.01	U
PCB 21 (BZ)	ng/L	0.0262	U	0.0223	U	0.0266	U	0.0213	U
PCB 22 (BZ)	ng/L	0.0275	U	0.0233	U	0.0278	U	0.0223	U
PCB 23 (BZ)	ng/L	0.0281	U	0.0239	U	0.0285	U	0.0228	U
PCB 24 (BZ)	ng/L	0.0501	U	0.0426	U	0.0509	U	0.0408	U
PCB 25 (BZ)	ng/L	0.0238	U	0.0202	U	0.0242	U	0.0194	U
PCB 26 (BZ)	ng/L	0.0263	U	0.0223	U	0.0266	U	0.0213	U
PCB 27 (BZ)	ng/L	0.0488	U	0.0415	U	0.0495	U	0.0397	U
PCB 28 (BZ)	ng/L	**0.0337**	J	0.0215	U	**0.0421**	J	0.0206	U
PCB 29 (BZ)	ng/L	0.0263	U	0.0223	U	0.0266	U	0.0213	U
PCB 3 (BZ)	ng/L	0.0135	U	0.00854	U	0.0105	U	0.00797	U
PCB 30 (BZ)	ng/L	0.0571	U	0.0486	U	0.0579	U	0.0464	U
PCB 31 (BZ)	ng/L	0.0258	U	0.0219	U	0.0262	U	0.021	U
PCB 32 (BZ)	ng/L	0.0448	U	0.0381	U	0.0454	U	0.0364	U
PCB 33 (BZ)	ng/L	0.0262	U	0.0223	U	0.0266	U	0.0213	U
PCB 34 (BZ)	ng/L	0.0273	U	0.0232	U	0.0277	U	0.0222	U
PCB 35 (BZ)	ng/L	0.0271	U	0.023	U	0.0275	U	0.022	U
PCB 36 (BZ)	ng/L	0.0253	U	0.0215	U	0.0257	U	0.0206	U
PCB 37 (BZ)	ng/L	0.0226	U	0.0192	U	0.0229	U	0.0184	U
PCB 38 (BZ)	ng/L	0.0259	U	0.022	U	0.0263	U	0.0211	U
PCB 39 (BZ)	ng/L	0.024	U	0.0204	U	0.0244	U	0.0195	U
PCB 4 (BZ)	ng/L	0.22	U	0.184	U	0.212	U	0.167	U
PCB 40 (BZ)	ng/L	0.0382	U	0.0279	U	0.0302	U	0.0245	U

Table H-1. 2004 Lake Winnebago Congener Data

LOCATION_CODE		LK-WINN		LK-WINN		LK-WINN		LK-WINN	
SAMPLE_NO		FR-LK-WINN01		FR-LK-WINN01		FR-LK-WINN01X		FR-LK-WINN01X	
SAMPLE_DATE		11-Nov-04		11-Nov-04		11-Nov-04		11-Nov-04	
SAMPLE_PURPOSE		REG		REG		FD		FD	
		UNFILTERED		FILTERED		UNFILTERED		FILTERED	
Parameter	Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PCB 41 (BZ)	ng/L	0.0382	U	0.0279	U	0.0302	U	0.0245	U
PCB 42 (BZ)	ng/L	0.0424	U	0.0309	U	0.0335	U	0.0271	U
PCB 43 (BZ)	ng/L	0.035	U	0.0255	U	0.0277	U	0.0224	U
PCB 44 (BZ)	ng/L	0.0344	U	0.0251	U	0.0272	U	0.0221	U
PCB 45 (BZ)	ng/L	0.04	U	0.0291	U	0.0316	U	0.0256	U
PCB 46 (BZ)	ng/L	0.0466	U	0.034	U	0.0369	U	0.0299	U
PCB 47 (BZ)	ng/L	0.0344	U	0.0251	U	0.0272	U	0.0221	U
PCB 48 (BZ)	ng/L	0.0382	U	0.0279	U	0.0302	U	0.0245	U
PCB 49 (BZ)	ng/L	0.0327	U	0.0238	U	0.0258	U	0.0209	U
PCB 5 (BZ)	ng/L	0.137	U	0.115	U	0.132	U	0.104	U
PCB 50 (BZ)	ng/L	0.0385	U	0.028	U	0.0304	U	0.0246	U
PCB 51 (BZ)	ng/L	0.04	U	0.0291	U	0.0316	U	0.0256	U
PCB 52 (BZ)	ng/L	0.0367	U	0.0267	U	0.029	U	0.0235	U
PCB 53 (BZ)	ng/L	0.0385	U	0.028	U	0.0304	U	0.0246	U
PCB 54 (BZ)	ng/L	0.0579	U	0.0422	U	0.0458	U	0.0371	U
PCB 55 (BZ)	ng/L	0.0288	U	0.021	U	0.0228	U	0.0185	U
PCB 56 (BZ)	ng/L	0.0284	U	0.0207	U	0.0225	U	0.0182	U
PCB 57 (BZ)	ng/L	0.0283	U	0.0207	U	0.0224	U	0.0182	U
PCB 58 (BZ)	ng/L	0.0277	U	0.0202	U	0.0219	U	0.0177	U
PCB 59 (BZ)	ng/L	0.0279	U	0.0203	U	0.022	U	0.0178	U
PCB 6 (BZ)	ng/L	0.126	U	**0.0469**	J	0.122	U	0.0959	U
PCB 60 (BZ)	ng/L	0.0279	U	0.0204	U	0.0221	U	0.0179	U
PCB 61 (BZ)	ng/L	0.0267	U	0.0195	U	**0.0446**	J	0.0171	U
PCB 62 (BZ)	ng/L	0.0279	U	0.0203	U	0.022	U	0.0178	U
PCB 63 (BZ)	ng/L	0.0265	U	0.0193	U	0.021	U	0.017	U
PCB 64 (BZ)	ng/L	0.0277	U	0.0202	U	0.0219	U	0.0178	U
PCB 65 (BZ)	ng/L	0.0344	U	0.0251	U	0.0272	U	0.0221	U
PCB 66 (BZ)	ng/L	0.0263	U	0.0192	U	0.0208	U	0.0169	U
PCB 67 (BZ)	ng/L	0.0247	U	0.018	U	0.0195	U	0.0158	U
PCB 68 (BZ)	ng/L	0.0256	U	0.0187	U	0.0203	U	0.0164	U
PCB 69 (BZ)	ng/L	0.0327	U	0.0238	U	0.0258	U	0.0209	U
PCB 7 (BZ)	ng/L	0.132	U	0.11	U	0.127	U	0.1	U
PCB 70 (BZ)	ng/L	0.0267	U	0.0195	U	**0.0446**	J	0.0171	U
PCB 71 (BZ)	ng/L	0.0382	U	0.0279	U	0.0302	U	0.0245	U
PCB 72 (BZ)	ng/L	0.0273	U	0.0199	U	0.0216	U	0.0175	U
PCB 73 (BZ)	ng/L	0.035	U	0.0255	U	0.0277	U	0.0224	U
PCB 74 (BZ)	ng/L	0.0267	U	0.0195	U	**0.0446**	J	0.0171	U
PCB 75 (BZ)	ng/L	0.0279	U	0.0203	U	0.022	U	0.0178	U
PCB 76 (BZ)	ng/L	0.0267	U	0.0195	U	**0.0446**	J	0.0171	U
PCB 77 (BZ)	ng/L	0.0246	U	0.0179	U	0.0195	U	0.0158	U
PCB 78 (BZ)	ng/L	0.0273	U	0.0199	U	0.0216	U	0.0175	U
PCB 79 (BZ)	ng/L	0.023	U	0.0168	U	0.0182	U	0.0148	U
PCB 8 (BZ)	ng/L	**0.0865**	J	0.106	U	**0.077**	J	**0.0508**	J
PCB 80 (BZ)	ng/L	0.0245	U	0.0179	U	0.0194	U	0.0157	U
PCB 81 (BZ)	ng/L	0.0223	U	0.0177	U	0.0194	U	0.0156	U
PCB 82 (BZ)	ng/L	0.0508	U	0.0409	U	0.0461	U	0.0386	U
PCB 83 (BZ)	ng/L	0.0527	U	0.0424	U	0.0478	U	0.04	U
PCB 84 (BZ)	ng/L	0.0514	U	0.0414	U	0.0466	U	0.0391	U
PCB 85 (BZ)	ng/L	0.0364	U	0.0293	U	0.033	U	0.0277	U
PCB 86 (BZ)	ng/L	0.0365	U	0.0294	U	0.0331	U	0.0277	U
PCB 87 (BZ)	ng/L	0.0365	U	0.0294	U	0.0331	U	0.0277	U
PCB 88 (BZ)	ng/L	0.0453	U	0.0365	U	0.0411	U	0.0344	U
PCB 89 (BZ)	ng/L	0.0491	U	0.0395	U	0.0445	U	0.0373	U
PCB 9 (BZ)	ng/L	0.132	U	0.111	U	0.128	U	0.101	U
PCB 90 (BZ)	ng/L	0.038	U	0.0306	U	0.0345	U	0.0289	U
PCB 91 (BZ)	ng/L	0.0453	U	0.0365	U	0.0411	U	0.0344	U
PCB 92 (BZ)	ng/L	0.0461	U	0.0371	U	0.0418	U	0.035	U
PCB 93 (BZ)	ng/L	0.0444	U	0.0358	U	0.0403	U	0.0338	U
PCB 94 (BZ)	ng/L	0.0485	U	0.0391	U	0.044	U	0.0369	U
PCB 95 (BZ)	ng/L	0.0445	U	0.0358	U	0.0404	U	0.0338	U
PCB 96 (BZ)	ng/L	0.0338	U	0.0272	U	0.0307	U	0.0257	U
PCB 97 (BZ)	ng/L	0.0365	U	0.0294	U	0.0331	U	0.0277	U
PCB 98 (BZ)	ng/L	0.0452	U	0.0364	U	0.041	U	0.0344	U
PCB 99 (BZ)	ng/L	0.0362	U	0.0291	U	0.0328	U	0.0275	U
# Peaks Detected		**5**		**2**		**7**		**2**	
Total PCBs	ng/L	**0.29**		**0.09**		**0.44**		**0.11**	

Notes:
BOLD = Detected value
U = Undetected at quantitation limit shown
J = Estimated value

Table H-2. Summary of Lower Fox River Total PCB Data
Lower Fox River Baseline Monitoring Plan

			Calculated Results (ng/l)				REPORTED RESULTS (ng/l)								
Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUM DISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
89GH5FI01		LFR_mouth	7.6							7.6		7.6			
89GH5FI02	89GH5RI02	LFR_mouth		7.6							7.6				
	89GH5RI03	LFR_mouth		16.3							16.3				
89GH5FI04	89GH5RI04	LFR_mouth	75.8	16.2	92.0					75.9	16.2	75.7			
89GH5FI05	89GH5RI05	LFR_mouth	89.7	23.2	112.9					89.8	23.2	89.7			
89GH5FI06	89GH5RI06	LFR_mouth	78.4	15.1	93.6					78.5	15.1	78.4			
89GH5FI07	89GH5RI07	LFR_mouth	71.6	20.6	92.2					71.8	20.6	71.6			
89GH5FI08	89GH5RI08	LFR_mouth	55.1	20.0	75.1					55.1	20.0	55.1			
89GH5FI09	89GH5RI09	LFR_mouth	40.5	14.3	54.8					40.5	14.3	40.4			
89GH5FI10	89GH5RI10	LFR_mouth	51.6	15.5	67.1					51.8	15.5	51.6			
89GH5FI11	89GH5RI11	LFR_mouth	55.4	14.5	70.0					55.5	14.5	55.4			
89GH5FI12	89GH5RI12	LFR_mouth	51.9	20.2	72.1					52.1	20.2	51.9			
89GH5FI13	89GH5RI13	LFR_mouth	40.1	14.4	54.5					40.2	14.4	40.1			
89GH5FI14	89GH5RI14	LFR_mouth	92.1	15.0	107.1					92.3	15.0	92.1			
89GH5FI15	89GH5RI15	LFR_mouth	52.5	16.6	69.1					52.5	16.6	52.5			
89GH5FI16	89GH5RI16	LFR_mouth	62.3	20.9	83.2					62.5	20.9	62.3			
89GH5FI17	89GH5RI17	LFR_mouth	45.6	25.8	71.5					45.8	25.8	45.6			
89GH5FI18	89GH5RI18	LFR_mouth	66.7	24.4	91.1					67.0	24.4	66.7			
89GH5FI19	89GH5RI19	LFR_mouth	47.7	23.6	71.3					47.9	23.6	47.7			
89GH5FI20	89GH5RI20	LFR_mouth	43.2	21.4	64.5					43.3	21.4	43.2			
89GH5FI21	89GH5RI21	LFR_mouth	127.9	23.6	151.4					128.2	23.6	127.9			
89GH5FI22	89GH5RI22	LFR_mouth	122.9	22.2	145.0					123.1	22.2	122.9			
89GH5FI23	89GH5RI23	LFR_mouth	109.2	22.3	131.5					109.5	22.3	109.2			
89GH5FI24	89GH5RI24	LFR_mouth	65.7	26.2	91.9					65.9	26.2	65.7			
89GH5FI25	89GH5RI25	LFR_mouth	60.6	24.7	85.3					60.8	24.7	60.6			
89GH5FI26	89GH5RI26	LFR_mouth	44.3							44.5		44.3			
89GH5FI27	89GH5RI27	LFR_mouth	68.6	19.9	88.4					68.9	19.9	68.6			
89GH5FI28	89GH5RI28	LFR_mouth	44.1	22.4	66.5					44.3	22.4	44.1			
89GH5FI29	89GH5RI29	LFR_mouth	41.0	25.8	66.8					41.2	25.8	40.9			
89GH5FI30	89GH5RI30	LFR_mouth	47.6	22.8	70.5					47.8	22.8	47.5			
89GH5FI31	89GH5RI31	LFR_mouth	46.0	18.7	64.8					46.2	18.7	46.0			
89GH5FI32	89GH5RI32	LFR_mouth	46.7	16.8	63.5					46.9	16.8	46.7			
89GH5FI33	89GH5RI33	LFR_mouth	41.5	17.3	58.9					41.7	17.3	41.5			
89GH5FI34	89GH5RI34	LFR_mouth	33.8	17.1	50.9					34.0	17.1	33.8			
89GH5FI35	89GH5RI35	LFR_mouth	41.4	15.1	56.6					41.6	15.1	41.4			
89GH5FI36	89GH5RI36	LFR_mouth	39.9	16.7	56.6					39.9	16.7	39.9			
89GH5FI37	89GH5RI37	LFR_mouth	36.2	15.1	51.3					36.2	15.1	36.2			
89GH5FI38	89GH5RI38	LFR_mouth	55.7	26.9	82.5					56.1	26.9	55.7			
89GH5FI39	89GH5RI39	LFR_mouth	68.8	25.5	94.3					68.9	25.5	68.8			
89GH5FI40	89GH5RI40	LFR_mouth	45.9	19.7	65.6					45.9	19.7	45.9			
89GH5FI41	89GH5RI41	LFR_mouth	53.8	25.5	79.3					54.0	25.5	53.8			
89GH5FI42	89GH5RI42	LFR_mouth	51.8	23.9	75.7					51.9	23.9	51.8			
89GH5FI43	89GH5RI43	LFR_mouth	55.3	24.9	80.2					55.6	24.9	55.3			
89GH5FI44	89GH5RI44	LFR_mouth	60.3	22.7	83.0					60.5	22.7	60.3			
89GH5FI45	89GH5RI45	LFR_mouth	57.5	23.9	81.4					57.7	23.9	57.5			
89GH5FI46	89GH5RI46	LFR_mouth	55.7	22.8	78.5					55.8	22.8	55.7			
89GH5FI47	89GH5RI47	LFR_mouth	47.1	23.1	70.2					47.2	23.1	47.0			

Table H-2. Summary of Lower Fox River Total PCB Data
Lower Fox River Baseline Monitoring Plan

			Calculated Results (ng/l)				REPORTED RESULTS (ng/l)								
Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUM DISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
89GH5FI48	89GH5RI48	LFR_mouth	53.6	21.6	75.2					53.8	21.6	53.6			
89GH5FI49	89GH5RI49	LFR_mouth	84.7	23.9	108.6					84.7	23.9	84.7			
89GH5FI50	89GH5RI50	LFR_mouth	85.5	25.2	110.7					85.6	25.2	85.5			
89GH5FI51	89GH5RI51	LFR_mouth	60.3	22.4	82.8					60.4	22.4	60.3			
89GH5FI52	89GH5RI52	LFR_mouth	64.5	28.6	93.1					64.7	28.6	64.5			
89GH5FI53	89GH5RI53	LFR_mouth	77.3	17.5	94.8					77.3	17.5	77.3			
89GH5FI54	89GH5RI54	LFR_mouth	57.2	25.2	82.4					57.2	25.2	57.2			
89GH5FI55	89GH5RI55	LFR_mouth	47.5	17.9	65.4					47.7	17.9	47.5			
89GH5FI56	89GH5RI56	LFR_mouth	68.0	20.9	88.9					68.2	20.9	68.0			
89GH5FI57	89GH5RI57	LFR_mouth	85.0	17.7	102.7					85.2	17.7	85.0			
89GH5FI58	89GH5RI58	LFR_mouth	31.8	15.4	47.2					31.9	15.4	31.8			
89GH5FI59	89GH5RI59	LFR_mouth		15.3							15.3				
89GH5FI60	89GH5RI60	LFR_mouth	57.5	21.8	79.3					57.7	21.8	57.5			
89GH5FI61	89GH5RI61	LFR_mouth	44.2	26.0	70.2					44.4	26.0	44.2			
89GH5FI63	89GH5RI63	LFR_mouth	30.5	21.4	51.9					30.7	21.4	30.5			
89GH5FI64	89GH5RI64	LFR_mouth	52.6		52.6					52.9		52.6			
89GH5FI65	89GH5RI65	LFR_mouth	46.7	17.8	64.5					46.9	17.8	46.7			
89GH5FI66	89GH5RI66	LFR_mouth	34.9	12.0	46.9					35.0	12.0	34.9			
89GH5FI67	89GH5RI67	LFR_mouth	46.8	13.0	59.7					46.8	12.9	46.8			
89GH5FI68	89GH5RI68	LFR_mouth	27.1	10.4	37.5					27.2	10.4	27.1			
	89GH5RI69	LFR_mouth		11.2							11.2				
89GH5FI70	89GH5RI70	LFR_mouth	32.8	12.9	45.7					32.8	12.9	32.8			
89GH5FI71	89GH5RI71	LFR_mouth	50.4	11.7	62.1					50.6	11.7	50.4			
89GH5FI72	89GH5RI72	LFR_mouth	33.7	11.9	45.6					33.7	11.9	33.7			
89GH5FI73	89GH5RI73	LFR_mouth	37.1	10.8	47.9					37.1	10.8	37.1			
89GH5FI74	89GH5RI74	LFR_mouth	32.5	10.8	43.3					32.7	10.8	32.5			
89GH5FI75	89GH5RI75	LFR_mouth	46.9	12.2	59.2					47.1	12.2	46.9			
89GH5FI76	89GH5RI76	LFR_mouth	41.5	11.8	53.3					41.5	11.8	41.5			
89GH5FI77	89GH5RI77	LFR_mouth	52.3	10.8	63.1					52.5	10.8	52.3			
89GH5FI78	89GH5RI78	LFR_mouth	50.8	10.2	61.0					50.8	10.2	50.8			
89GH5FI79	89GH5RI79	LFR_mouth	51.3	11.3	62.6					51.5	11.3	51.3			
89GH5FI80	89GH5RI80	LFR_mouth	31.8	11.5	43.3					32.0	11.5	31.8			
89GH5FI81	89GH5RI81	LFR_mouth	41.9	16.8	58.7					41.9	16.8	41.9			
89GH5FI82	89GH5RI82	LFR_mouth	50.0	12.1	62.1					50.0	12.1	50.0			
89GH5FI83	89GH5RI83	LFR_mouth	64.1	8.8	72.9					64.2	8.8	64.1			
89GH5FI84	89GH5RI84	LFR_mouth	6.9	3.6	10.5					6.9	3.6	6.9			
89GH5RI01		LFR_mouth	5.8								5.810				
90GH5FI100	90GH5RI100	LFR_mouth	15.2	4.3	19.5					15.2	4.3	15.2			
90GH5FI101	90GH5RI101	LFR_mouth	12.4	4.3	16.7					12.4	4.3	12.4			
90GH5FI102	90GH5RI102	LFR_mouth	14.9	4.1	19.0					14.9	4.1	14.9			
90GH5FI103	90GH5RI103	LFR_mouth	27.7	4.9	32.6					27.7	4.9	27.7			
90GH5FI104	90GH5RI104	LFR_mouth	27.6		27.6					27.6		27.6			
90GH5FI105	90GH5RI105	LFR_mouth	12.5	3.8	16.2					12.5	3.8	12.5			
90GH5FI106	90GH5RI106	LFR_mouth	10.6	4.0	14.5					10.6	3.9	10.6			
90GH5FI107	90GH5RI107	LFR_mouth	16.6	4.3	20.9					16.6	4.3	16.6			
90GH5FI108	90GH5RI108	LFR_mouth	17.1	4.9	22.0					17.2	4.9	17.1			
90GH5FI109	90GH5RI109	LFR_mouth	14.0	5.6	19.7					14.1	5.6	14.0			

Table H-2. Summary of Lower Fox River Total PCB Data
Lower Fox River Baseline Monitoring Plan

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Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUM DISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
90GH5FI110	90GH5RI110	LFR_mouth	24.4	6.6	31.0					24.5	6.6	24.4			
90GH5FI111	90GH5RI111	LFR_mouth	16.1	5.4	21.5					16.1	5.4	16.1			
90GH5FI112	90GH5RI112	LFR_mouth	27.7	7.3	35.0					27.7	7.3	27.7			
90GH5FI113	90GH5RI113	LFR_mouth	22.2	7.4	29.6					22.3	7.4	22.2			
90GH5FI114	90GH5RI114	LFR_mouth	27.5	8.4	36.0					27.6	8.4	27.5			
90GH5FI115	90GH5RI115	LFR_mouth	35.6	10.8	46.4					35.6	10.8	35.6			
90GH5FI116	90GH5RI116	LFR_mouth	35.1	12.1	47.2					35.1	12.1	35.1			
90GH5FI117	90GH5RI117	LFR_mouth	46.7	14.4	61.1					46.7	14.4	46.7			
90GH5FI118	90GH5RI118	LFR_mouth	44.1	15.2	59.3					44.2	15.2	44.1			
90GH5FI119	90GH5RI119	LFR_mouth	33.3	16.7	50.1					33.4	16.7	33.3			
90GH5FI85	90GH5RI85	LFR_mouth	5.0	3.7	8.7					5.1	3.7	5.0			
90GH5FI86	90GH5RI86	LFR_mouth	5.9	4.2	10.0					5.9	4.2	5.9			
90GH5FI87	90GH5RI87	LFR_mouth		4.1							4.1				
90GH5FI88	90GH5RI88	LFR_mouth	9.0	5.0	14.0					9.1	5.0	9.0			
90GH5FI89	90GH5RI89	LFR_mouth	10.6	6.2	16.8					10.6	6.2	10.6			
90GH5FI90	90GH5RI90	LFR_mouth	21.5	6.6	28.1					21.5	6.6	21.5			
90GH5FI91	90GH5RI91	LFR_mouth	15.7	6.0	21.8					15.8	6.0	15.7			
90GH5FI92	90GH5RI92	LFR_mouth	18.6	6.0	24.6					18.6	6.0	18.6			
90GH5FI93	90GH5RI93	LFR_mouth	14.3	5.6	20.0					14.4	5.6	14.3			
90GH5FI94	90GH5RI94	LFR_mouth	20.3	6.4	26.7					20.3	6.4	20.3			
90GH5FI95	90GH5RI95	LFR_mouth	28.5	6.1	34.7					28.5	6.1	28.5			
90GH5FI96	90GH5RI96	LFR_mouth	24.1	6.2	30.3					24.2	6.2	24.1			
90GH5FI97	90GH5RI97	LFR_mouth	17.0	6.2	23.2					17.1	6.2	17.0			
90GH5FI98	90GH5RI98	LFR_mouth	25.8	5.3	31.1					25.9	5.3	25.8			
90GH5FI99	90GH5RI99	LFR_mouth	11.5	4.7	16.2					11.5	4.7	11.5			
9003243P	9003242F	OU1	0.4	0.8	1.2		0.6	0.5							
9003451P	9003451F	OU1	0.6	0.6	1.2		1.8	0.9							
	9003243F	OU1		0.6			0.1								
9003623P	9003623F	OU1	0.6	0.7	1.3		1.6	0.5							
9003776P	9003776F	OU1	0.7	0.7	1.4		1.8	1.3							
9004432P	9004432F	OU1	0.4	0.6	1.0		1.5	0.4							
DP	DF	OU1	0.5	0.8	1.3		2.5	0.2							
OA001177P	OA001177F	OU1	0.4	0.5	0.9		1.4								
OA001180P	OA001180F	OU1	0.4	0.7	1.0		0.5	0.2							
OA001628P	OA001628F	OU1	0.2	0.5	0.7		1.0								
OA001631P	OA001631F	OU1	0.3	0.6	0.9		1.4	0.1							
OA002396P	OA002396F	OU1	0.3	0.6	0.8		1.7								
OA002398P	OA002398F	OU1	0.3	0.4	0.7		1.2								
OA003241P	OA003241F	OU1	0.3	0.5	0.8		0.9	0.1							
OA003245P	OA003245F	OU1	0.2	0.7	0.9		1.9	0.05							
OA004471P	OA004471F	OU1	0.2	0.7	0.9		1.7								
OA004479P	OA004479F	OU1	0.2	0.4	0.7		0.6								
OB000378P	OB000378F	OU1	0.5	1.5	2.0		4.1	0.5							
OB000381P	OB000381F	OU1	0.4	0.6	1.1		2.0	0.4							
OB000386P	OB000386F	OU1	0.3	0.4	0.7		0.3	0.1							
OB001107P	OB001107F	OU1	0.1	0.6	0.7		1.4	0.1							
OB001110P	OB001110F	OU1	0.3	0.5	0.8		0.5	0.12							

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Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUM DISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
OB001111P	OB001111F	OU1	0.2	0.8	1.0		2.4								
OB001115P	OB001115F	OU1	0.6	0.8	1.3		2.1	0.9							
OB001116P	OB001116F	OU1	0.2	0.5	0.7		1.4	0.1							
OB002899P	OB002899F	OU1	0.3	0.5	0.8		1.08								
OB002903P	OB002903F	OU1	0.2	0.6	0.8		0.98								
OB002906P	OB002906F	OU1	2.1	0.6	2.6		1	5.2							
9003241P	9003241F	OU2	8.7	2.1	10.7		7.54	29.0							
9003244P		OU2	5.2					17.1							
9003450P	9003450F	OU2	10.4	3.0	13.4		13.3	34.8							
9003452P	9003452F	OU2	12.7	2.6	15.2		11.0	42.6							
9003619P	9003619F	OU2	10.9	2.9	13.7		11.9	35.6							
9003620P	9003620F	OU2	15.4	3.1	18.5		13.6	51.6							
9003621P	9003621F	OU2	10.9	3.1	14.0		13.2	36.2							
9003777P	9003777F	OU2	4.6	1.1	5.6		3.7	14.5							
9003778P	9003778F	OU2	11.0	1.6	12.6		6.0	35.9							
9004428P	9004428F	OU2	14.9	4.7	19.6		18.9	46.2							
9004429P	9004429F	OU2	12.2	4.1	16.3		16.6	38.9							
9004430P	9004430F	OU2	10.2	4.4	14.6		17.5	32.9							
AO001179P	AO001179F	OU2	10.4	3.7	14.1		14.6	33.7							
AP	AF	OU2	7.6	2.2	9.8		8.5	24.1							
BP	BF	OU2	9.3	2.3	11.6		9.7	29.7							
OA001178P	OA001178F	OU2	13.3	3.9	17.2		14.9	44.1							
OA001183P	OA001183F	OU2	12.3	4.8	17.1		19.0	40.2							
OA001184P	OA001184F	OU2	7.9	9.7	17.6		17.8	41.2							
OA001625P	OA001625F	OU2	14.5	3.8	18.2		15.0	46.9							
OA001626P	OA001626F	OU2	10.6	4.0	14.6		16.2	33.1							
OA001632P	OA001632F	OU2	16.5	3.9	20.4		15.9	52.2							
OA001633P	OA001633F	OU2	12.3	3.7	16.0		16.2	39.2							
OA002394P	OA002394F	OU2	8.2	3.1	11.2		12.6	24.9							
OA002395P	OA002395F	OU2	9.7	4.0	13.7		16.5	31.4							
OA003237P	OA003237F	OU2	8.5	3.4	11.9		13.5	27.3							
OA003238P	OA003238F	OU2	8.4	3.9	12.3		16.2	26.3							
OA003239P	OA003239F	OU2	7.3	3.9	11.2		15.8	22.6							
OA003243P	OA003243F	OU2	8.4	4.5	12.9		17.9	27.8							
OA003244P	OA003244F	OU2	8.4	2.9	11.3		11.5	27.1							
OA004473P	OA004473F	OU2	9.5	2.0	11.4		8.4	32.0							
OA004474P	OA004474F	OU2	8.7	3.6	12.3		14.6	28.5							
OA004476P	OA004476F	OU2	9.1	2.3	11.4		8.8	31.4							
OA004478P	OA004478F	OU2	8.3	2.5	10.8		9.6	27.2							
OB000379P	OB000379F	OU2	1.8	0.8	2.6		2.7	5.2							
OB000380P	OB000380F	OU2	1.5	0.8	2.3		2.8	4.9							
OB000383P	OB000383F	OU2	0.5	1.1	1.6		2.0								
OB000385P	OB000385F	OU2	0.6	0.9	1.4		2.8								
OB000387P	OB000387F	OU2	0.6	0.8	1.3		2.4	1.1							
OB001106P	OB001106F	OU2	0.2	0.8	1.0		2.5	0.2							
OB001108P	OB001108F	OU2	0.5	1.0	1.5		3.3								
OB001112P	OB001112F	OU2	0.5	0.8	1.3		2.71	0.8							

Table H-2. Summary of Lower Fox River Total PCB Data
Lower Fox River Baseline Monitoring Plan

			Calculated Results (ng/l)				REPORTED RESULTS (ng/l)								
Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUM DISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
OB001114P		OU2	0.7					2.5							
OB002900P	OB002900F	OU2	4.1	1.9	5.9		7.6	13.3							
OB002901P	OB002901F	OU2	1.0	0.9	1.8		2.9	2.8							
OB002902P	OB002902F	OU2	0.8	0.8	1.5		2.6	2.0							
OB002904P	OB002904F	OU2	1.6	0.9	2.5		3.0	4.9							
OB002905P	OB002905F	OU2	3.3	1.0	4.3		3.7	10.8							
OB004144P	OB004144F	OU2	3.0	1.1	4.1		4.3	10.1							
OB004146P	OB004146F	OU2	1.2	0.7	1.9		3.4	3.7							
OB004148P	OB004148F	OU2	3.5	1.1	4.6		5.2	12.7							
89GH6FI01	89GH6RI01	OU3	3.5	26.0	29.4					3.5	25.9	3.5			
89GH6FI02	89GH6RI02	OU3	7.2	4.3	11.5					7.2	4.2	7.2			
89GH6FI03	89GH6RI03	OU3	30.5	1.3	31.8					30.5	1.3	30.5			
89GH6FI04	89GH6RI04	OU3	42.4	27.6	70.0					42.4	27.6	42.4			
89GH6FI05	89GH6RI05	OU3	48.7	12.9	61.6					48.8	12.9	48.7			
89GH6FI06	89GH6RI06	OU3	96.3	18.4	114.7					96.4	18.3	96.3			
89GH6FI07	89GH6RI07	OU3	72.4	15.7	88.1					72.5	15.7	72.4			
89GH6FI08	89GH6RI08	OU3	56.4	18.7	75.1					56.4	18.7	56.4			
89GH6FI09	89GH6RI09	OU3	31.7	15.5	47.2					31.7	15.5	31.7			
89GH6FI10	89GH6RI10	OU3	50.9	9.1	60.0					50.9	9.1	50.9			
89GH6FI11	89GH6RI11	OU3	63.7	10.0	73.7					63.8	10.0	63.7			
89GH6FI12	89GH6RI12	OU3	54.3	15.0	69.2					54.4	15.0	54.3			
89GH6FI13	89GH6RI13	OU3	63.4	17.2	80.6					63.5	17.2	63.4			
89GH6FI14	89GH6RI14	OU3	63.5	21.7	85.3					63.6	21.7	63.5			
89GH6FI15	89GH6RI15	OU3	36.8	14.6	51.4					36.8	14.6	36.8			
89GH6FI16	89GH6RI16	OU3	35.5	17.2	52.7					35.7	17.2	35.5			
89GH6FI17	89GH6RI17	OU3	45.3	17.0	62.4					45.4	17.0	45.3			
89GH6FI18	89GH6RI18	OU3	39.4	16.4	55.8					39.4	16.4	39.3			
89GH6FI19	89GH6RI19	OU3	53.4	19.7	73.0					53.4	19.7	53.4			
89GH6FI20	89GH6RI20	OU3	60.3	17.2	77.5					60.4	17.2	60.3			
89GH6FI21	89GH6RI21	OU3	64.9	18.2	83.2					65.0	18.2	64.9			
89GH6FI22	89GH6RI22	OU3	51.0	17.9	68.9					51.1	17.9	51.0			
89GH6FI23	89GH6RI23	OU3	43.9	16.8	60.6					43.9	16.8	43.9			
89GH6FI24	89GH6RI24	OU3	31.5	14.8	46.3					31.5	14.8	31.5			
89GH6FI25	89GH6RI25	OU3	38.7	15.2	54.0					38.8	15.2	38.7			
89GH6FI26	89GH6RI26	OU3	34.5	13.9	48.4					34.5	13.9	34.5			
89GH6FI27	89GH6RI27	OU3	24.1	11.0	35.0					24.1	11.0	24.1			
89GH6FI28	89GH6RI28	OU3	32.8	12.9	45.7					32.8	12.9	32.8			
89GH6FI29	89GH6RI29	OU3	33.1	11.9	45.0					33.1	11.9	33.1			
89GH6FI30	89GH6RI30	OU3	43.3	12.1	55.5					43.4	12.1	43.3			
89GH6FI31	89GH6RI31	OU3	28.8		28.8					28.8		28.8			
89GH6FI32	89GH6RI32	OU3	43.3	12.3	55.6					43.3	12.3	43.3			
89GH6FI33	89GH6RI33	OU3	20.7	6.8	27.5					20.8	6.8	20.7			
89GH6FI34	89GH6RI34	OU3	11.1	4.0	15.1					11.2	4.0	11.1			
89GH6FI35	89GH6RI35	OU3	5.2	2.6	7.8					5.3	2.6	5.2			
89GH6FI36	89GH6RI36	OU3	4.5	2.7	7.2					4.6	2.7	4.5			
89GH6FI37	89GH6RI37	OU3	6.0	5.9	12.0					6.1	5.9	6.0			
9003240P	9003240F	OU3	6.8	2.1	8.9		8.0	23.7							

Table H-2. Summary of Lower Fox River Total PCB Data
Lower Fox River Baseline Monitoring Plan

			Calculated Results (ng/l)				REPORTED RESULTS (ng/l)								
Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUM DISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
9003449P	9003449F	OU3	10.7	3.9	14.6		16.0	35.6							
9003622P	9003622F	OU3	11.8	3.5	15.3		14.7	40.6							
9003779P	9003779F	OU3	25.2	2.6	27.8		10.4	83.5							
9004431P	9004431F	OU3	10.0	4.4	14.4		17.6	32.7							
90GH6FI38	90GH6RI38	OU3	2.8	2.5	5.3					2.9	2.5	2.8			
90GH6FI39	90GH6RI39	OU3	3.3	3.4	6.7					3.3	3.4	3.3			
90GH6FI40	90GH6RI40	OU3	3.5	2.7	6.2					3.5	2.7	3.5			
90GH6FI41	90GH6RI41	OU3	3.9	3.3	7.2					4.0	3.3	3.9			
90GH6FI42	90GH6RI42	OU3	4.4	3.5	7.9					4.4	3.5	4.4			
90GH6FI43	90GH6RI43	OU3	17.6	5.3	22.9					17.7	5.3	17.6			
90GH6FI44	90GH6RI44	OU3	4.7	2.2	6.9					4.8	2.2	4.7			
90GH6FI45	90GH6RI45	OU3	6.7	3.5	10.2					6.8	3.5	6.7			
90GH6FI46	90GH6RI46	OU3	11.4	4.7	16.1					11.5	4.7	11.4			
90GH6FI47	90GH6RI47	OU3	16.5	6.7	23.3					16.6	6.7	16.5			
90GH6FI48	90GH6RI48	OU3	29.9	11.0	40.9					30.0	11.0	29.9			
90GH6FI49	90GH6RI49	OU3	31.0	11.1	42.1					31.0	11.1	31.0			
90GH6FI50	90GH6RI50	OU3	39.4	15.0	54.4					39.5	15.0	39.4			
CP	CF	OU3	5.9	0.7	6.6		12.4	71.9							
OA001176P	OA001176F	OU3	10.7	3.7	14.4		13.7	36.1							
OA001181P	OA001181F	OU3	11.9	3.5	15.5		13.7	39.9							
OA001182P	OA001182F	OU3	12.4	3.8	16.2		14.2	41.0							
OA001627P	OA001627F	OU3	11.8	3.3	15.1		12.8	39.1							
OA001630P	OA001630F	OU3	13.5	3.7	17.3		15.2	45.2							
OA002397P	OA002397F	OU3	6.4	2.6	9.0		10.5	22.8							
OA003240P	OA003240F	OU3	8.1	3.7	11.8		13.9	26.5							
OA003246P	OA003246F	OU3	7.8	2.9	10.6		10.8	25.5							
OA004475P	OA004475F	OU3	7.7	2.4	10.0		9.4	26.4							
OA004477P	OA004477F	OU3	12.1	2.9	15.0		10.9	41.0							
OB000382P	OB000382F	OU3	2.7	1.2	4.0		4.4	8.8							
OB000384P	OB000384F	OU3	1.4	1.0	2.3		3.8	1.0							
OB001109P	OB001109F	OU3	1.2	0.9	2.1		2.6	0.2							
OB001113P	OB001113F	OU3	0.5	0.9	1.4		3.5	0.6							
OB004145P	OB004145F	OU3	20.5	1.2	21.8		5.1	69.8							
OB004147P	OB004147F	OU3	21.1	1.4	22.5		6.3	69.8							
OB004149P	OB004149F	OU3	4.5	1.2	5.8		5.5	13.6							
OB004150P	OB004150F	OU3	3.7	1.4	5.1		6.4	13.4							
SW050002		OU3	1.9	22.1	23.9	17.2	22.0	1.9						4.5	12.7
SW050003		OU3	0.2	31.9	32.1	0.3									
SW050004		OU3	0.1	22.7	22.9										
SW050005		OU3	1.0	0.3	1.3										
SW050006		OU3	2.6	4.7	7.3										
SW050007		OU3	14.5	4.7	19.1										
SW050008		OU3	12.5	2.1	33.2										
SW050009		OU3	4.7	14.4	19.1	18.6									
SW050010		OU3	1.6	16.5	18.1	3.0									
SW050011		OU3	13.3	26.3	39.8	22.1									
SW050012		OU3	12.7	23.6	36.3	31.8									

Table H-2. Summary of Lower Fox River Total PCB Data
Lower Fox River Baseline Monitoring Plan

			Calculated Results (ng/l)				REPORTED RESULTS (ng/l)								
Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUMDISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
SW050013		OU3	4.3	23.5	27.8	20.0									
SW050014		OU3	3.9	25.6	29.5	16.1									
#10P	#10F	OU4	14.6	1.9	16.5		9.1	50.9							
#11P	#11F	OU4	17.9	2.1	20.0		10.0	63.7							
#12P	#12F	OU4	15.4	3.1	18.5		15.0	54.3							
#13P	#13F	OU4	15.1	3.2	18.3		17.2	63.4							
#14P	#14F	OU4	15.2	4.3	19.6		21.7	63.5							
#15P	#15F	OU4	9.0	3.0	12.0		14.6	36.8							
#16P	#16F	OU4	8.7	3.4	12.1		17.2	35.5							
#17P	#17F	OU4	10.8	3.4	14.2		17.0	45.3							
#18P	#18F	OU4	10.0	3.3	13.3		16.4	39.3							
#19P	#19F	OU4	12.4	4.0	16.4		19.7	53.4							
#1P	#1F	OU4	0.5	1.2	1.7		25.9	3.5							
#20P	#20F	OU4	14.1	3.5	17.6		17.2	60.3							
#21P	#21F	OU4	15.0	3.7	18.6		18.2	64.9							
#22P	#22F	OU4	12.9	3.8	16.7		17.9	51.0							
#23P	#23F	OU4	11.3	3.5	14.7		16.8	43.9							
#24P	#24F	OU4	7.8	2.9	10.7		14.8	31.5							
#25P	#25F	OU4	9.7	3.1	12.8		15.2	38.7							
#26P	#26F	OU4	8.3	2.9	11.3		13.9	34.5							
#27P	#27F	OU4	6.0	2.3	8.3		11.0	24.1							
#28P	#28F	OU4	8.1	2.6	10.7		12.9	32.8							
#29P	#29F	OU4	8.1	2.4	10.5		11.9	33.1							
#2P	#2F	OU4	1.7	0.7	2.4		4.2	7.2							
#30P	#30F	OU4	11.5	2.5	14.0		12.1	43.3							
#31P		OU4	7.5		7.5			28.8							
#32P	#32F	OU4	11.8	2.6	14.4		12.3	43.3							
#33P	#33F	OU4	5.6	1.4	7.0		6.8	20.7							
#34P	#34F	OU4	2.9	0.8	3.7		4.0	11.1							
#35P	#35F	OU4	1.3	0.5	1.8		2.6	5.2							
#36P	#36F	OU4	1.2	0.5	1.7		2.7	4.5							
#37P	#37F	OU4	1.2	1.2	2.4		5.9	6.0							
#38P	#38F	OU4	0.7	0.5	1.2		2.5	2.8							
#39P	#39F	OU4	0.7	0.7	1.4		3.4	3.3							
#3P	#3F	OU4	7.5	0.2	7.7		1.3	30.5							
#40P	#40F	OU4	0.9	0.6	1.5		2.7	3.5							
#41P	#41F	OU4	0.8	0.7	1.5		3.3	3.9							
#42P	#42F	OU4	1.0	0.7	1.7		3.5	4.4							
#43P	#43F	OU4	4.8	0.9	5.8		5.3	17.6							
#44P	#44F	OU4	1.2	0.4	1.6		2.2	4.7							
#45P	#45F	OU4	0.8	0.7	1.6		3.6	6.7							
#46P	#46F	OU4	2.9	0.9	3.8		4.7	11.4							
#47P	#47F	OU4	3.8	1.4	5.2		6.7	16.5							
#48P	#48F	OU4	7.4	2.2	9.6		11.0	29.9							
#49P	#49F	OU4	7.4	2.3	9.7		11.1	31.0							
#4P	#4F	OU4	10.7	5.8	16.4		27.6	42.4							
#50P	#50F	OU4	9.7	3.1	12.8		15.0	39.4							

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Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUM DISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
#5P	#5F	OU4	12.4	2.5	14.9		12.9	48.7							
#6P	#6F	OU4	19.4	3.5	23.0		18.3	96.3							
#7P	#7F	OU4	17.0	3.1	20.1		15.7	72.4							
#8P	#8F	OU4	13.6	3.8	17.4		18.7	56.4							
#9P	#9F	OU4	8.0	3.0	11.0		15.5	31.7							
89GG25R96		OU4			5.6					3.9	1.8	3.8			
89GG25S70		OU4			136.5					116.8	19.7	116.8			
89GG25S90		OU4			176.7					149.1	27.6	149.1			
89GG26D10		OU4			109.0					84.6	24.5	84.4			
89GG26S10		OU4			128.5					105.5	23.1	105.2			
89GG26S30		OU4			112.1					86.7	25.4	86.7			
89GG26S50		OU4			108.0					82.2	25.8	82.1			
89GG26S70		OU4			128.9					103.9	25.1	103.8			
89GG31D81		OU4			72.0					55.3	16.8	55.3			
89GG31S01		OU4			66.1					55.1	11.1	55.0			
89GG31S21		OU4			62.2					47.9	14.4	47.8			
89GG31S41		OU4			55.6					37.3	18.4	37.1			
89GG31S81		OU4			48.0					31.1	17.0	31.0			
89GG32S01		OU4			72.7					56.6	16.0	56.6			
89GG41R96		OU4			46.2					35.9	20.4	24.8			
89GG41S01		OU4			49.8					29.3	20.6	29.2			
89GG41S21		OU4			72.3					46.5	25.9	46.4			
89GG41S41		OU4			109.2					78.1	31.2	78.0			
89GG41S61		OU4			65.3					41.2	24.3	41.1			
89GG41S81		OU4			100.1					70.6	29.5	70.5			
89GG42S01		OU4			103.0					77.8	25.2	77.7			
89GG56D61		OU4			53.9					36.2	17.7	36.2			
89GG56R96		OU4			41.7					18.6	30.1	11.2			
89GG56S01		OU4			55.9					37.6	18.5	37.4			
89GG56S21		OU4			79.0					55.9	23.4	55.7			
89GG56S41		OU4			65.1					38.2	26.9	38.1			
89GG56S61		OU4			45.6					28.6	17.1	28.4			
89GG56S81		OU4			70.4					45.0	25.6	44.8			
89GG57S01		OU4			60.1					39.0	21.2	38.9			
90GG01D61		OU4			101.5					75.6	26.1	75.3			
90GG01S01		OU4			63.6					48.2	15.7	47.9			
90GG01S21		OU4			102.9					87.0	16.3	86.6			
90GG01S41		OU4			92.7					72.6	20.4	72.3			
90GG01S61		OU4			122.6					98.0	25.0	97.6			
90GG01S81		OU4			102.2					78.8	23.8	78.4			
90GG02S01		OU4			124.7					100.0	25.0	99.7			
90GG26S10		OU4			65.1					47.7	17.4	47.7			
90GG26S50		OU4			114.7					92.9	22.0	92.7			
90GG26S70		OU4			63.9					43.4	20.6	43.3			
90GG26S90		OU4			74.3					49.4	25.0	49.2			
90GG27S10		OU4			78.9					60.2	18.9	60.0			
SW060001		OU4	8.29	13.59	21.8861	121.5	13.6	7.6	21.9				121.5	19.9	131.6

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Sample_ID (SUSP)	Sample_ID (DISS)	OU	Calculated CONGENER SUM SUSP	Calculated CONGENER SUM DISS	Congener Sum (SUSP+DISS)	Congener Sum (SUSP+DISS) (HRGC/MS)	PCBS DISS	PCBS SUSP	PCBS TOT (PART+DISS)	PCBS HTOT MAX SUSP	PCBS HTOT MIN DISS	PCBS HTOT MIN SUSP	PCBS TOT (HRGC/MS, PART+DISS)	PCBS WTR FLT FRAC (HRGC/MS)	PCBS WTR SUS FRAC (HRGC/MS)
SW090001		OU4	7.57	16.85	24.417	168.8	16.8	8.3	24.4				168.8	37.1	101.6
SW090002		OU4	3.01	34.62	37.6337	119.7	35.0	3.0						28.6	91.1
SW090003		OU4	0.94	32.26	33.1947	7.7									
SW090004		OU4	0.56	44.47	45.0266										
SW090005		OU4	1.35	1	2.3454										
SW090006		OU4	2.99	8.33	11.3261										
SW090007		OU4	13.87	2.68	16.5542										
SW090008		OU4	9.78	2.07	11.8466										
SW090009		OU4	9.86	16.26	26.118	84.8									
SW090010		OU4	12.75	8.21	30.9922	53.5									
SW090011		OU4	32.88	37.93	70.815	153.7									
SW090012		OU4	19.8	33.64	53.435	101.4									
SW090013		OU4	16.61	44.76	61.368	157.5									
SW090014		OU4	14.68	45.26	59.939	89.7									

Result not reporetd or unavailable for this sample.

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR_Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 001 DISS NG/L	Minimum	0.0168	0.0174	0.0166					0.038	0.038
	Maximum	0.0539	1.613	0.0696					0.038	0.038
PCB 001 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 001 SUSP NG/L	Minimum	0.0154	0.0170	0.0041					0.0380	0.0380
	Maximum	0.0492	1.6819	0.1203					0.2900	0.1900
PCB 001 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 003 DISS NG/L	Minimum	0.0279	0.0253	0.0271						
	Maximum	0.1041	2.8906	0.1303						
PCB 003 SUSP NG/L	Minimum	0.0253	0.0197	0.0076						
	Maximum	0.1337	2.9500	0.3006						
PCB 004 DISS NG/L	Minimum								0.0170	0.0170
	Maximum								0.0180	0.0170
PCB 004 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 004 SUSP NG/L	Minimum								0.0170	0.0170
	Maximum								0.0180	0.0170
PCB 004 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.2362
PCB 004/010 DISS NG/L	Minimum		0.0026							
	Maximum		0.0026							
PCB 004/010 SUSP NG/L	Minimum	0.0022	0.0022							
	Maximum	0.0026	0.1741							
PCB 005 DISS NG/L	Minimum								0.0100	0.0100
	Maximum								0.0100	0.3900
PCB 005 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 005 SUSP NG/L	Minimum								0.0100	0.0100
	Maximum								0.0110	0.0100
PCB 005 SUSP NG/L (HRGC/MS)	Minimum								0.2120	
	Maximum								0.2120	
PCB 005/008 DISS NG/L	Minimum									
	Maximum									
PCB 005/008 SUSP NG/L	Minimum	0.0045								
	Maximum	0.0069								
PCB 006 DISS NG/L	Minimum	0.0024	0.0016						0.0080	0.0080
	Maximum	0.0024	0.0822						0.0080	0.6500
PCB 006 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 006 SUSP NG/L	Minimum		0.1262						0.0080	0.0080
	Maximum		0.1262						0.0084	0.0080
PCB 006 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2174	0.2362
PCB 007 DISS NG/L	Minimum		0.0710						0.0100	0.0100
	Maximum		0.0710						0.5600	0.0360
PCB 007 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 007 SUSP NG/L	Minimum	0.0010	0.0551						0.0100	0.0100
	Maximum	0.0010	0.0551						0.2600	0.2100
PCB 007 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 008 DISS NG/L	Minimum								0.0110	0.0110

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
	Maximum								0.2300	0.8500
PCB 008 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 008 SUSP NG/L	Minimum								0.0110	0.0110
	Maximum								0.5200	1.1000
PCB 008 SUSP NG/L (HRGC/MS)	Minimum								0.2120	
	Maximum								0.2120	
PCB 012/013 DISS NG/L	Minimum	0.0024	0.0013	0.0013						
	Maximum	0.0039	0.1503	0.0035						
PCB 012/013 SUSP NG/L	Minimum	0.0011	0.0014	0.0009						
	Maximum	0.0086	0.1636	0.0146						
PCB 016/032 DISS NG/L	Minimum			0.0013					0.0260	0.0540
	Maximum			0.0013					0.0500	0.0540
PCB 016/032 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 016/032 SUSP NG/L	Minimum	0.0014							0.0100	
	Maximum	0.0014							0.0100	
PCB 016/032 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 017 DISS NG/L	Minimum		0.0013						0.0240	
	Maximum		0.0013						0.0530	
PCB 017 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 017 SUSP NG/L	Minimum								0.0100	0.1200
	Maximum								0.0920	0.1200
PCB 017 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2120	0.2362
PCB 018 DISS NG/L	Minimum		0.0015						0.0100	0.0100
	Maximum		0.0015						0.5800	0.5100
PCB 018 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 018 SUSP NG/L	Minimum								0.0100	0.0200
	Maximum								0.4600	1.2000
PCB 018 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 019 DISS NG/L	Minimum		0.0015						0.0270	0.0270
	Maximum		0.0015						0.3700	0.4600
PCB 019 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 019 SUSP NG/L	Minimum	0.0017	0.0018						0.0270	0.0270
	Maximum	0.0017	0.1221						0.0420	0.0590
PCB 019 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 021 DISS NG/L	Minimum	0.0012	0.0009	0.0008						
	Maximum	0.0088	0.1878	0.0058						
PCB 021 SUSP NG/L	Minimum	0.0019	0.0014	0.0005						
	Maximum	0.0086	0.5586	0.0223						
PCB 022 DISS NG/L	Minimum								0.0056	0.0056
	Maximum								0.0870	0.2300
PCB 022 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 022 SUSP NG/L	Minimum	0.0019							0.0059	0.0220
	Maximum	0.0019							0.3300	0.9200

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR_Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 022 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 024 DISS NG/L	Minimum								0.0340	0.0091
	Maximum								0.5500	0.5900
PCB 024 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 024 SUSP NG/L	Minimum								0.0096	0.0091
	Maximum								0.0096	0.0091
PCB 024 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 024/027 DISS NG/L	Minimum		0.1030							
	Maximum		0.1030							
PCB 024/027 SUSP NG/L	Minimum	0.0009	0.0012	0.0002						
	Maximum	0.0009	0.1110	0.0002						
PCB 025 DISS NG/L	Minimum		0.0008	0.0008					0.0190	0.0190
	Maximum		0.0974	0.0008					0.0200	0.0190
PCB 025 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 025 SUSP NG/L	Minimum		0.0691	0.0011					0.0190	0.0190
	Maximum		0.0691	0.0011					0.0190	0.0190
PCB 025 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 026 DISS NG/L	Minimum		0.0010						0.0130	0.0130
	Maximum		0.0011						0.0130	0.0130
PCB 026 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 026 SUSP NG/L	Minimum		0.0017						0.0130	0.0130
	Maximum		0.0758						0.0140	0.0130
PCB 026 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 027 DISS NG/L	Minimum								0.0110	0.0110
	Maximum								0.0120	0.0110
PCB 027 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 027 SUSP NG/L	Minimum								0.0110	0.0110
	Maximum								0.0120	0.0110
PCB 027 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2138
	Maximum								0.2238	0.4944
PCB 028 DISS NG/L	Minimum									0.0220
	Maximum									0.0220
PCB 028 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 028 SUSP NG/L	Minimum								0.0220	0.0220
	Maximum								0.0240	0.0220
PCB 028 SUSP NG/L (HRGC/MS)	Minimum								0.2120	
	Maximum								0.2120	
PCB 028/031 DISS NG/L	Minimum				0.0150	0.0150	0.0150	0.0150		
	Maximum									
PCB 028/031 SUSP NG/L	Minimum	0.0012			0.0150	0.0150	0.0150	0.0150		
	Maximum	0.0012								
PCB 029 DISS NG/L	Minimum	0.0012	0.0008	0.0009					0.0092	0.0092
	Maximum	0.0042	0.0461	0.0029					0.0160	0.0110
PCB 029 DISS NG/L (HRGC/MS)	Minimum								0.2000	

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR_Mouth	OU1	OU2	OU3	OU4	OU3	OU4
	Maximum								0.2000	
PCB 029 SUSP NG/L	Minimum	0.0010	0.0010	0.0009					0.0092	0.0092
	Maximum	0.0029	0.1917	0.0014					0.0130	0.0092
PCB 029 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 031 DISS NG/L	Minimum								0.0200	0.0200
	Maximum								0.1500	0.0200
PCB 031 DISS NG/L (HRGC/MS)	Minimum									
	Maximum									
PCB 031 SUSP NG/L	Minimum								0.0200	
	Maximum								0.0210	
PCB 031 SUSP NG/L (HRGC/MS)	Minimum								0.2120	
	Maximum								0.2120	
PCB 033 DISS NG/L	Minimum	0.0023		0.0014					0.0120	0.0120
	Maximum	0.0023		0.0014					0.0130	0.0120
PCB 033 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 033 SUSP NG/L	Minimum			0.0017					0.0120	0.0120
	Maximum			0.0020					0.0130	0.0120
PCB 033 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 037/042 DISS NG/L	Minimum								0.0110	0.0110
	Maximum								0.0110	0.0110
PCB 037/042 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 037/042 SUSP NG/L	Minimum		0.0014	0.0034						
	Maximum		0.1025	0.0034						
PCB 037/042 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 040 DISS NG/L	Minimum		0.1013						0.0051	0.0051
	Maximum		0.1013						0.0051	0.0051
PCB 040 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 040 SUSP NG/L	Minimum		0.0718						0.0051	0.0051
	Maximum		0.1076						0.0054	0.0051
PCB 040 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2120	0.2362
PCB 041/064/071 DISS NG/L	Minimum		0.0015							
	Maximum		0.0015							
PCB 041/064/071 SUSP NG/L	Minimum	0.0017	0.0011	0.0002						
	Maximum	0.0017	0.1122	0.0059						
PCB 043 DISS NG/L	Minimum	0.0017	0.0710							
	Maximum	0.0028	0.1420							
PCB 043 SUSP NG/L	Minimum	0.0037	0.0017	0.0036						
	Maximum	0.0037	0.1799	0.0036						
PCB 044 DISS NG/L	Minimum								0.0300	0.0600
	Maximum								0.1700	0.1800
PCB 044 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 044 SUSP NG/L	Minimum								0.0082	
	Maximum								0.0082	
PCB 044 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 045 DISS NG/L	Minimum		0.0943						0.0089	0.0089
	Maximum		0.0943						0.0089	0.0089
PCB 045 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 045 SUSP NG/L	Minimum		0.0670						0.0089	0.0089
	Maximum		0.0670						0.0093	0.0089
PCB 045 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 046 DISS NG/L	Minimum		0.0015						0.0180	0.0180
	Maximum		0.1155						0.2800	0.2200
PCB 046 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 046 SUSP NG/L	Minimum		0.0015						0.0180	0.0180
	Maximum		0.1206						0.0190	0.0240
PCB 046 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 047 DISS NG/L	Minimum								0.0081	0.1500
	Maximum								0.0790	0.1500
PCB 047 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 047 SUSP NG/L	Minimum								0.0081	0.0250
	Maximum								0.1300	0.1400
PCB 047 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 047/048 DISS NG/L	Minimum		0.0018							
	Maximum		0.0018							
PCB 047/048 SUSP NG/L	Minimum									
	Maximum									
PCB 048 DISS NG/L	Minimum								0.0150	0.0150
	Maximum								2.0000	1.5000
PCB 048 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 048 SUSP NG/L	Minimum								0.0150	0.0150
	Maximum								1.4000	1.9000
PCB 048 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2138
	Maximum								0.2238	0.2362
PCB 049 DISS NG/L	Minimum								0.0200	0.0470
	Maximum								0.1500	0.5600
PCB 049 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 049 SUSP NG/L	Minimum								0.0140	
	Maximum								0.0150	
PCB 049 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 051 DISS NG/L	Minimum	0.0014	0.0837							
	Maximum	0.0014	0.0837							
PCB 051 SUSP NG/L	Minimum		0.0011							
	Maximum		0.0913							
PCB 052 DISS NG/L	Minimum								0.0640	0.1000
	Maximum								0.0640	0.1000
PCB 052 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 052 SUSP NG/L	Minimum								0.0160	0.0870

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
	Maximum								0.0670	0.0870
PCB 052 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 053 DISS NG/L	Minimum	0.0022	0.1289	0.0019					0.0120	0.0120
	Maximum	0.0022	0.1289	0.0019					0.0310	0.0120
PCB 053 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 053 SUSP NG/L	Minimum	0.0013	0.1389	0.0010					0.0120	0.0120
	Maximum	0.0021	0.1389	0.0021					0.0120	0.0120
PCB 053 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2138
	Maximum								0.2238	0.2362
PCB 056 DISS NG/L	Minimum								0.0280	0.0280
	Maximum								0.0300	0.0280
PCB 056 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 056 SUSP NG/L	Minimum								0.0280	0.0280
	Maximum								0.0300	0.0280
PCB 056 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2174	0.2362
PCB 056/060 DISS NG/L	Minimum				0.0900	0.0900	0.0900	0.0900		
	Maximum									
PCB 056/060 SUSP NG/L	Minimum				0.0900	0.0900	0.0900	0.0900		
	Maximum									
PCB 059 DISS NG/L	Minimum								0.0066	0.0066
	Maximum								0.0670	0.1200
PCB 059 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 059 SUSP NG/L	Minimum								0.0066	0.0066
	Maximum								0.0070	0.0066
PCB 059 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.2368
PCB 060/092 DISS NG/L	Minimum								0.0160	0.0160
	Maximum								0.0160	0.0160
PCB 060/092 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 060/092 SUSP NG/L	Minimum								0.0160	0.0160
	Maximum								0.0160	0.0160
PCB 060/092 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 063 DISS NG/L	Minimum	0.0014	0.0451	0.0016					0.0079	0.0079
	Maximum	0.0038	0.1068	0.0016					0.0083	0.0079
PCB 063 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 063 SUSP NG/L	Minimum	0.0018	0.0014						0.0079	0.0079
	Maximum	0.0018	0.1178						0.0083	0.0079
PCB 063 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 064/041 DISS NG/L	Minimum								0.0120	0.0120
	Maximum								0.1400	0.3600
PCB 064/041 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 064/041 SUSP NG/L	Minimum								0.0120	0.0120
	Maximum								0.0940	0.3600

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 064/041 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2120	0.2362
PCB 066/095 DISS NG/L	Minimum	0.0015	0.0017	0.0021					0.0090	0.0090
	Maximum	0.0032	0.0552	0.0021					0.3400	0.4800
PCB 066/095 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 066/095 SUSP NG/L	Minimum	0.0015	0.0009						0.0095	0.0090
	Maximum	0.0015	0.0035						0.0095	0.0090
PCB 066/095 SUSP NG/L (HRGC/MS)	Minimum								0.2036	
	Maximum								0.2120	
PCB 070 DISS NG/L	Minimum								0.0037	0.0037
	Maximum								0.0570	0.0320
PCB 070 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 070 SUSP NG/L	Minimum								0.0520	0.0610
	Maximum								0.0520	0.0610
PCB 070 SUSP NG/L (HRGC/MS)	Minimum								0.2120	
	Maximum								0.2120	
PCB 070/076 DISS NG/L	Minimum									
	Maximum									
PCB 070/076 SUSP NG/L	Minimum	0.0015	0.0009							
	Maximum	0.0016	0.0016							
PCB 071 DISS NG/L	Minimum								0.0069	
	Maximum								0.0069	
PCB 071 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 071 SUSP NG/L	Minimum								0.0069	
	Maximum								0.0072	
PCB 071 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2120	0.2362
PCB 074 DISS NG/L	Minimum								0.0042	0.0042
	Maximum								0.0820	0.2100
PCB 074 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 074 SUSP NG/L	Minimum								0.0042	0.0042
	Maximum								0.0045	0.0042
PCB 074 SUSP NG/L (HRGC/MS)	Minimum								0.2120	
	Maximum								0.2120	
PCB 076 DISS NG/L	Minimum								0.0036	0.0036
	Maximum								0.0460	0.0410
PCB 076 DISS NG/L (HRGC/MS)	Minimum								0.2000	
	Maximum								0.2000	
PCB 076 SUSP NG/L	Minimum								0.0036	0.0036
	Maximum								0.0038	0.0036
PCB 076 SUSP NG/L (HRGC/MS)	Minimum								0.2120	
	Maximum								0.2120	
PCB 077/110 DISS NG/L	Minimum				0.0600	0.0600	0.0600	0.0600	0.0190	0.0190
	Maximum								0.0200	0.0190
PCB 077/110 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 077/110 SUSP NG/L	Minimum				0.0600	0.0600	0.0600	0.0600	0.0190	
	Maximum								0.0200	
PCB 077/110 SUSP NG/L (HRGC/MS)	Minimum								0.2120	

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR_Mouth	OU1	OU2	OU3	OU4	OU3	OU4
	Maximum								0.2120	
PCB 081 DISS NG/L	Minimum	0.0008	0.0009	0.0005						
	Maximum	0.0017	0.0242	0.0016						
PCB 081 SUSP NG/L	Minimum	0.0007	0.0009	0.0008						
	Maximum	0.0016	0.1074	0.0021						
PCB 082 DISS NG/L	Minimum	0.0009	0.0008	0.0004					0.0110	0.0110
	Maximum	0.0009	0.0009	0.0004					0.0110	0.0110
PCB 082 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 082 SUSP NG/L	Minimum		0.0477						0.0110	0.0110
	Maximum		0.0477						0.0110	0.0110
PCB 082 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 083 DISS NG/L	Minimum	0.0008	0.0008	0.0006						
	Maximum	0.0014	0.0799	0.0018						
PCB 083 SUSP NG/L	Minimum	0.0008	0.0010	0.0010						
	Maximum	0.0013	0.0902	0.0010						
PCB 084 DISS NG/L	Minimum								0.0064	0.0064
	Maximum								0.0670	0.0860
PCB 084 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 084 SUSP NG/L	Minimum								0.0064	0.0064
	Maximum								0.0450	0.0890
PCB 084 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 084/092 DISS NG/L	Minimum			0.0030						
	Maximum			0.0030						
PCB 084/092 SUSP NG/L	Minimum		0.2029							
	Maximum		0.2029							
PCB 085 DISS NG/L	Minimum			0.0009					0.0044	0.0044
	Maximum			0.0010					0.0800	0.0610
PCB 085 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 085 SUSP NG/L	Minimum		0.0608						0.0044	0.0044
	Maximum		0.1022						0.0046	0.0044
PCB 085 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2120	0.2362
PCB 087 DISS NG/L	Minimum									
	Maximum									
PCB 087 SUSP NG/L	Minimum									
	Maximum									
PCB 087/081 DISS NG/L	Minimum								0.0140	0.0140
	Maximum								0.0150	0.0140
PCB 087/081 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 087/081 SUSP NG/L	Minimum								0.0140	0.0140
	Maximum								0.0150	0.0140
PCB 087/081 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 089 DISS NG/L	Minimum	0.0016	0.0500	0.0011						
	Maximum	0.0055	0.1561	0.0029						
PCB 089 SUSP NG/L	Minimum	0.0012	0.0016	0.0010						
	Maximum	0.0025	0.1690	0.0013						

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 091 DISS NG/L	Minimum	0.0010	0.0846	0.0009					0.0078	0.0078
	Maximum	0.0016	0.0846	0.0013					0.0480	0.1400
PCB 091 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 091 SUSP NG/L	Minimum	0.0009	0.0012	0.0011					0.0078	0.0078
	Maximum	0.0015	0.0996	0.0011					0.5000	0.2900
PCB 091 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 097 DISS NG/L	Minimum								0.0031	0.0460
	Maximum								0.0260	0.0470
PCB 097 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 097 SUSP NG/L	Minimum								0.0031	0.0120
	Maximum								0.0430	0.0980
PCB 097 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 099 DISS NG/L	Minimum								0.0095	0.0095
	Maximum								10.0000	0.9500
PCB 099 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 099 SUSP NG/L	Minimum		0.0741						0.0095	0.0095
	Maximum		0.0741						0.0100	0.0095
PCB 099 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2174	0.2362
PCB 100 DISS NG/L	Minimum	0.0013	0.0016							
	Maximum	0.0015	0.0999							
PCB 100 SUSP NG/L	Minimum		0.0015							
	Maximum		0.1117							
PCB 101 DISS NG/L	Minimum				0.0400	0.0400	0.0400	0.0400		
	Maximum									
PCB 101 SUSP NG/L	Minimum				0.0400	0.0400	0.0400	0.0400		
	Maximum									
PCB 101/090 DISS NG/L	Minimum								0.0095	0.0095
	Maximum								0.0095	0.0095
PCB 101/090 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 101/090 SUSP NG/L	Minimum								0.0095	0.0095
	Maximum								0.0100	0.0095
PCB 101/090 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 105 DISS NG/L	Minimum								0.0076	0.0076
	Maximum								0.0350	0.0110
PCB 105 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 105 SUSP NG/L	Minimum								0.0076	0.0076
	Maximum								0.0360	0.1500
PCB 105 SUSP NG/L (HRGC/MS)	Minimum									
	Maximum									
PCB 105/132/153 DISS NG/L	Minimum									
	Maximum									
PCB 105/132/153 SUSP NG/L	Minimum									
	Maximum									
PCB 107 DISS NG/L	Minimum	0.0007	0.0008	0.0007					0.0110	0.0110

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR_Mouth	OU1	OU2	OU3	OU4	OU3	OU4
	Maximum	0.0007	0.0720	0.0009					0.0120	0.0110
PCB 107 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 107 SUSP NG/L	Minimum		0.0010						0.0110	0.0110
	Maximum		0.0353						0.0120	0.0110
PCB 107 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 114 DISS NG/L	Minimum								0.0061	0.0061
	Maximum								0.0180	0.0170
PCB 114 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 114 SUSP NG/L	Minimum								0.0061	0.0061
	Maximum								0.0160	0.0330
PCB 114 SUSP NG/L (HRGC/MS)	Minimum								0.0204	0.0213
	Maximum								0.0224	0.0494
PCB 114/134 DISS NG/L	Minimum	0.0015	0.0017	0.0011						
	Maximum	0.0028	0.1550	0.0050						
PCB 114/134 SUSP NG/L	Minimum	0.0014	0.0028	0.0012						
	Maximum	0.0062	0.1896	0.0097						
PCB 118 DISS NG/L	Minimum				0.0500	0.0500	0.0500	0.0500	0.0064	0.0064
	Maximum								0.0067	0.0064
PCB 118 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 118 SUSP NG/L	Minimum				0.0500	0.0500	0.0500	0.0500	0.0064	
	Maximum								0.0067	
PCB 118 SUSP NG/L (HRGC/MS)	Minimum									
	Maximum									
PCB 119 DISS NG/L	Minimum	0.0017	0.0024	0.0010					0.0051	0.0051
	Maximum	0.0076	0.1436	0.0032					0.0300	0.0460
PCB 119 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 119 SUSP NG/L	Minimum		0.0016						0.0051	0.0051
	Maximum		0.1628						0.0054	0.0051
PCB 119 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2362
	Maximum								0.2238	0.2362
PCB 124/135/144/147 DISS NG/L	Minimum									
	Maximum									
PCB 124/135/144/147 SUSP NG/L	Minimum									
	Maximum									
PCB 128 DISS NG/L	Minimum	0.0009	0.0011	0.0004					0.0160	0.0160
	Maximum	0.0030	0.0508	0.0024					0.0170	0.0170
PCB 128 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 128 SUSP NG/L	Minimum		0.0015						0.0160	0.0160
	Maximum		0.0727						0.0180	0.0270
PCB 128 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 129/178 DISS NG/L	Minimum	0.0015	0.0825	0.0006						
	Maximum	0.0017	0.0825	0.0022						
PCB 129/178 SUSP NG/L	Minimum		0.0015							
	Maximum		0.0999							
PCB 130 DISS NG/L	Minimum	0.0006	0.0009	0.0008						
	Maximum	0.0159	0.1899	0.0068						

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR_Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 130 SUSP NG/L	Minimum	0.0008	0.0013	0.0012						
	Maximum	0.0063	0.2922	0.0012						
PCB 131 DISS NG/L	Minimum	0.0003	0.0002	0.0002						
	Maximum	0.0012	0.0260	0.0006						
PCB 131 SUSP NG/L	Minimum	0.0003	0.0004	0.0002						
	Maximum	0.0007	0.0333	0.0016						
PCB 132/168 DISS NG/L	Minimum								0.0140	0.0140
	Maximum								0.9100	0.6700
PCB 132/168 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 132/168 SUSP NG/L	Minimum								0.0140	0.0140
	Maximum								1.4000	1.8000
PCB 132/168 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 135/144 DISS NG/L	Minimum								0.0220	0.0220
	Maximum								0.2200	0.2000
PCB 135/144 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 135/144 SUSP NG/L	Minimum								0.0220	0.0220
	Maximum								0.0240	0.0220
PCB 135/144 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 136 DISS NG/L	Minimum	0.0005	0.0004	0.0004					0.0060	0.0060
	Maximum	0.0018	0.0228	0.0013					0.0063	0.0060
PCB 136 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 136 SUSP NG/L	Minimum	0.0004	0.0003	0.0001					0.0060	0.0060
	Maximum	0.0017	0.0367	0.0026					0.0063	0.0060
PCB 136 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 137 DISS NG/L	Minimum								0.0100	0.0100
	Maximum								0.0110	0.0100
PCB 137 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 137 SUSP NG/L	Minimum								0.0100	0.0100
	Maximum								0.0110	0.0100
PCB 137 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 137/176 DISS NG/L	Minimum	0.0006	0.0007	0.0005						
	Maximum	0.0023	0.0530	0.0011						
PCB 137/176 SUSP NG/L	Minimum	0.0012	0.0010	0.0005						
	Maximum	0.0019	0.0756	0.0041						
PCB 138/158/163 DISS NG/L	Minimum	0.0008	0.0282	0.0006						
	Maximum	0.0011	0.0635	0.0014						
PCB 138/158/163 SUSP NG/L	Minimum		0.0038							
	Maximum		0.0804							
PCB 138/163 DISS NG/L	Minimum				0.0400	0.0400	0.0400	0.0400	0.0170	0.0170
	Maximum								0.0560	0.0850
PCB 138/163 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 138/163 SUSP NG/L	Minimum				0.0400	0.0400	0.0400	0.0400	0.0170	0.0170
	Maximum								0.0180	0.0170
PCB 138/163 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2138

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR_Mouth	OU1	OU2	OU3	OU4	OU3	OU4
	Maximum								0.2238	0.4944
PCB 141 DISS NG/L	Minimum	0.0004	0.0004	0.0003					0.0086	0.0086
	Maximum	0.0010	0.0006	0.0004					0.0091	0.0086
PCB 141 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 141 SUSP NG/L	Minimum	0.0003	0.0004	0.0002					0.0086	0.0086
	Maximum	0.0008	0.0021	0.0019					0.0091	0.0086
PCB 141 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 146 DISS NG/L	Minimum	0.0008	0.0008	0.0007					0.0072	0.0073
	Maximum	0.0011	0.0673	0.0011					0.0097	0.0260
PCB 146 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 146 SUSP NG/L	Minimum		0.0012	0.0018					0.0072	0.0072
	Maximum		0.0822	0.0040					0.0076	0.0073
PCB 146 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 149 DISS NG/L	Minimum				0.0400	0.0400	0.0400	0.0400		
	Maximum									
PCB 149 SUSP NG/L	Minimum				0.0400	0.0400	0.0400	0.0400		
	Maximum									
PCB 149/123 DISS NG/L	Minimum								0.0120	0.0120
	Maximum								0.0130	0.0120
PCB 149/123 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 149/123 SUSP NG/L	Minimum								0.0120	0.0120
	Maximum								0.0130	0.0120
PCB 149/123 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2138
	Maximum								0.2238	0.4944
PCB 151 DISS NG/L	Minimum			0.0004					0.0120	0.0120
	Maximum			0.0004					0.0120	0.0120
PCB 151 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 151 SUSP NG/L	Minimum								0.0120	0.0120
	Maximum								0.0130	0.1200
PCB 151 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 153/184 DISS NG/L	Minimum								0.0140	0.0140
	Maximum								0.0540	0.1100
PCB 153/184 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 153/184 SUSP NG/L	Minimum								0.0140	0.0140
	Maximum								0.0150	0.0290
PCB 153/184 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 156/171 DISS NG/L	Minimum								0.0260	0.0260
	Maximum								0.0270	0.0260
PCB 156/171 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 156/171 SUSP NG/L	Minimum								0.0260	0.0260
	Maximum								0.0270	0.2600
PCB 156/171 SUSP NG/L (HRGC/MS)	Minimum								0.0204	0.0214
	Maximum								0.0224	0.2362

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 156/171/202 DISS NG/L	Minimum	0.0006	0.0546	0.0005						
	Maximum	0.0010	0.0546	0.0015						
PCB 156/171/202 SUSP NG/L	Minimum		0.0009	0.0004						
	Maximum		0.0670	0.0030						
PCB 157 DISS NG/L	Minimum								0.0130	0.0130
	Maximum								0.0140	0.0130
PCB 157 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 157 SUSP NG/L	Minimum								0.0130	0.0130
	Maximum								0.0140	0.1300
PCB 157 SUSP NG/L (HRGC/MS)	Minimum								0.0204	0.0214
	Maximum								0.0224	0.0236
PCB 157/200 DISS NG/L	Minimum	0.0008	0.0006	0.0006						
	Maximum	0.0043	0.0908	0.0024						
PCB 157/200 SUSP NG/L	Minimum	0.0012	0.0015	0.0007						
	Maximum	0.0041	0.1130	0.0062						
PCB 158 DISS NG/L	Minimum								0.0087	0.0087
	Maximum								0.0092	0.0087
PCB 158 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 158 SUSP NG/L	Minimum								0.0087	0.0087
	Maximum								0.0092	0.0870
PCB 158 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 167 DISS NG/L	Minimum	0.0004	0.0003	0.0004					0.0088	0.0088
	Maximum	0.0020	0.0446	0.0053					0.0180	0.0170
PCB 167 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 167 SUSP NG/L	Minimum		0.0008						0.0170	0.0170
	Maximum		0.0544						0.0180	0.1700
PCB 167 SUSP NG/L (HRGC/MS)	Minimum								0.0204	0.0213
	Maximum								0.0224	0.0494
PCB 169 DISS NG/L	Minimum								0.0082	0.0082
	Maximum								0.0087	0.0082
PCB 169 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 169 SUSP NG/L	Minimum								0.0082	0.0082
	Maximum								0.0087	0.0820
PCB 169 SUSP NG/L (HRGC/MS)	Minimum								0.0204	0.0213
	Maximum								0.0224	0.0494
PCB 170 DISS NG/L	Minimum								0.0110	0.0110
	Maximum								0.0110	0.0110
PCB 170 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 170 SUSP NG/L	Minimum								0.0110	0.0110
	Maximum								0.0110	0.1100
PCB 170 SUSP NG/L (HRGC/MS)	Minimum								0.0212	0.0236
	Maximum								0.0212	0.0236
PCB 170/190 DISS NG/L	Minimum	0.0007	0.0007	0.0005						
	Maximum	0.0034	0.0741	0.0019						
PCB 170/190 SUSP NG/L	Minimum	0.0010	0.0014	0.0006						
	Maximum	0.0010	0.0839	0.0048						
PCB 172 DISS NG/L	Minimum								0.0170	0.0170

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
	Maximum								0.0180	0.0170
PCB 172 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 172 SUSP NG/L	Minimum								0.0170	0.0170
	Maximum								0.0180	0.1700
PCB 172 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 172/197 DISS NG/L	Minimum	0.0007	0.0007	0.0007						
	Maximum	0.0024	0.1426	0.0033						
PCB 172/197 SUSP NG/L	Minimum		0.0014	0.0042						
	Maximum		0.1172	0.0042						
PCB 173 DISS NG/L	Minimum	0.0005	0.0003	0.0003						
	Maximum	0.0031	0.0600	0.0018						
PCB 173 SUSP NG/L	Minimum	0.0004	0.0009	0.0004						
	Maximum	0.0030	0.0902	0.0065						
PCB 174 DISS NG/L	Minimum			0.0010					0.0130	0.0130
	Maximum			0.0010					0.0140	0.0130
PCB 174 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 174 SUSP NG/L	Minimum									
	Maximum									
PCB 174 SUSP NG/L	Minimum								0.0130	0.0130
	Maximum								0.0140	0.1300
PCB 174 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 175 DISS NG/L	Minimum	0.0004	0.0006	0.0006						
	Maximum	0.0038	0.0797	0.0020						
PCB 175 SUSP NG/L	Minimum	0.0006	0.0011	0.0003						
	Maximum	0.0040	0.1102	0.0061						
PCB 176 DISS NG/L	Minimum								0.0170	0.0170
	Maximum								0.0180	0.0170
PCB 176 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 176 SUSP NG/L	Minimum								0.0170	0.0170
	Maximum								0.0180	0.1700
PCB 176 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 177 DISS NG/L	Minimum		0.0007	0.0006					0.0210	0.0210
	Maximum		0.0007	0.0016					0.0220	0.0210
PCB 177 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 177 SUSP NG/L	Minimum		0.0010						0.0210	0.0210
	Maximum		0.0723						0.0220	0.2100
PCB 177 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 178/126 DISS NG/L	Minimum								0.0210	0.0210
	Maximum								0.0220	0.0210
PCB 178/126 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 178/126 SUSP NG/L	Minimum								0.0210	0.0210
	Maximum								0.0220	0.2100
PCB 178/126 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 IFRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 180 DISS NG/L	Minimum	0.0009			0.0600	0.0600	0.0600	0.0600	0.0170	0.0170
	Maximum	0.0009							0.0290	0.0410
PCB 180 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 180 SUSP NG/L	Minimum				0.0600	0.0600	0.0600	0.0600	0.0170	0.0170
	Maximum								0.0170	0.1700
PCB 180 SUSP NG/L (HRGC/MS)	Minimum									
	Maximum									
PCB 182/187 DISS NG/L	Minimum	0.0011		0.0011					0.0190	0.0190
	Maximum	0.0011		0.0011					0.0200	0.0190
PCB 182/187 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 182/187 SUSP NG/L	Minimum								0.0190	0.0190
	Maximum								0.0200	0.1900
PCB 182/187 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 183 DISS NG/L	Minimum		0.0670						0.0110	0.0110
	Maximum		0.0670						0.0120	0.0110
PCB 183 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 183 SUSP NG/L	Minimum		0.0793						0.0110	0.0110
	Maximum		0.0793						0.0120	0.1100
PCB 183 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 185 DISS NG/L	Minimum	0.0007	0.0005	0.0005					0.0140	0.0140
	Maximum	0.0029	0.0624	0.0016					0.0140	0.0140
PCB 185 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 185 SUSP NG/L	Minimum	0.0007	0.0037	0.0005					0.0140	0.0140
	Maximum	0.0017	0.0774	0.0030					0.0140	0.1400
PCB 185 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 189 DISS NG/L	Minimum	0.0006	0.0004	0.0004					0.0120	0.0120
	Maximum	0.0031	0.0823	0.0019					0.0120	0.0120
PCB 189 DISS NG/L (HRGC/MS)	Minimum								0.0200	0.0200
	Maximum								0.0200	0.0200
PCB 189 SUSP NG/L	Minimum	0.0007	0.0010	0.0006					0.0120	0.0120
	Maximum	0.0029	0.1290	0.0037					0.0120	0.1200
PCB 189 SUSP NG/L (HRGC/MS)	Minimum								0.0204	0.0213
	Maximum								0.0224	0.0494
PCB 190 DISS NG/L	Minimum								0.0094	0.0094
	Maximum								0.0099	0.0094
PCB 190 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 190 SUSP NG/L	Minimum								0.0094	0.0094
	Maximum								0.0099	0.0940
PCB 190 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 191 DISS NG/L	Minimum	0.0006	0.0004	0.0004						
	Maximum	0.0042	0.0920	0.0017						
PCB 191 SUSP NG/L	Minimum	0.0007	0.0007	0.0003						
	Maximum	0.0061	0.1661	0.0091						
PCB 193 DISS NG/L	Minimum	0.0004	0.0006	0.0004						

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
	Maximum	0.0031	0.0662	0.0017						
PCB 193 SUSP NG/L	Minimum		0.0010							
	Maximum		0.0815							
PCB 194 DISS NG/L	Minimum	0.0004	0.0003	0.0003					0.0160	0.0160
	Maximum	0.0010	0.0462	0.0011					0.0170	0.0160
PCB 194 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 194 SUSP NG/L	Minimum		0.0008						0.0160	0.0160
	Maximum		0.0593						0.0170	0.1600
PCB 194 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 195 DISS NG/L	Minimum								0.0140	0.0140
	Maximum								0.0150	0.0140
PCB 195 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 195 SUSP NG/L	Minimum								0.0140	0.0140
	Maximum								0.0150	0.1400
PCB 195 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 195/208 DISS NG/L	Minimum	0.0011	0.0014	0.0010						
	Maximum	0.0027	0.1198	0.0030						
PCB 195/208 SUSP NG/L	Minimum		0.0020							
	Maximum		0.1580							
PCB 196/203 DISS NG/L	Minimum	0.0009	0.0011	0.0008						
	Maximum	0.0018	0.0848	0.0022						
PCB 196/203 SUSP NG/L	Minimum		0.0016	0.0011						
	Maximum		0.1030	0.0011						
PCB 197 DISS NG/L	Minimum								0.0310	0.0310
	Maximum								0.0570	0.0380
PCB 197 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 197 SUSP NG/L	Minimum								0.0310	0.0310
	Maximum								0.0330	0.3100
PCB 197 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 198 DISS NG/L	Minimum	0.0006	0.0004	0.0004						
	Maximum	0.0028	0.0724	0.0018						
PCB 198 SUSP NG/L	Minimum	0.0005	0.0007	0.0006						
	Maximum	0.0030	0.0565	0.0041						
PCB 199 DISS NG/L	Minimum	0.0004	0.0003	0.0003					0.0160	0.0160
	Maximum	0.0018	0.0401	0.0011					0.0170	0.0160
PCB 199 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 199 SUSP NG/L	Minimum	0.0005	0.0007	0.0008					0.0160	0.0160
	Maximum	0.0005	0.0487	0.0008					0.0170	0.1600
PCB 199 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 201 DISS NG/L	Minimum	0.0008	0.0009	0.0006					0.0130	0.0130
	Maximum	0.0017	0.0750	0.0020					0.0140	0.0130
PCB 201 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 201 SUSP NG/L	Minimum		0.0020	0.0009					0.0130	0.0130
	Maximum		0.0905	0.0043					0.0140	0.1300
PCB 201 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 202 DISS NG/L	Minimum								0.0130	0.0130
	Maximum								0.0140	0.0130
PCB 202 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 202 SUSP NG/L	Minimum								0.0130	0.0130
	Maximum								0.0140	0.1300
PCB 202 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944

Table H-3. Summary of Reporting Limits for Lower Fox River Water Column Congener Data, By OU and Study

PARAMETER		1988-90 Green Bay Mass Balance Study Surface Water Surveys (EPA/GLNPO by Cook)			1989-90 Fox River Mass Balance Study Water Column Data				2000-01 FRG Fox River Surface Water Surveys (lab data)	
		OU3	OU4	LFR_Mouth	OU1	OU2	OU3	OU4	OU3	OU4
PCB 203/196 DISS NG/L	Minimum								0.0250	0.0250
	Maximum								0.0270	0.0250
PCB 203/196 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 203/196 SUSP NG/L	Minimum								0.0250	0.0250
	Maximum								0.0270	0.2500
PCB 203/196 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 205 DISS NG/L	Minimum	0.0004	0.0003	0.0003						
	Maximum	0.0024	0.0688	0.0013						
PCB 205 SUSP NG/L	Minimum	0.0006	0.0008	0.0004						
	Maximum	0.0022	0.1393	0.0030						
PCB 206 DISS NG/L	Minimum	0.0006	0.0009	0.0004					0.0170	0.0170
	Maximum	0.0031	0.0730	0.0017					0.0180	0.0180
PCB 206 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 206 SUSP NG/L	Minimum		0.0011						0.0170	0.0170
	Maximum		0.0894						0.0180	0.1700
PCB 206 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 207 DISS NG/L	Minimum	0.0005	0.0003	0.0003						
	Maximum	0.0016	0.0571	0.0013						
PCB 207 SUSP NG/L	Minimum	0.0007	0.0010	0.0006						
	Maximum	0.0017	0.0785	0.0031						
PCB 208 DISS NG/L	Minimum								0.0180	0.0180
	Maximum								0.0190	0.0180
PCB 208 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 208 SUSP NG/L	Minimum								0.0180	0.0180
	Maximum								0.0190	0.1800
PCB 208 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944
PCB 209 DISS NG/L	Minimum	0.0005	0.0003	0.0002					0.0230	0.0230
	Maximum	0.0026	0.0578	0.0020					0.0240	0.0230
PCB 209 DISS NG/L (HRGC/MS)	Minimum								0.2000	0.2000
	Maximum								0.2000	0.2000
PCB 209 SUSP NG/L	Minimum		0.0007	0.0003					0.0230	0.0230
	Maximum		0.1130	0.0028					0.0240	0.2300
PCB 209 SUSP NG/L (HRGC/MS)	Minimum								0.2036	0.2129
	Maximum								0.2238	0.4944

NOTE: 1989-90 FRMBS LOD values were obtained from A Deterministic PCB Transport Model for the Lower Fox River Between Lake Winnebago and Depere, Wisonsin, Appendix I, Table I-1 (WDNR, 1995)

Table H-4. Lower Fox River Historic Water Column Congener Data for OU1 (Suspended and Dissolved)

Sample Name	9003242F		9003243F		9003243P		9003451F		9003451P		9003623F		9003623P		9003776F		9003776P		9004432F	
Sample Date	4/18/89		4/18/89		4/18/89		5/2/89		5/2/89		5/16/89		5/16/89		5/31/89		5/31/89		6/28/89	
Fraction	Dissolved		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.46		0.3		0.14		0.24		0.16		0.33		0.15		0.21		0.21		0.23	
PCB 056/060	0.05		0.05				0.08		0.12		0.07		0.17		0.08		0.18		0.06	
PCB 077/110	0.1		0.08		0.07		0.1		0.08		0.08		0.07		0.12		0.09		0.09	
PCB 101	0.04		0.04		0.06		0.06		0.06		0.05		0.06		0.06		0.07		0.04	
PCB 118	0.04		0.04		0.04		0.04		0.04		0.03		0.04		0.06		0.04		0.05	
PCB 138/163	0.04		0.04		0.05		0.05		0.05		0.05		0.05		0.1		0.07		0.05	
PCB 149	0.04		0.03		0.03		0.03		0.03		0.03		0.04		0.05		0.04		0.03	
PCB 180			0.02		0.02		0.02		0.03		0.02		0.05		0.06					
Total Suspended PCBs (by congener sum) =					0.41				0.57				0.63				0.70			
Total Congeners Analyzed (Susp) =					7				8				8				7			
Total Congeners Detected (Susp) =					7				8				8				7			
Reported TPCBs (Susp) =					0.51				0.93				0.49				1.26			
Total Dissolved PCBs (by congener sum) =	0.77		0.60				0.62				0.66				0.74				0.55	
Total Congeners Analyzed (Diss) =	7		8				8				8				8				7	
Total Congeners Detected (Diss) =	7		8				8				8				8				7	
Reported TPCBs (Diss) =	0.56		0.12				1.78				1.63				1.8				1.45	

NOTE: No replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-4. Lower Fox River Historic Water Column Congener Data for OU1 (Suspended and Dissolved)

Sample Name	9004432P		DF		DP		OA001177F		OA001177P		OA001180F		OA001180P		OA001628F		OA001628P		OA001631F	
Sample Date	6/28/89		6/15/89		4/18/90		7/12/89		7/12/89		7/26/89		7/26/89		8/22/89		8/22/89		8/8/89	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.13		0.3		0.16		0.25		0.14		0.25		0.11		0.17		0.13		0.16	
PCB 056/060			0.08		0.1		0.05		0.04		0.04		0.04		0.05		0.05		0.06	
PCB 077/110	0.05		0.12		0.06		0.07		0.06		0.09		0.06		0.08				0.13	
PCB 101	0.03		0.07		0.04		0.04		0.03		0.05		0.03		0.05				0.07	
PCB 118	0.1		0.06		0.03		0.03		0.04		0.06		0.04		0.04				0.06	
PCB 138/163	0.04		0.08		0.04		0.03		0.05		0.1		0.04		0.04		0.04		0.06	
PCB 149	0.03		0.05		0.03		0.02		0.03		0.04		0.03		0.03				0.04	
PCB 180	0.03		0.04						0.02		0.02		0.02		0.01		0.01		0.02	
Total Suspended PCBs (by congener sum) =	**0.41**				**0.46**				**0.41**				**0.37**				**0.23**			
Total Congeners Analyzed (Susp) =	**7**				**7**				**8**				**8**				**4**			
Total Congeners Detected (Susp) =	**7**				**7**				**8**				**8**				**4**			
Reported TPCBs (Susp) =	**0.37**				**0.24**								**0.16**							
Total Dissolved PCBs (by congener sum) =			**0.80**				**0.49**				**0.65**				**0.47**				**0.60**	
Total Congeners Analyzed (Diss) =			**8**				**7**				**8**				**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**7**				**8**				**8**				**8**	
Reported TPCBs (Diss) =			**2.45**				**1.42**				**0.52**				**0.99**				**1.39**	

NOTE: No replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-4. Lower Fox River Historic Water Column Congener Data for OU1 (Suspended and Dissolved)

Sample Name	OA001631P		OA002396F		OA002396P		OA002398F		OA002398P		OA003241F		OA003241P		OA003245F		OA003245P		OA004471F	
Sample Date	8/8/89		10/4/89		10/4/89		10/4/89		10/4/89		9/19/89		9/19/89		9/5/89		9/5/89		10/18/89	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.11		0.19		0.08		0.15		0.08		0.12		0.1		0.27		0.08		0.2	
PCB 056/060			0.07		0.03		0.04		0.02		0.05		0.03		0.08				0.08	
PCB 077/110	0.07		0.1		0.05		0.07		0.05		0.11		0.06		0.11		0.04		0.13	
PCB 101	0.03		0.06		0.02		0.05		0.03		0.06		0.04		0.07		0.03		0.07	
PCB 118	0.03		0.04		0.02		0.03		0.02		0.04		0.03		0.04				0.06	
PCB 138/163	0.04		0.05		0.03		0.04		0.03		0.05		0.04		0.05				0.07	
PCB 149	0.02		0.03		0.01		0.03		0.02		0.04		0.02		0.04				0.05	
PCB 180	0.02		0.02		0.01		0.02		0.01		0.02		0.02				0.04		0.02	
Total Suspended PCBs (by congener sum) =	**0.32**				**0.25**				**0.26**				**0.34**				**0.19**			
Total Congeners Analyzed (Susp) =	**7**				**8**				**8**				**8**				**4**			
Total Congeners Detected (Susp) =	**7**				**8**				**8**				**8**				**4**			
Reported TPCBs (Susp) =	**0.07**												**0.11**				**0.05**			
Total Dissolved PCBs (by congener sum) =			**0.56**				**0.43**				**0.49**				**0.66**				**0.68**	
Total Congeners Analyzed (Diss) =			**8**				**8**				**8**				**7**				**8**	
Total Congeners Detected (Diss) =			**8**				**8**				**8**				**7**				**8**	
Reported TPCBs (Diss) =			**1.66**				**1.17**				**0.87**				**1.9**				**1.71**	

NOTE: No replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-4. Lower Fox River Historic Water Column Congener Data for OU1 (Suspended and Dissolved)

Sample Name	OA004471P		OA004479F		OA004479P		OB000378F		OB000378P		OB000381F		OB000381P		OB000386F		OB000386P		OB001107F	
Sample Date	10/18/89		10/31/89		10/31/89		11/14/89		11/14/89		11/14/89		11/14/89		12/5/89		12/5/89		1/17/90	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.05		0.12		0.05		0.15		0.1		0.2		0.11		0.12		0.09		0.2	
PCB 056/060	0.02		0.05		0.02		0.08		0.05		0.07		0.04		0.04		0.04		0.05	
PCB 077/110	0.04		0.08		0.04		0.54		0.1		0.12		0.07		0.07		0.06		0.09	
PCB 101	0.03		0.05		0.02		0.37		0.06		0.08		0.04		0.05		0.03		0.05	
PCB 118	0.02		0.04		0.02		0.12		0.04		0.05		0.05		0.03		0.03		0.05	
PCB 138/163	0.03		0.05		0.03		0.09		0.06		0.05		0.04		0.03		0.03		0.04	
PCB 149	0.02		0.03		0.02		0.12		0.04		0.05		0.05		0.03		0.02		0.06	
PCB 180			0.02		0.01		0.02		0.02		0.02		0.03		0.02		0.02		0.02	
Total Suspended PCBs (by congener sum) =	**0.21**				**0.21**				**0.47**				**0.43**				**0.32**			
Total Congeners Analyzed (Susp) =	**7**				**8**				**8**				**8**				**8**			
Total Congeners Detected (Susp) =	**7**				**8**				**8**				**8**				**8**			
Reported TPCBs (Susp) =									**0.47**				**0.41**				**0.09**			
Total Dissolved PCBs (by congener sum) =			**0.44**				**1.49**				**0.64**				**0.39**				**0.56**	
Total Congeners Analyzed (Diss) =			**8**				**8**				**8**				**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**8**				**8**				**8**				**8**	
Reported TPCBs (Diss) =			**0.62**				**4.14**				**1.95**				**0.32**				**1.44**	

NOTE: No replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-4. Lower Fox River Historic Water Column Congener Data for OU1 (Suspended and Dissolved)

Sample Name	OB001107P		OB001110F		OB001110P		OB001111F		OB001111P		OB001115F		OB001115P		OB001116F		OB001116P		OB002899F	
Sample Date	1/17/90		2/13/90		2/13/90		2/13/90		2/13/90		3/13/90		3/13/90		3/23/90		3/23/90		3/13/90	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.04		0.15				0.39		0.08		0.28		0.13		0.21		0.05		0.17	
PCB 056/060			0.04		0.02		0.07		0.02		0.07		0.04		0.05				0.05	
PCB 077/110	0.03		0.09		0.07		0.1		0.03		0.13		0.14		0.08		0.04		0.09	
PCB 101	0.02		0.05		0.05		0.06		0.02		0.07		0.08		0.05		0.03		0.05	
PCB 118			0.04		0.03		0.05		0.01		0.06		0.05		0.04				0.04	
PCB 138/163			0.05		0.06		0.05		0.02		0.06		0.07		0.04		0.02		0.05	
PCB 149			0.04		0.03		0.04		0.02		0.06		0.04		0.05		0.02		0.04	
PCB 180			0.03		0.02		0.02				0.03		0.02		0.02				0.03	
Total Suspended PCBs (by congener sum) =	0.09				0.28				0.20				0.57				0.16			
Total Congeners Analyzed (Susp) =	3				7				7				8				5			
Total Congeners Detected (Susp) =	3				7				7				8				5			
Reported TPCBs (Susp) =	0.12				0.12								0.86				0.13			
Total Dissolved PCBs (by congener sum) =			0.49				0.78				0.76				0.54				0.52	
Total Congeners Analyzed (Diss) =			8				8				8				8				8	
Total Congeners Detected (Diss) =			8				8				8				8				8	
Reported TPCBs (Diss) =			0.54				2.4				2.12				1.4				1.08	

NOTE: No replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-4. Lower Fox River Historic Water Column Congener Data for OU1 (Suspended and Dissolved)

Sample Name	OB002899P		OB002903F		OB002903P		OB002906F		OB002906P	
Sample Date	3/13/90		4/2/90		4/2/90		4/19/90		4/19/90	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.1		0.19		0.07		0.19		0.3	
PCB 056/060	0.02		0.05				0.05		0.11	
PCB 077/110	0.04		0.09		0.05		0.09		0.53	
PCB 101	0.03		0.06		0.03		0.06		0.31	
PCB 118	0.02		0.04		0.02		0.04		0.24	
PCB 138/163	0.03		0.05		0.03		0.05		0.35	
PCB 149	0.02		0.04		0.02		0.04		0.16	
PCB 180	0.02		0.03				0.03		0.08	
Total Suspended PCBs (by congener sum) =	**0.28**				**0.22**				**2.08**	
Total Congeners Analyzed (Susp) =	**8**				**6**				**8**	
Total Congeners Detected (Susp) =	**8**				**6**				**8**	
Reported TPCBs (Susp) =					**0.04**				**5.16**	
Total Dissolved PCBs (by congener sum) =			**0.55**				**0.55**			
Total Congeners Analyzed (Diss) =			**8**				**8**			
Total Congeners Detected (Diss) =			**8**				**8**			
Reported TPCBs (Diss) =			**0.98**				1			

NOTE: No replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website *database*

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	9003241F		9003241P		9003244P		9003450F		9003450P		9003452F		9003452P		9003619F		9003619P		9003620F	
Sample Date	4/19/89		4/19/89		4/20/89		5/2/89		5/2/89		5/3/89		5/3/89		5/17/89		5/17/89		5/16/89	
Fraction	Dissolved		Suspended		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	1.5		5.5		3.5		2.2		7.1		2		8.2		2.1		6.9		2.3	
PCB 056/060	0.1		0.95		0.17		0.22		0.82		0.16		1.3		0.22		0.99		0.24	
PCB 077/110	0.15		0.72		0.5		0.2		0.85		0.16		1.1		0.18		1.1		0.21	
PCB 101	0.07		0.38		0.24		0.12		0.38		0.09		0.5		0.1		0.45		0.12	
PCB 118	0.08		0.42		0.27		0.09		0.42		0.07		0.55		0.08		0.52		0.09	
PCB 138/163	0.06		0.34		0.23		0.09		0.37		0.05		0.47		0.07		0.39		0.08	
PCB 149	0.07		0.24		0.16		0.07		0.26		0.04		0.32		0.06		0.3		0.06	
PCB 180	0.02		0.13		0.08		0.04		0.15		0.02		0.21		0.04		0.21		0.03	
Total Suspended PCBs (by congener sum) =			**8.68**		**5.15**				**10.35**				**12.65**				**10.86**			
Total Congeners Analyzed (Susp) =			**8**		**8**				**8**				**8**				**8**			
Total Congeners Detected (Susp) =			**8**		**8**				**8**				**8**				**8**			
Reported TPCBs (Susp) =			**29**		**17.09**				**34.81**				**42.64**				**35.61**			
Total Dissolved PCBs (by congener sum) =	**2.05**						**3.03**				**2.59**				**2.85**				**3.13**	
Total Congeners Analyzed (Diss) =	**8**						**8**				**8**				**8**				**8**	
Total Congeners Detected (Diss) =	**8**						**8**				**8**				**8**				**8**	
Reported TPCBs (Diss) =	**7.54**						**13.27**				**11.04**				**11.93**				**13.57**	

NOTE: No replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	9003620P		9003621F		9003621P		9003777F		9003777P		9003778F		9003778P		9004428F		9004428P		9004429F	
Sample Date	5/16/89		5/17/89		5/17/89		5/31/89		5/31/89		6/1/89		6/1/89		6/27/89		6/27/89		6/27/89	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	10		2.3		7.3		0.6		3.1		1.1		7.4		3.6		9.2		3.2	
PCB 056/060	1.7		0.31		1		0.08		0.37		0.12		1.2		0.34		1.8		0.26	
PCB 077/110	1.3		0.18		0.88		0.11		0.37		0.14		0.71		0.3		1.3		0.26	
PCB 101	0.56		0.11		0.45		0.06		0.15		0.08		0.37		0.14		0.53		0.12	
PCB 118	0.71		0.06		0.42		0.06		0.2		0.06		0.47		0.12		0.8		0.1	
PCB 138/163	0.51		0.07		0.4		0.07		0.2		0.06		0.39		0.1		0.62		0.08	
PCB 149	0.35		0.05		0.27		0.04		0.11		0.04		0.22		0.07		0.32		0.05	
PCB 180	0.22		0.03		0.17		0.03		0.09				0.2		0.05		0.32		0.02	
Total Suspended PCBs (by congener sum) =	**15.35**				**10.89**				**4.59**				**10.96**				**14.89**			
Total Congeners Analyzed (Susp) =	**8**				**8**				**8**				**8**				**8**			
Total Congeners Detected (Susp) =	**8**				**8**				**8**				**8**				**8**			
Reported TPCBs (Susp) =	**51.61**				**36.16**				**14.46**				**35.91**				**46.18**			
Total Dissolved PCBs (by congener sum) =			**3.11**				**1.05**				**1.60**				**4.72**				**4.09**	
Total Congeners Analyzed (Diss) =			**8**				**8**				**7**				**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**8**				**7**				**8**				**8**	
Reported TPCBs (Diss) =			**13.15**				**3.66**				**6.02**				**18.86**				**16.61**	

NOTE: No replicates samples were reported for this dat

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	9004429P		9004430F		9004430P		AF		AO001179F		AO001179P		AP		BF		BP		OA001178F	
Sample Date	6/27/89		6/27/89		6/27/89		6/14/89		7/26/89		7/26/89		6/14/89		6/14/89		6/14/89		7/26/89	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Dissolved		Suspended		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	8.3		3.5		6.2		1.5		2.7		6.8		5		1.5		5.7		2.9	
PCB 056/060	1.1		0.3		1.2		0.16		0.19		0.85		0.73		0.22		1.2		0.21	
PCB 077/110	0.92		0.26		0.84		0.18		0.25		1		0.73		0.19		0.95		0.25	
PCB 101	0.35		0.12		0.33		0.1		0.14		0.47		0.33		0.12		0.41		0.14	
PCB 118	0.65		0.1		0.7		0.09		0.12		0.53		0.31		0.09		0.35		0.13	
PCB 138/163	0.44		0.08		0.43		0.09		0.14		0.38		0.27		0.09		0.33		0.15	
PCB 149	0.24		0.05		0.25		0.06		0.08		0.27		0.16		0.06		0.18		0.08	
PCB 180	0.21		0.03		0.23				0.03		0.14		0.11		0.02		0.15		0.05	
Total Suspended PCBs (by congener sum) =	**12.21**				**10.18**						**10.44**		**7.64**				**9.27**			
Total Congeners Analyzed (Susp) =	**8**				**8**						**8**		**8**				**8**			
Total Congeners Detected (Susp) =	**8**				**8**						**8**		**8**				**8**			
Reported TPCBs (Susp) =	**38.93**				**32.88**						**33.66**		**24.07**				**29.69**			
Total Dissolved PCBs (by congener sum) =			**4.44**				**2.18**		**3.65**						**2.29**				**3.91**	
Total Congeners Analyzed (Diss) =			**8**				**7**		**8**						**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**7**		**8**						**8**				**8**	
Reported TPCBs (Diss) =			**17.46**				**8.51**		**14.61**						**9.66**				**14.92**	

NOTE: No replicates samples were reported for this dat

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	OA001178P		OA001183F		OA001183P		OA001184F		OA001184P		OA001625F		OA001625P		OA001626F		OA001626P		OA001632F	
Sample Date	7/26/89		7/12/89		7/12/89		7/11/89		7/11/89		8/23/89		8/23/89		8/22/89		8/22/89		8/9/89	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	8.4		3.8		8.5		8.7		3.7		2.9		9.3		3.2		7.1		3	
PCB 056/060	1.3		0.25		0.88		0.29		1.1		0.24		1.4		0.21		0.83		0.2	
PCB 077/110	1.2		0.29		0.98		0.25		0.95		0.23		1.3		0.23		1		0.24	
PCB 101	0.6		0.14		0.44		0.14		0.47		0.12		0.6		0.11		0.46		0.13	
PCB 118	0.63		0.12		0.62		0.13		0.65		0.09		0.65		0.08		0.47		0.12	
PCB 138/163	0.53		0.08		0.41		0.1		0.48		0.08		0.57		0.07		0.34		0.13	
PCB 149	0.35		0.07		0.32		0.07		0.33		0.06		0.37		0.05		0.26		0.07	
PCB 180	0.26		0.02		0.17		0.04		0.21		0.04		0.29		0.02		0.13		0.03	
Total Suspended PCBs (by congener sum) =	**13.27**				**12.32**				**7.89**				**14.48**				**10.59**			
Total Congeners Analyzed (Susp) =	**8**				**8**				**8**				**8**				**8**			
Total Congeners Detected (Susp) =	**8**				**8**				**8**				**8**				**8**			
Reported TPCBs (Susp) =	**44.1**				**40.16**				**41.2**				**46.94**				**33.06**			
Total Dissolved PCBs (by congener sum) =			**4.77**				**9.72**				**3.76**				**3.97**				**3.92**	
Total Congeners Analyzed (Diss) =			**8**				**8**				**8**				**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**8**				**8**				**8**				**8**	
Reported TPCBs (Diss) =			**18.95**				**17.82**				**15.02**				**16.2**				**15.93**	

NOTE: No replicates samples were reported for this dat

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	OA001632P		OA001633F		OA001633P		OA002394F		OA002394P		OA002395F		OA002395P		OA003237F		OA003237P		OA003238F	
Sample Date	8/9/89		8/8/89		8/8/89		10/3/89		10/3/89		10/3/89		10/3/89		9/20/89		9/20/89		9/20/89	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	11		3		7.9		2.3		4.8		3.1		5.9		2.5		5		2.9	
PCB 056/060	1.5		0.18		1		0.19		0.83		0.26		1.1		0.22		0.92		0.25	
PCB 077/110	1.5		0.22		1.3		0.21		1.1		0.26		1.1		0.25		0.89		0.31	
PCB 101	0.69		0.11		0.58		0.12		0.43		0.14		0.47		0.15		0.45		0.17	
PCB 118	0.67		0.08		0.57		0.07		0.36		0.08		0.4		0.09		0.42		0.09	
PCB 138/163	0.53		0.07		0.44		0.07		0.34		0.08		0.35		0.09		0.38		0.09	
PCB 149	0.35		0.05		0.31		0.06		0.19		0.06		0.22		0.08		0.24		0.08	
PCB 180	0.23		0.02		0.18		0.05		0.12		0.02		0.16		0.04		0.17		0.03	
Total Suspended PCBs (by congener sum) =	**16.47**				**12.28**				**8.17**				**9.70**				**8.47**			
Total Congeners Analyzed (Susp) =	**8**				**8**				**8**				**8**				**8**			
Total Congeners Detected (Susp) =	**8**				**8**				**8**				**8**				**8**			
Reported TPCBs (Susp) =	**52.17**				**39.18**				**24.94**				**31.39**				**27.33**			
Total Dissolved PCBs (by congener sum) =			**3.73**				**3.07**				**4.00**				**3.42**				**3.92**	
Total Congeners Analyzed (Diss) =			**8**				**8**				**8**				**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**8**				**8**				**8**				**8**	
Reported TPCBs (Diss) =			**16.23**				**12.58**				**16.49**				**13.51**				**16.17**	

NOTE: No replicates samples were reported for this dat.

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	OA003238P		OA003239F		OA003239P		OA003243F		OA003243P		OA003244F		OA003244P		OA004473F		OA004473P		OA004474F	
Sample Date	9/20/89		9/20/89		9/20/89		9/5/89		9/6/89		9/6/89		9/6/89		10/17/89		10/17/89		10/17/89	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	5.3		2.9		4.5		3.4		5.1		2.2		5.2		1.4		5.7		2.7	
PCB 056/060	0.76		0.26		0.64		0.29		0.78		0.19		0.84		0.12		0.97		0.19	
PCB 077/110	0.87		0.32		0.8		0.35		0.92		0.18		0.76		0.16		0.94		0.26	
PCB 101	0.41		0.18		0.38		0.19		0.46		0.11		0.39		0.09		0.47		0.13	
PCB 118	0.38		0.09		0.34		0.12		0.42		0.08		0.42		0.07		0.51		0.11	
PCB 138/163	0.32		0.08		0.29		0.1		0.32		0.08		0.37		0.06		0.41		0.1	
PCB 149	0.22		0.08		0.2		0.08		0.24		0.06		0.25		0.04		0.28		0.07	
PCB 180	0.13		0.03		0.12				0.12				0.18		0.02		0.18		0.03	
Total Suspended PCBs (by congener sum) =	**8.39**				**7.27**				**8.36**				**8.41**				**9.46**			
Total Congeners Analyzed (Susp) =	**8**				**8**				**8**				**8**				**8**			
Total Congeners Detected (Susp) =	**8**				**8**				**8**				**8**				**8**			
Reported TPCBs (Susp) =	**26.33**				**22.56**				**27.83**				**27.11**				**32**			
Total Dissolved PCBs (by congener sum) =			**3.94**				**4.53**				**2.90**				**1.96**				**3.59**	
Total Congeners Analyzed (Diss) =			**8**				**7**				**7**				**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**7**				**7**				**8**				**8**	
Reported TPCBs (Diss) =			**15.78**				**17.91**				**11.48**				**8.38**				**14.61**	

NOTE: No replicates samples were reported for this dat

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	OA004474P		OA004476F		OA004476P		OA004478F		OA004478P		OB000379F		OB000379P		OB000380F		OB000380P		OB000383F	
Sample Date	10/17/89		11/1/89		11/1/89		10/31/89		10/31/89		11/15/89		11/15/89		11/15/89		11/15/89		12/6/89	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	5.3		1.6		5.5		1.7		4.7		0.45		0.97		0.41		0.72		0.26	
PCB 056/060	0.8		0.15		0.95		0.16		0.85		0.07		0.14		0.07		0.16		0.07	
PCB 077/110	0.92		0.2		0.95		0.21		1		0.1		0.21		0.12		0.2		0.11	
PCB 101	0.44		0.11		0.44		0.11		0.45		0.06		0.1		0.07		0.1		0.07	
PCB 118	0.48		0.08		0.2		0.09		0.51		0.04		0.11		0.05		0.04		0.5	
PCB 138/163	0.35		0.08		0.4		0.09		0.4		0.04		0.12		0.05		0.1		0.05	
PCB 149	0.26		0.06		0.51		0.06		0.26		0.04		0.08		0.04		0.11		0.04	
PCB 180	0.14		0.03		0.18		0.04		0.17		0.01		0.05		0.02		0.05		0.02	
Total Suspended PCBs (by congener sum) =	**8.69**				**9.13**				**8.34**				**1.78**				**1.48**			
Total Congeners Analyzed (Susp) =	**8**				**8**				**8**				**8**				**8**			
Total Congeners Detected (Susp) =	**8**				**8**				**8**				**8**				**8**			
Reported TPCBs (Susp) =	**28.49**				**31.39**				**27.16**				**5.2**				**4.85**			
Total Dissolved PCBs (by congener sum) =			**2.31**				**2.46**				**0.81**				**0.83**				**1.12**	
Total Congeners Analyzed (Diss) =			**8**				**8**				**8**				**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**8**				**8**				**8**				**8**	
Reported TPCBs (Diss) =			**8.78**				**9.59**				**2.69**				**2.82**				**1.96**	

NOTE: No replicates samples were reported for this dat

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	OB000383P		OB000385F		OB000385P		OB000387F		OB000387P		OB001106F		OB001106P		OB001108F		OB001108P		OB001112F	
Sample Date	12/6/89		12/6/89		12/6/89		12/5/89		12/5/89		1/18/90		1/18/90		1/18/90		1/18/90		2/13/90	
Fraction	Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.19		0.42		0.22		0.25		0.14		0.36		0 03		0.5		0.18		0.46	
PCB 056/060	0.05		0.1		0.07		0.07		0.05		0.07				0.08		0.05		0.06	
PCB 077/110	0.07		0.12		0.09		0.13		0.12		0.12		0.05		0.13		0.09		0.09	
PCB 101	0.04		0.08		0.05		0.07		0.06		0.07		0.03		0.07		0.05		0.06	
PCB 118			0.05				0.06		0.06		0.06				0.06		0.03		0.03	
PCB 138/163	0.04		0.05		0.05		0.07		0.07		0.06		0.03		0.06		0.05		0.04	
PCB 149	0.04		0.04		0.05		0.07		0.04		0.07		0.02		0.06		0.03		0.04	
PCB 180	0.02		0.02		0.02		0.05		0.03		0.03				0.03		0.02		0.02	
Total Suspended PCBs (by congener sum) =	**0.45**				**0.55**				**0.57**				**0.16**				**0.50**			
Total Congeners Analyzed (Susp) =	**7**				**7**				**8**				**5**				**8**			
Total Congeners Detected (Susp) =	**7**				**7**				**8**				**5**				**8**			
Reported TPCBs (Susp) =					**0.55**				**1.05**				**0.22**				**0.5**			
Total Dissolved PCBs (by congener sum) =			**0.88**				**0.77**				**0.84**				**0.99**				**0.80**	
Total Congeners Analyzed (Diss) =			**8**				**8**				**8**				**8**				**8**	
Total Congeners Detected (Diss) =			**8**				**8**				**8**				**8**				**8**	
Reported TPCBs (Diss) =			**2.81**				**2.35**				**2.45**				**0.78**				**2.71**	

NOTE: No replicates samples were reported for this dat

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
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Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	OB001112P		OB001114P		OB002900F		OB002900P		OB002901F		OB002901P		OB002902F		OB002902P		OB002904F		OB002904P	
Sample Date	2/13/90		2/14/90		3/13/90		3/13/90		3/19/90		3/19/90		3/23/90		3/23/90		4/2/90		4/2/90	
Fraction	Suspended		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.25		0.45		1.2		2		0.42		0.49		0.44		0.36		0.52		0.86	
PCB 056/060	0.04		0.05		0.11		0.32		0.08		0.09		0.06		0.06		0.07		0.14	
PCB 077/110	0.07		0.07		0.19		0.57		0.12		0.13		0.09		0.1		0.11		0.22	
PCB 101	0.04		0.05		0.11		0.26		0.07		0.07		0.06		0.06		0.07		0.11	
PCB 118	0.03		0.03		0.07		0.27		0.05		0.05		0.03		0.05		0.04		0.09	
PCB 138/163	0.04		0.04		0.08		0.32		0.06		0.06		0.04		0.06		0.05		0.09	
PCB 149	0.03		0.03		0.06		0.2		0.04		0.05		0.03		0.04		0.04		0.07	
PCB 180	0.03		0.01		0.03		0.12		0.03		0.03		0.02		0.02		0.02		0.04	
Total Suspended PCBs (by congener sum) =	**0.53**		**0.73**				**4.06**				**0.97**				**0.75**				**1.62**	
Total Congeners Analyzed (Susp) =	**8**		**8**				**8**				**8**				**8**				**8**	
Total Congeners Detected (Susp) =	**8**		**8**				**8**				**8**				**8**				**8**	
Reported TPCBs (Susp) =	**0.81**		**2.48**				**13.3**				**2.82**				**1.95**				**4.92**	
Total Dissolved PCBs (by congener sum) =					**1.85**				**0.87**				**0.77**				**0.92**			
Total Congeners Analyzed (Diss) =					**8**				**8**				**8**				**8**			
Total Congeners Detected (Diss) =					**8**				**8**				**8**				**8**			
Reported TPCBs (Diss) =					**7.63**				**2.93**				**2.6**				**3.02**			

NOTE: No replicates samples were reported for this dat

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-5. Lower Fox River Historic Water Column Congener Data For OU2 (Suspended and Dissolved)

Sample Name	OB002905F		OB002905P		OB004144F		OB004144P		OB004146F		OB004146P		OB004148F		OB004148P	
Sample Date	4/18/90		4/18/90		3/13/90		3/13/90		4/2/90		4/2/90		4/18/90		4/18/90	
Fraction	Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended		Dissolved		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 028/031	0.65		1.9		0.65		1.6		0.49		0.62		0.76		1.6	
PCB 056/060	0.06		0.3		0.1		0.36		0.09		0.11		0.1		0.44	
PCB 077/110	0.09		0.4		0.12		0.45		0.1		0.16		0.12		0.54	
PCB 101	0.06		0.21		0.07		0.21		0.06		0.08		0.07		0.26	
PCB 118	0.04		0.15		0.15						0.06				0.21	
PCB 138/163	0.04		0.15				0.18				0.07				0.24	
PCB 149	0.03		0.11				0.1				0.05				0.15	
PCB 180	0.02		0.07				0.09								0.1	
Total Suspended PCBs (by congener sum) =			**3.29**				**2.99**				**1.15**				**3.54**	
Total Congeners Analyzed (Susp) =			**8**				**7**				**7**				**8**	
Total Congeners Detected (Susp) =			**8**				**7**				**7**				**8**	
Reported TPCBs (Susp) =			**10.81**				**10.14**				**3.67**				**12.66**	
Total Dissolved PCBs (by congener sum) =	**0.99**				**1.09**				**0.74**				**1.05**			
Total Congeners Analyzed (Diss) =	**8**				**5**				**4**				**4**			
Total Congeners Detected (Diss) =	**8**				**5**				**4**				**4**			
Reported TPCBs (Diss) =	**3.73**				**4.31**				**3.4**				**5.17**			

NOTE: No replicates samples were reported for this dat

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI01		89GH6FI02		89GH6FI03		89GH6FI04		89GH6FI05		89GH6FI06		89GH6FI07		89GH6FI08		89GH6FI09		89GH6FI10		89GH6FI11		89GH6FI12		89GH6FI13		89GH6FI14		89GH6FI15		89GH6FI16		89GH6FI17	
Sample Date	1/19/89		4/13/89		4/19/89		4/19/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/13/89		6/21/89		6/28/89		7/5/89		7/12/89		7/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congeners (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0.0019		0.0544		0.0687		0	U	0.1654		12.5119		0.0038		0.0084		0.0149		0.0023		0	U	0	U	0.1524		0	U	0.1305		0	U	1.844	
PCB 003	0.3782		0.3387		0.2165		0.2435		0.0258		0.0286		0.0089		0	U	0.014		0.0184		0	U	0	U	0	U	0	U	0.0134		0	U	0	U
PCB 004																																		
PCB 004/010	0.0488		0.0366		0.0328		0.0486		0.0484		0.0925		0.1365		0.0629		0.048		0.0776		0.0521		0.068		0.0774		0.0752		0.0395		0.0301		0.0484	
PCB 005																																		
PCB 005/008	0.1825		0.5226		1.0442		1.6058		1.2479		3.0315		2.7818		1.8296		0.8542		2.9331		1.752		1.6914		1.9085		2.6054		0.7846		1.0514		1.4798	
PCB 006	0.0063		0.0393		0.189		0.1895		0.1208		0.2752		0.3662		0.1507		0.0926		0.4487		0.2415		0.2322		0.2287		0.2566		0.1863		0.1514		0.2008	
PCB 007	0.0057		0.0375		0.0145		0.032		0.0323		0.0392		0.0408		0.0241		0.0129		0.0345		0.0245		0.0241		0.0259		0.0392		0.0141		0.0116		0.0306	
PCB 008																																		
PCB 012/013	0.0112		0	U	0	U	0	U	0	U	0	U	0.0327		0	U	0.0162		0.0191		0	U	0	U	0	U	0	U	0.0045		0	U	0	U
PCB 016/032	0	U	0.3135		0.9462		1.4588		1.6136		3.3365		2.5239		1.6961		0.9005		1.5685		1.4505		1.4414		1.546		1.9128		0.6619		0.9401		1.047	
PCB 017	0.1769		0.1761		0.7944		1.2171		1.0796		2.2405		1.6302		1.1868		0.7447		0.91		0.9254		0.9854		1.2205		1.791		0.6878		0.609		0.828	
PCB 018	0.064		0.2124		0.9148		1.3803		1.6685		3.0532		3.416		1.9715		1.1485		1.401		1.3843		1.3705		1.7424		1.9213		0.9556		0.8957		1.1925	
PCB 019	0.0497		0.0157		0.0449		0.0666		0.0706		0.1565		0.1199		0.0837		0.0563		0.0686		0.0533		0.0651		0.0765		0.1017		0.0489		0.0476		0.0755	
PCB 021	0.0369		0.0143		0.0237		0.0197		0.0125		0	U	0	U	0.0107		0.0053		0.005		0.03		0.0295		0.0423		0.0086		0.0498		0	U	0.0263	
PCB 022	0	U	0.1752		0.8655		1.3599		1.5821		3.2996		2.8096		1.9514		1.0286		1.9553		2.2836		1.8204		2.3052		2.4599		1.1024		1.1743		1.2032	
PCB 024																																		
PCB 024/027	0	U	0.0286		0.1009		0.1588		0.1661		0.2514		0.2017		0.1455		0.0954		0.1286		0.1617		0.1603		0.1987		0.2496		0.1091		0.1255		0.1509	
PCB 025	0.043		0.0729		0.4925		0.4185		0.5301		0.9354		0.9461		0.5812		0.4392		0.6463		0.6715		0.5296		0.7342		0.625		0.3942		0.4062		0.4491	
PCB 026	0.2934		0.1257		0.8042		0.7043		0.948		1.4483		1.2957		1.6306		0.8404		0.9318		1.1035		0.878		1.0796		0.9861		0.6406		0.5678		0.6986	
PCB 027																																		
PCB 028																																		
PCB 028/031	0.189		1.0096		4.4806		6.8263		7.4873		11.762		10.2041		8.9244		4.7898		9.5259		11.2868		9.5634		8.717		9.1155		5.2082		4.7604		6.0079	
PCB 029	0	U	0	U	0.0465		0.0688		0.0429		0.0464		0.0512		0.0225		0.0082		0.0162		0.0538		0.0482		0.0603		0.0936		0.032		0.0534		0.0432	
PCB 031																																		
PCB 033	0.2824		0.2407		1.0801		1.8072		1.71		4.7492		3.1171		2.3728		1.3298		1.547		2.6279		1.9804		2.4211		3.257		1.1721		1.2808		1.4283	
PCB 037/042	0.2356		0.1382		0.6433		0.9218		1.2529		1.9481		1.6248		1.2256		0.6868		0.9549		1.3281		1.0573		1.3944		1.6916		0.826		0.9555		1.1464	
PCB 040	0.0034		0.047		0.2983		0.3938		0.5631		0.8354		0.6832		0.5373		0.3206		0.3985		0.5521		0.4847		0.6539		0.5778		0.4153		0.4365		0.4132	
PCB 041/064/071	0.0488		0.2206		1.1568		1.6123		2.4437		0	U	3.1016		2.4072		1.3167		1.8448		2.39		1.9985		2.6356		2.4576		1.6213		1.4148		1.7787	
PCB 043	0.0352		0.0105		0.1091		0.1291		0.0834		0.4457		0.3705		0.2789		0.1719		0.2033		0.214		0.2325		0.2645		0.1605		0	U	0.1156		0.2377	
PCB 044	0.1182		0.251		1.2029		1.7662		2.1912		4.1293		3.0978		2.4889		1.3704		1.6674		2.2498		1.8754		2.5128		2.9284		1.56		1.4776		1.801	
PCB 045	0.0258		0.0481		0.1879		0.2777		0.4706		0.7082		0.5263		0.4508		0.2691		0.302		0.351		0.322		0.4025		0.4971		0.2551		0.3099		0.3631	
PCB 046	0.0278		0.0233		0.1524		0.1661		0.2624		0.4032		0.2952		0.2431		0.1429		0.1674		0.1736		0.1497		0.1993		0.2619		0.1293		0.1166		0.2094	
PCB 047																																		
PCB 048																																		
PCB 047/048	0.0429		0.182		0.916		1.1381		1.6756		3.5833		2.6125		1.8402		1.0939		1.3361		1.4952		1.4703		1.664		1.802		1.2227		0.9923		1.337	
PCB 049	0.0537		0.2041		1.155		1.482		0.8995		2.7957		2.2425		2.3931		1.305		1.6371		2.0263		1.8888		2.3487		1.7992		1.6617		1.1306		1.5144	
PCB 051	0.0125		0.0196		0.0555		0.0716		0.088		0.1536		0.1375		0.1134		0.0676		0.0801		0.0657		0.065		0.0781		0.0911		0.0398		0.0492		0.0528	
PCB 052	0.1066		0.2797		1.1728		1.4678		1.8377		2.912		2.3707		2.2325		1.2704		1.6375		1.6412		1.4006		1.8204		1.9395		1.2017		0.9903		1.5321	
PCB 053	0	U	0.0473		0.2006		0.2941		0.3794		0.8115		0.6197		0.4312		0.2106		0.4229		0.1448		0.23		0.3039		0.4713		0.1994		0.1852		0.2321	
PCB 056																																		
PCB 059																																		
PCB 060/092																																		
PCB 056/060	0.0529		0.1839		0.894		1.2845		1.7121		2.4361		2.3204		1.5061		0.8627		1.492		2.204		1.7296		2.393		1.9977		1.1495		1.2875		1.5304	
PCB 063	0.002		0.0368		0.1553		0.1966		0.2084		0.3832		0.3515		0.2277		0.1698		0.3051		0.2341		0.1879		0.2213		0.2083		0.2089		0.1018		0.1043	
PCB 064/041																																		
PCB 066/095	0	U	0.3309		1.7132		2.2619		3.3312		5.8419		4.8769		3.0413		1.7128		2.8242		5.8965		4.6593		6.0098		4.102		3.3899		3.1268		3.7293	
PCB 070																																		
PCB 070/076	0	U	0.2808		1.5491		1.9591		2.6243		4.1274		3.368		2.572		1.2925		1.9829		5.2764		3.6057		5.149		3.667		2.4648		2.2722		2.7551	

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI01		89GH6FI02		89GH6FI03		89GH6FI04		89GH6FI05		89GH6FI06		89GH6FI07		89GH6FI08		89GH6FI09		89GH6FI10		89GH6FI11		89GH6FI12		89GH6FI13		89GH6FI14		89GH6FI15		89GH6FI16		89GH6FI17	
Sample Date	1/19/89		4/13/89		4/19/89		4/19/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/13/89		6/21/89		6/28/89		7/5/89		7/12/89		7/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 071																																		
PCB 074	0.07		0.1138		0.6183		0.897		0.9057		1.5279		1.3919		0.9373		0.5259		0.8806		1.2559		1.0112		1.244		1.168		0.6691		0.7886		0.8722	
PCB 076																																		
PCB 077/110	0.071		0.1381		0.5916		0.8217		0.9647		1.2447		1.3631		0.8032		0.5434		0.9299		1.5858		1.3119		1.427		1.0115		0.8039		0.8443		0.9944	
PCB 081	0	U	0.0037		0.0093		0.0106		0.0153		0.0177		0.0209		0.012		0.0108		0.0194		0.0388		0.0282		0.0351		0.0191		0.0216		0.013		0.0157	
PCB 082	0.0216		0.0202		0.0938		0.1024		0.1515		0.2833		0.197		0.1788		0.113		0.1502		0.1144		0.1272		0.1133		0.2278		0.0884		0.0991		0.115	
PCB 083	0	U	0.0097		0.0366		0.0451		0.0799		0.1182		0.105		0.0741		0.0416		0.0681		0.1414		0.105		0.1125		0.0684		0.0589		0.0503		0.0426	
PCB 084																																		
PCB 084/092	0.0272		0.0665		0.3032		0.3879		0.5809		0.957		0.877		0.587		0.3625		0.5258		0.753		0.6348		0.8477		0.6115		0.4462		0.3762		0.4774	
PCB 085	0.0183		0.0242		0.1091		0.1488		0.1981		0.2623		0.2428		0.1742		0.1028		0.1691		0.2446		0.2027		0.2367		0.2036		0.1494		0.1569		0.1778	
PCB 087	0.0256		0.0461		0.1626		0.2131		0.2916		0.3951		0.3877		0.2617		0.1609		0.2657		0.3807		0.3436		0.3697		0.3096		0.2288		0.2224		0.2584	
PCB 087/081																																		
PCB 089	0.011		0.0005		0.0147		0.0219		0.0301		0.0312		0.0323		0.0221		0.0139		0.0166		0.0366		0.0292		0.0722		0.0241		0.0196		0.0129		0.0587	
PCB 091	0	U	0.0064		0.0783		0.2073		0.2413		0.3964		0.3108		0.1779		0.1489		0.17		0.2091		0.2988		0.5565		0.1231		0.3339		0.1871		0.0909	
PCB 097	0.0467		0.0375		0.1673		0.2218		0.2691		0.4056		0.3813		0.2552		0.1542		0.2595		0.4036		0.3348		0.3835		0.3046		0.2288		0.2093		0.2645	
PCB 099	0.0256		0.0523		0.2205		0.2933		0.3802		0.5352		0.4552		0.3418		0.2099		0.3382		0.5853		0.4697		0.5147		0.3838		0.3195		0.2964		0.3362	
PCB 100	0.0522		0.0054		0.0689		0.0956		0.1608		0.2156		0.1939		0.1359		0.0767		0.1081		0.2192		0.1806		0.1652		0.1435		0.1444		0.0885		0.0724	
PCB 101	0.0537		0.0966		0.3699		0.4562		0.6021		0.9002		0.7905		0.5599		0.3391		0.5422		0.9708		0.8108		0.9085		0.638		0.55		0.5016		0.5839	
PCB 101/090																																		
PCB 105																																		
PCB 105/132/153	0.0616		0.1386		0.5491		0.6457		0.8458		1.7491		1.2575		0.9916		0.6534		1.1234		0.9849		0.993		1.028		1.2755		0.7803		0.6433		0.8112	
PCB 107	0.0136		0.0094		0.0647		0.0496		0.1013		0.1021		0.0828		0.0706		0.0516		0.0717		0.0781		0.0782		0.073		0.0998		0.0613		0.0705		0.0643	
PCB 114																																		
PCB 114/134	0	U	0	U	0.1209		0	U	0.0648		0.2446		0.1323		0.4923		0.2354		0.151		0.1234		0.0957		0.1025		0.3392		0.0579		0	U	0.1896	
PCB 118	0.0203		0.0641		0.3086		0.3584		0.5133		0.9654		0.7066		0.5638		0.3584		0.6007		0.5559		0.575		0.4888		0.8592		0.3936		0.4442		0.5215	
PCB 119	0.0043		0.011		0.0487		0.059		0.0687		0.0681		0.067		0.0499		0.0374		0.0576		0.1061		0.0758		0.0872		0.055		0.0598		0.0833		0.0733	
PCB 124/135/144/147	0.0174		0.0216		0.072		0.0637		0.0885		0.1815		0.1247		0.112		0.0699		0.1056		0.089		0.102		0.0839		0.1078		0.0713		0.0726		0.0775	
PCB 128	0.006		0.0158		0.0527		0.0604		0.1064		0.1663		0.1388		0.1		0.0624		0.1229		0.1253		0.1437		0.1031		0.1365		0.0757		0.0583		0.0857	
PCB 129/178	0.0091		0.0089		0.0318		0.0382		0.0444		0.0919		0.0704		0.0529		0.0363		0.0656		0.0461		0.0457		0.0408		0.0692		0.0333		0.039		0.0454	
PCB 130	0.0081		0.0061		0.0398		0.0524		0.0544		0.2061		0.1601		0.1208		0.0784		0.1443		0.0702		0.0735		0.0589		0.2131		0.0506		0.0423		0.1359	
PCB 131	0.0001		0.0381		0.0247		0.1166		0.0155		0.0423		0.0149		0.1754		0.0599		0.0284		0.0152		0.0049		0.011		0.0965		0.0031		0.0538		0.0271	
PCB 132/168																																		
PCB 135/144																																		
PCB 136	0	U	0	U	0	U	0.0409		0.0423		0	U	0	U	0	U	0	U	0	U	0.2951		0.1679		0.3181		0	U	0.1403		0	U	0.1406	
PCB 137																																		
PCB 137/176	0.0189		0.0042		0.0145		0.0178		0.0133		0.0384		0.0252		0.0195		0.0126		0.0246		0.0251		0.0261		0.0219		0.0446		0.0153		0.0016		0.024	
PCB 138/158/163	0.0715		0.1154		0.4488		0.4592		0.5492		1.0266		0.7695		0.6198		0.6886		0.7342		0.5814		0.6732		0.5205		0.837		0.3915		0.4618		0.6015	
PCB 138/163																																		
PCB 141	0.0212		0	U	0	U	0	U	0.1143		0.1605		0	U	0	U	0	U	0	U	0.0831		0	U	0.0729		0.1142		0.0555		0.0567		0.073	
PCB 146	0.0226		0.0787		0.3503		0.789		0.3777		1.0121		0.5206		0.6969		0.3309		0.4309		0.3661		0.3659		0.3395		0.6569		0.2377		0.5777		0.4146	
PCB 149	0.0273		0.0642		0.2198		0.2327		0.3065		0.6762		0.4656		0.3882		0.2516		0.3984		0.3212		0.3523		0.2741		0.4384		0.2422		0.2282		0.2731	
PCB 149/123																																		
PCB 151	0.0237		0.0323		0.1016		0.096		0.1229		0.239		0.1652		0.1486		0.0954		0.1413		0.1093		0.1175		0.101		0.1521		0.0759		0.0814		0.0929	
PCB 153/184																																		
PCB 156/171																																		
PCB 156/171/202	0.0034		0.0123		0.0528		0.0666		0.1044		0.1505		0.1428		0.0964		0.0732		0.1342		0.12		0.1247		0.0965		0.1277		0.0986		0.0799		0.0769	
PCB 157/200	0	U	0	U	0.0128		0.0172		0.033		0.0384		0.0253		0.0214		0.0139		0.0282		0	U	0	U	0.0189		0.0265		0.0152		0	U	0	U
PCB 157																																		
PCB 158																																		

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI01		89GH6FI02		89GH6FI03		89GH6FI04		89GH6FI05		89GH6FI06		89GH6FI07		89GH6FI08		89GH6FI09		89GH6FI10		89GH6FI11		89GH6FI12		89GH6FI13		89GH6FI14		89GH6FI15		89GH6FI16		89GH6FI17	
Sample Date	1/19/89		4/13/89		4/19/89		4/19/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/13/89		6/21/89		6/28/89		7/5/89		7/12/89		7/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 167	0 001		0 0035		0 0121		0 0189		0 0284		0 0518		0 0416		0 0285		0 0123		0 03		0 0425		0 0466		0 0361		0 0384		0 0223		0 0175		0 0306	
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																				
PCB 172																																				
PCB 170/190	0 0475		0 0704		0 326		0 6526		0 187		0 5599		0 2999		0 8745		0	U	0 4296		0 26		0 2204		0 1992		0 3549		0 065		0 2135		0 2419	
PCB 172/197	0 0089		0 0026		0 0178		0 0389		0 0287		0 0568		0 0489		0 0225		0 0171		0 0403		0 0377		0 0393		0 0362		0 0383		0 023		0 0228		0 0328	
PCB 173	0	U	0	U	0 0009		0 0011		0 0015		0 002		0 0017		0 0012		0 0012		0 0017		0	U	0	U	0	U	0 0015		0 0059		0 0023		0	U
PCB 174	0 0065		0 0152		0 0692		0 086		0 101		0 2039		0 1705		0 1218		0 0773		0 1543		0 1258		0 1272		0 1114		0 1575		0 111		0 0995		0 1172	
PCB 175	0 0019		0	U	0 0029		0 0036		0	U	0 0123		0 0065		0 0057		0 007		0	U	0 0005		0 0012		0	U	0 0063		0 0075		0	U	0	U
PCB 176																																				
PCB 177	0 0046		0 0118		0 0517		0 0586		0 0353		0 1351		0 1159		0 0772		0 0495		0 1108		0 0954		0 0944		0 0757		0 1121		0 0769		0 0847		0 07	
PCB 178/126																																				
PCB 180	0 0175		0 0395		0 173		0 2164		0 236		0 4229		0 3673		0 2464		0 1692		0 3526		0 3633		0 344		0 3656		0 351		0 249		0 1648		0 2669	
PCB 182/187	0 0136		0 0279		0 1205		0 1348		0 1592		0 3059		0 2421		0 1852		0 1224		0 2262		0 1826		0 1826		0 1635		0 2275		0 1173		0 1275		0 147	
PCB 183	0 0032		0 0113		0 057		0 073		0 0857		0 1619		0 1231		0 0979		0 0606		0 1128		0 0963		0 1008		0 0877		0 1159		0 065		0 084		0 0811	
PCB 185	0	U	0 003		0 0262		0 0135		0 0238		0 0315		0 0303		0 0217		0 0408		0 0312		0 0172		0 0181		0 0146		0 0397		0 0097		0 0136		0 0158	
PCB 189	0 0007		0 0003		0 0045		0 0084		0 0106		0 013		0 0095		0 0034		0 0037		0 0088		0 007		0 007		0 006		0 0115		0 0093		0 0052		0 0087	
PCB 190																																				
PCB 191	0 0002		0	U	0	U	0 0069		0 0189		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0 0012		0 0042		0 0101		0 0131		0 0252		0 0328		0 026		0 0227		0 0166		0 0245		0 0423		0 0379		0 0522		0 022		0 0465		0 0325		0 0126	
PCB 194	0 0071		0 0063		0 0419		0 0592		0 0522		0 0893		0 0899		0 0512		0 0312		0 0894		0 0992		0 0791		0 0962		0 0796		0 0427		0 0517		0 0728	
PCB 195																																				
PCB 195/208	0 0037		0 0148		0 0868		0 1006		0 1133		0 1797		0 1767		0 11		0 0719		0 1968		0 1588		0 1598		0 1325		0 1814		0 0788		0 1116		0 1303	
PCB 196/203	0 0056		0 0175		0 1039		0 1293		0 1373		0 2409		0 2293		0 1422		0 0962		0 2249		0 2099		0 2054		0 2136		0 2198		0 1124		0 1443		0 1435	
PCB 197																																				
PCB 198	0 0115		0	U	0	U	0	U	0 0057		0 0493		0 0099		0 1205		0 043		0 0267		0 0303		0 0041		0 0036		0	U	0 0117		0	U	0 0112	
PCB 199	0 0047		0	U	0 0076		0 0128		0 0158		0 0301		0 0203		0 0109		0 0075		0 0175		0 0214		0 0187		0 0198		0 0144		0 0202		0 0088		0 0221	
PCB 201	0 0076		0 0183		0 1273		0 3238		0 1215		0 2383		0 2071		0 1742		0 1051		0 21		0 1851		0 1695		0 1484		0 2023		0 0914		0 2565		0 1286	
PCB 202																																				
PCB 203/196																																				
PCB 205	0 0061		0 0042		0 0131		0 0349		0 0252		0 0426		0 0348		0 0165		0 0034		0 0303		0 0806		0 024		0 0293		0 0322		0 0257		0	U	0 0177	
PCB 206	0 0058		0 0096		0 0755		0 0803		0 084		0 1257		0 1427		0 0693		0 0575		0 1465		0 1393		0 1605		0 1331		0 1419		0 0658		0 0665		0 1022	
PCB 207	0	U	0 0015		0 0051		0 0085		0 0108		0 012		0 0148		0 0068		0 0083		0 0169		0	U	0	U	0	U	0 0106		0	U	0 0152		0 0189	
PCB 208																																				
PCB 209	0 002		0 0065		0 0779		0 2394		0 1676		0 105		0 1145		0 0714		0 0525		0 111		0 0873		0 0865		0 0737		0 1262		0 0372		0 05		0 06	
Total Suspended PCBs (by congener sum) =	3.46		7.23		30.49		42.43		48.69		96.32		72.43		56.37		31.69		50.89		63.66		54.29		63.42		63.52		36.80		35.48		45.31	
Total Congeners Analyzed (Susp) =	93		93		93		93		93		93		93		93		93		93		93		93		93		93		93		93		93	
Total Congeners Detected (Susp) =	76		81		87		87		90		87		88		87		88		88		85		84		86		86		89		81		86	
Reported TPCBs (Susp) =																																				

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI18		89GH6FI19		89GH6FI20		89GH6FI21		89GH6FI22		89GH6FI23		89GH6FI24		89GH6FI25		89GH6FI26		89GH6FI27		89GH6FI28		89GH6FI29		89GH6FI30		89GH6FI31		89GH6FI32		89GH6FI33		89GH6FI34	
Sample Date	7/25/89		7/31/89		8/9/89		8/14/89		8/23/89		8/29/89		9/6/89		9/13/89		9/20/89		9/27/89		10/4/89		10/12/89		10/18/89		10/24/89		10/31/89		11/7/89		11/14/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0216		0	U	0	U	0.0747		0.132		0.0587		0.0391		0.0267	
PCB 003	0.0287		0	U	0	U	0	U	0.0072		0	U	0	U	0	U	0	U	0.0059		0.271		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 004																																			
PCB 004/010	0.0383		0.0438		0.053		0.0578		0.046		0.0438		0.0289		0.0419		0.04		0.0195		0	U	0	U	0.0497		0.0471		0.0569		0.0294		0.017	
PCB 005																																			
PCB 005/008	0.8259		1.3373		1.5391		1.5721		1.4716		1.0544		0.8134		1.2488		0.9397		0.5432		0.8816		0.7791		0	U	0	U	0	U	0	U	0	U
PCB 006	0.1341		0.2327		0.2939		0.2808		0.2524		0.172		0.086		0.1662		0.1472		0.062		0.2088		0.0788		0.1821		0.1514		0.2394		0.1313		0.0952	
PCB 007	0.0127		0.018		0.0227		0.0208		0.0186		0.0161		0.0127		0.0475		0.0159		0.0076		0.0947		0.0334		0.0209		0.0145		0.0235		0.013		0.0077	
PCB 008																																			
PCB 012/013	0.0063		0.0044		0	U	0.0262		0.0149		0.0099		0.007		0.0128		0.0088		0.0039		0.0049		0.0085		0.0092		0.0088		0.0066		0.0083		0.0035	
PCB 016/032	0.9822		1.5577		1.5862		1.6912		1.0119		0.8473		0.6396		0.9044		0.9686		0.4301		0.5997		0.6341		1.0891		0.8058		1.3102		0.5277		0.3057	
PCB 017	0.7617		1.1459		1.4015		1.5868		1.089		0.9016		0.6224		0.7581		0.704		0.439		0.5734		0.6154		0.9455		0.7639		0.9891		0.4191		0.1943	
PCB 018	1.1149		1.6467		1.8711		2.4472		1.3689		1.2696		0.9379		1.1112		1.0024		0.6472		0.8535		0.9126		1.2355		0.7724		1.2616		0.5195		0.264	
PCB 019	0.0546		0.0669		0.1065		0.1133		0.0678		0.0536		0.0419		0.0591		0.0521		0.0289		0.0251		0.0456		0.0634		0.0515		0.0691		0.0305		0.0125	
PCB 021	0	U	0.0319		0.0434		0.027		0.0237		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0162		0.0138		0	U	0	U	0	U
PCB 022	1.1984		1.8553		2.0515		2.1253		1.504		1.2095		0.9486		1.2735		0.9706		0.6443		0.8947		0.8894		1.3699		0.9079		1.5031		0.8021		0.2784	
PCB 024																																			
PCB 024/027	0.1276		0.1947		0.2445		0.2785		0.1518		0.1212		0.1008		0.1089		0.0974		0.0665		0.0873		0.097		0.1539		0.1174		0.159		0.0598		0.0352	
PCB 025	0.6887		0.6504		0.7801		0.7654		0.6552		0.7089		0.5065		0.5599		0.4687		0.2758		0.3748		0.393		0.5545		0.5072		0.5219		0.3476		0.1418	
PCB 026	1.0208		0.8803		1.0967		1.0915		1.0577		0.6687		0.7385		0.8463		0.7773		0.4813		0.6124		0.637		1.061		0.7672		0.9952		0.4414		0.2136	
PCB 027																																			
PCB 028																																			
PCB 028/031	5.8803		7.1028		8.1534		8.1446		7.7041		6.7075		4.5824		5.6209		4.9225		3.2804		4.49		4.3833		7.0141		4.6332		7.5208		3.3025		1.5937	
PCB 029	0.066		0.0422		0.0474		0.0416		0.093		0.0397		0.0328		0.0411		0.0402		0.0174		0.0286		0.0379		0	U	0	U	0.0798		0	U	0.0253	
PCB 031																																			
PCB 033	1.3254		2.2026		2.3026		2.5705		1.745		1.3278		0.9461		1.2851		1.1059		0.6426		0.9014		0.8782		1.4908		0.8957		1.9453		0.7674		0.342	
PCB 037/042	0.9038		1.2246		1.4268		1.5227		1.2321		1.0097		0.7497		0.8878		0.8056		0.5818		0.8083		0.8401		1.0284		0.7158		0.9866		0.5463		0.1956	
PCB 040	0.431		0.6107		0.6768		0.7252		0.4638		0.3868		0.2965		0.3553		0.313		0.2408		0.3433		0.3589		0.4498		0.2666		0.3849		0.2005		0.0922	
PCB 041/064/071	1.8236		2.3705		2.8582		3.1084		2.0261		1.593		1.234		1.4802		1.2964		0.9635		1.2805		1.3571		1.6965		1.0969		1.571		0.7688		0.3948	
PCB 043	0.164		0.1919		0.2023		0.1837		0.1341		0.1269		0.0991		0.0858		0.1217		0.073		0.1118		0.1062		0.1242		0.1024		0.1227		0.1003		0.0579	
PCB 044	1.6773		2.4747		2.7964		3.4126		2.1452		1.8601		1.3644		1.5741		1.4532		1.0681		1.4829		1.5221		1.8911		1.1436		1.6348		0.8273		0.3727	
PCB 045	0.3072		0.3962		0.3744		0.4872		0.3387		0.3269		0.2368		0.2653		0.255		0.17		0.2489		0.2794		0.3168		0.2215		0.325		0.194		0.0636	
PCB 046	0.1368		0.1972		0.2157		0.2365		0.1834		0.1774		0.1264		0.1588		0.149		0.0992		0.1435		0.1653		0.2004		0.1368		0.1712		0.1077		0.0236	
PCB 047																																			
PCB 048																																			
PCB 047/048	1.3339		1.5304		1.8902		1.8736		1.4901		1.366		0.9837		1.1404		1.0371		0.7702		1.0486		1.0538		1.244		0.8558		1.1747		0.6004		0.3494	
PCB 049	1.8044		1.6982		2.022		2.0549		1.9037		2.0223		1.2621		1.4778		1.2973		0.9453		1.3508		1.3005		1.6334		1.0529		1.4882		0.71		0.384	
PCB 051	0.0554		0.0896		0.0926		0.1211		0.0593		0.0555		0.0504		0.0661		0.0646		0.02		0.0292		0.0477		0.0698		0.0625		0.0799		0.037		0.017	
PCB 052	1.2931		1.6336		2.6634		1.9739		1.884		1.9877		1.2813		1.4439		1.3363		0.9607		1.3822		1.3473		1.7055		0.9849		1.4453		0.6869		0.3177	
PCB 053	0.207		0.2671		0.3351		0.4615		0.3526		0.3279		0.2353		0.3114		0.2746		0.2087		0.2379		0.3016		0.2965		0.2065		0	U	0.1218		0.0654	
PCB 056																																			
PCB 059																																			
PCB 060/092																																			
PCB 056/060	1.2562		1.7087		1.9032		2.0735		1.5928		1.2239		0.92		1.1519		0.9625		0.7545		1.0267		1.0668		1.3478		0.7902		1.2936		0.6293		0.3305	
PCB 063	0.1791		0.2961		0.2815		0.2074		0.1796		0.1641		0.1226		0.1553		0.1322		0.1108		0.1328		0.1303		0.1285		0.0918		0.1362		0.1148		0.0205	
PCB 064/041																																			
PCB 066/095	2.409		5.0779		4.9741		5.3065		4.1615		3.0504		2.3759		2.5665		2.6696		1.8536		2.3044		2.5677		3.4116		2.1778		3.567		1.5557		1.6549	
PCB 070																																			
PCB 070/076	2.6048		3.4167		3.8424		4.394		3.6875		3.0697		2.2042		2.4497		2.6504		1.7892		2.1944		2.4314		3.1569		2.0123		2.9929		1.2587		0.5958	

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI18		89GH6FI19		89GH6FI20		89GH6FI21		89GH6FI22		89GH6FI23		89GH6FI24		89GH6FI25		89GH6FI26		89GH6FI27		89GH6FI28		89GH6FI29		89GH6FI30		89GH6FI31		89GH6FI32		89GH6FI33		89GH6FI34	
Sample Date	7/25/89		7/31/89		8/9/89		8/14/89		8/23/89		8/29/89		9/6/89		9/13/89		9/20/89		9/27/89		10/4/89		10/12/89		10/16/89		10/24/89		10/31/89		11/7/89		11/14/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 071																																		
PCB 074	0 7567		1.0312		1.1704		1.2509		0.9313		0 653		0.558		0.6706		0.5846		0.4504		0.594		0.6062		0.7396		0.4755		0.7457		0.369		0 179	
PCB 076																																		
PCB 077/110	0 9587		1.1743		1.3966		1.5595		1.1081		0.8686		0 6589		0 8157		0.6846		0.5955		0.7341		0.803		0.8741		0.597		0 7945		0.4531		0.257	
PCB 081	0.023		0.0228		0.0238		0.0232		0.0257		0 0159		0.0112		0.0233		0.0111		0.0139		0.0195		0.0155		0.0097		0.0089		0.0144		0.0034		0	U
PCB 082	0 0944		0 1269		0 13		0.1564		0.1439		0.1575		0.085		0.1148		0.1055		0.0642		0.1122		0.1055		0.1389		0.0732		0 1404		0.0568		0.0357	
PCB 083	0 0819		0 1014		0.1019		0 0871		0.0675		0.049		0 0385		0 0462		0.0401		0.038		0.0385		0.0521		0.0464		0.0309		0 0464		0.0137		0.0058	
PCB 084																																		
PCB 084/092	0.453		0.6005		0.6944		0.942		0.4879		0.4969		0 3685		0 4521		0.3918		0.3441		0.4445		0.4605		0.4123		0.3337		0.4227		0.2002		0.0744	
PCB 085	0.1618		0.2195		0.2586		0 2687		0 202		0.1551		0.1189		0.1428		0.1237		0.1033		0.1314		0.1465		0 1657		0.0924		0.1415		0.0716		0.0394	
PCB 087	0.2412		0.3132		0.3577		0 3856		0.2924		0.2363		0.1857		0.2204		0.1941		0.1564		0.1988		0.2128		0 2505		0.1446		0.2141		0.1202		0 0668	
PCB 087/081																																		
PCB 089	0 017		0 0276		0.0235		0.0583		0.0207		0 0153		0 0164		0.0131		0.0188		0.0312		0.0322		0 039		0.0194		0.03		0 0462		0.0332		0	U
PCB 091	0.2846		0.3766		0.2237		0.1999		0.1447		0 0846		0.1108		0.168		0.0623		0.0934		0.0804		0.0769		0.1218		0.0471		0.0751		0 029		0	U
PCB 097	0.2505		0.3332		0.3895		0.4377		0.3024		0 2288		0.1724		0.2054		0.1795		0.1447		0 1626		0.1958		0.2439		0.1498		0.2206		0.1291		0.0747	
PCB 099	0 3628		0 4858		0.5811		0.6464		0.389		0 3126		0.238		0.2731		0.2391		0.1896		0.253		0.2695		0.3072		0.2026		0 2905		0.1545		0.0837	
PCB 100	0 1403		0.2099		0.2576		0.1908		0.1088		0 1094		0 0652		0.0722		0.0674		0.0557		0.0776		0.0888		0.1095		0.0569		0 1076		0.0865		0.0151	
PCB 101	0.6095		0.8133		0.9508		1.1797		0 6831		0 5321		0.4053		0.5532		0.4148		0.3433		0.4443		0.4684		0.5535		0.3471		0.5047		0.2871		0 1595	
PCB 101/090																																		
PCB 105																																		
PCB 105/132/153	0.6444		0.8685		0.873		1.0618		1 0406		1 0082		0.6769		0.8447		0.685		0.527		0.7335		0.6975		0.9298		0.6588		0.9071		0.5051		0.2939	
PCB 107	0 0528		0.0913		0.0906		0.108		0.0985		0.081		0.0623		0.0784		0.0741		0.0535		0 0787		0.0677		0.0985		0.0747		0.1142		0.0596		0.0126	
PCB 114																																		
PCB 114/134	0.0933		0.0689		0.0804		0.1043		0 2251		0.1584		0.0606		0.1089		0.0752		0 0505		0 0778		0.0572		0.085		0 0559		0.0837		0.0456		0.0227	
PCB 118	0.3834		0.5098		0.497		0.5875		0 5656		0.6319		0.3987		0.5023		0.4237		0 3029		0.4452		0.4233		0.5154		0 3625		0.5465		0.2844		0.1504	
PCB 119	0.0647		0.0987		0 1231		0.1317		0.0523		0.0477		0.0386		0.0465		0.0413		0.0321		0.0419		0.0446		0.0408		0.0346		0.0427		0.0294		0.0184	
PCB 124/135/144/147	0.0715		0.0861		0.0885		0 1065		0 1017		0.0919		0.0595		0.0725		0 0734		0.043		0.0823		0.063		0.0824		0.0638		0.1053		0.0574		0.0178	
PCB 128	0.076		0.0811		0.086		0.0974		0 0967		0.1417		0.0683		0.1148		0 0814		0.0611		0.0852		0.0861		0.112		0.0656		0.1248		0.0515		0.0265	
PCB 129/178	0 0345		0.0476		0.0488		0.0558		0.0504		0.049		0 037		0 0489		0.0381		0.0314		0.0419		0.0402		0.0384		0.0299		0.044		0.0264		0.0125	
PCB 130	0.0465		0.0332		0.0351		0 0389		0 1247		0.1574		0.1006		0	U	0 1151		0.0854		0.1155		0.1142		0 1406		0.0925		0.1307		0.0748		0.0407	
PCB 131	0	U	0 004		0.0043		0.006		0.0195		0.0228		0.0162		0 0217		0.0079		0.0029		0.0041		0.0039		0.0048		0.0025		0 0057		0.0019		0	U
PCB 132/168																																		
PCB 135/144																																		
PCB 136	0	U	0.1744		0.2273		0.2172		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137																																		
PCB 137/176	0.0131		0.0163		0.0171		0.0184		0.0155		0.022		0.0137		0 0161		0.0152		0.0117		0.0157		0.0143		0.0236		0.0158		0.0257		0.0139		0.008	
PCB 138/158/163	0 4636		0.5562		0.6048		0.7041		0.6142		0.663		0.417		0 5267		0.4457		0.3717		0.4628		0.4836		0.6049		0.3999		0.5709		0.3132		0.1881	
PCB 138/163																																		
PCB 141	0	U	0.0845		0.0784		0.1046		0.0822		0.096		0 0634		0.0859		0.07		0.0506		0.0726		0.0681		0.0814		0.0505		0 0832		0.0348		0.0243	
PCB 146	0 2779		0 3713		0.3519		0.4362		0.4659		0.455		0 2716		0 4876		0.3262		0.212		0.2883		0 2834		0.3955		0.2289		0 4308		0 1849		0.09	
PCB 149	0.2266		0 3062		0.3183		0.3955		0.327		0 3744		0 2355		0 292		0.2699		0.1914		0.2856		0.2566		0.3186		0.2318		0 3488		0 1612		0.0937	
PCB 149/123																																		
PCB 151	0.0867		0 1067		0.1118		0.1347		0.1105		0.133		0.0788		0.104		0.0928		0.0586		0.1063		0.0954		0.1047		0.0739		0.1193		0.0561		0 0374	
PCB 153/184																																		
PCB 156/171																																		
PCB 156/171/202	0.0631		0.1003		0.1068		0.1145		0 1106		0 1093		0.0724		0.0954		0.0817		0.0555		0.0898		0.0748		0.0833		0 0791		0.0854		0.0474		0.0305	
PCB 157/200	0.0099		0.0195		0 0211		0.0241		0.0023		0.0192		0.0128		0 06		0 0201		0.0094		0.0162		0.0117		0.0149		0.0107		0.0018		0 0008		0	U
PCB 157																																		
PCB 158																																		

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI18		89GH6FI19		89GH6FI20		89GH6FI21		89GH6FI22		89GH6FI23		89GH6FI24		89GH6FI25		89GH6FI26		89GH6FI27		89GH6FI28		89GH6FI29		89GH6FI30		89GH6FI31		89GH6FI32		89GH6FI33		89GH6FI34	
Sample Date	7/25/89		7/31/89		8/9/89		8/14/89		8/23/89		8/29/89		9/6/89		9/13/89		9/20/89		9/27/89		10/4/89		10/12/89		10/18/89		10/24/89		10/31/89		11/7/89		11/14/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 167	0 0295		0 0199		0.0209		0 0213		0 033		0.0307		0 0181		0.0285		0.0286		0.016		0.0247		0.0289		0.0277		0 0174		0.029		0.0155		0.0076	
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																				
PCB 172																																				
PCB 170/190	0 1344		0 1881		0.2653		0.3064		0.2446		0.1756		0 1151		0.1899		0.1225		0.1019		0.1352		0.152		0.1822		0.1268		0.1648		0.0878		0.0506	
PCB 172/197	0 0235		0 0321		0 035		0 0374		0.0322		0.037		0 0229		0.0326		0.0254		0.0214		0.0265		0.0265		0.0358		0.0236		0.0307		0 018		0.0096	
PCB 173	0.0004		0	U	0	U	0	U	0.0019		0.0033		0.002		0	U	0.0136		0.0019		0.0021		0.0014		0.003		0.0019		0.0036		0.003		0.0027	
PCB 174	0.0764		0.1158		0.1211		0.1391		0.1296		0.1488		0.0855		0.1245		0.0914		0.0702		0.1116		0.0851		0.1181		0.0743		0.1207		0.0509		0.0339	
PCB 175	0	U	0.0106		0	U	0 0134		0.0074		0 0085		0.006		0.005		0.0037		0.0031		0.0036		0.0038		0	U	0	U	0	U	0	U	0	U	0	U
PCB 176																																				
PCB 177	0 0557		0.084		0.0885		0.0984		0.1011		0.1101		0.0627		0.0873		0.072		0.056		0 08		0 0672		0.0832		0.0681		0.0806		0.0433		0.032	
PCB 176/126																																				
PCB 180	0.2493		0.2655		0.2779		0.3091		0.3044		0.2611		0.1794		0.2385		0.1923		0.154		0.195		0.1958		0.2633		0.1788		0.2525		0.1362		0.082	
PCB 182/187	0 1214		0 1627		0.1734		0.1978		0.1717		0.1937		0 1176		0.1697		0.1344		0.1058		0.1354		0.1308		0.1568		0.1038		0.1612		0.0803		0.0479	
PCB 183	0.065		0.0805		0.0853		0.0962		0.0912		0.0961		0.0633		0.1149		0.067		0.0517		0.0706		0.0665		0.0799		0.0544		0.0829		0.0436		0.0251	
PCB 185	0 0086		0.013		0.0141		0 0163		0.0251		0.0221		0.018		0.0233		0.0151		0.0106		0.0167		0.0163		0.0299		0.0284		0.014		0.0068		0 0031	
PCB 189	0.0072		0.0067		0.0072		0.0078		0.0076		0.0072		0.0049		0.0029		0.005		0.004		0.0034		0 0051		0.0059		0.0103		0.0074		0.0032		0.0091	
PCB 190																																				
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0085		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0344		0 0244		0.0231		0.0247		0.0198		0.0156		0.0105		0.0188		0.0111		0.0094		0.0118		0.0118		0.0169		0 0084		0.0126		0.0067		0.0039	
PCB 194	0.0934		0.0639		0.0818		0.0778		0.0781		0.0527		0.0371		0.0769		0.0447		0.0385		0.0447		0 0466		0.0649		0.0472		0.0605		0.0321		0.0201	
PCB 195																																				
PCB 195/208	0.1054		0 1397		0.1463		0.1843		0.1407		0 1137		0.0793		0.1403		0.0891		0.0769		0.1018		0 0936		0.1169		0.0882		0.1279		0.0695		0.0442	
PCB 196/203	0 1164		0.162		0.1743		0.19		0.1663		0 1522		0 1051		0.1667		0 117		0.1039		0.1187		0 1203		0.1446		0.0995		0.1455		0.0761		0 0486	
PCB 197																																				
PCB 198	0.0703		0.0046		0.0057		0.0096		0.0092		0.0074		0.0011		0.0073		0.0055		0.0043		0 0059		0 0123		0.0044		0.0034		0.0064		0.0037		0.0017	
PCB 199	0 0164		0.022		0 019		0.0234		0.0179		0.011		0.0069		0.0119		0.008		0.0064		0.0132		0.0079		0.0182		0 0123		0 0193		0.0055		0.0078	
PCB 201	0.1247		0.1511		0.1591		0.1763		0.1502		0.1462		0.0983		0.1391		0.1088		0.0913		0.1145		0.1113		0.1298		0.0906		0.1343		0.07		0.0452	
PCB 202																																				
PCB 203/196																																				
PCB 205	0	U	0	U	0	U	0	U	0.0267		0.0178		0.0136		0.0242		0.0148		0.0116		0.0128		0.0168		0.0288		0 0247		0.0239		0.0208		0 0181	
PCB 206	0.0711		0.1201		0.1085		0.1209		0.1137		0.0913		0.0599		0.0981		0.0733		0.066		0 0747		0 0777		0.0912		0 0667		0.0922		0.0509		0.037	
PCB 207	0.0028		0.0082		0.0054		0.0098		0.012		0.0144		0.0104		0.0237		0.0187		0.0106		0.0093		0 014		0	U	0.0069		0.0099		0	U	0	U		
PCB 208																																				
PCB 209	0.0654		0 0473		0.0492		0 0536		0.0367		0 0728		0 0505		0.0599		0.0646		0 0602		0.0642		0.0664		0.0341		0.0229		0.0422		0.0291		0.0143	
Total Suspended PCBs (by congener sum) =	39.37		53.38		60.33		64.93		51.05		43.87		31.47		38.72		34.46		24.08		32.80		33.08		43.33		28.79		43.27		20.71		11.10	
Total Congeners Analyzed (Susp) =	93		93		93		93		93		93		93		93		93		93		93		93		93		93		93		93		93	
Total Congeners Detected (Susp) =	84		87		85		87		89		87		87		85		87		89		88		86		85		86		85		84		80	
Reported TPCBs (Susp) =																																				

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI35		89GH6FI36		89GH6FI37		9003240P		9003449P		9003622P		9003779P		9004431P		90GH6FI38		90GH6FI39		90GH6FI40		90GH6FI41		90GH6FI42		90GH6FI43		90GH6FI44		90GH6FI45		90GH6FI46		90GH6FI47	
Sample Date	11/30/89		11/30/89		12/13/89		4/19/89		5/3/89		5/17/89		6/1/89		6/28/89		1/11/90		1/25/90		2/8/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90		4/17/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0.0875		0.0328		0	U											0	U	0	U	0	U	0	U	0	U	0.0552		0.0308		0	U	0	U	0	U
PCB 003	0	U	0	U	0	U											0	U	0.0354		0.0672		0.5008		0.0476		0	U	0	U	0	U	0	U	0.1355	
PCB 004																																						
PCB 004/010	0.022		0.0134		0	U											0.0058		0.0121		0.0057		0	U	0.0082		0.025		0.0099		0.0132		0.0249		0.0237	
PCB 005																																						
PCB 005/008	0	U	0	U	0.2135												0.1258		0.1457		0.189		0.184		0.1769		0	U	0	U	0	U	0	U	0.5828	
PCB 006	0.0252		0.0151		0.1103												0.0184		0.025		0.0208		0.0284		0.0258		0.1467		0.0317		0.0441		0.0694		0.0834	
PCB 007	0.0047		0	U	0.1612												0.0027		0.0036		0.0027		0.0051		0.0027		0.0112		0.0027		0.0054		0.0012		0.0076	
PCB 008																																						
PCB 012/013	0.004		0.0077		0	U											0.0031		0.0057		0.0019		0	U	0.0025		0.0043		0.0012		0.0027		0	U	0.0063	
PCB 016/032	0.1397		0.1208		0.1385												0.0794		0.0884		0.1036		0.086		0.1118		0.3988		0.1164		0.2035		0.2331		0.3652	
PCB 017	0.1033		0.0963		0.1026												0.0501		0.0667		0.0594		0.0799		0.078		0.3045		0.0766		0.1612		0.2444		0.3129	
PCB 018	0.1277		0.1137		0.1224												0.0682		0.0711		0.082		0.1081		0.102		0.3953		0.1069		0.1968		0.3199		0.4011	
PCB 019	0.0076		0.006		0.0014												0.0056		0.0022		0.0037		0.0036		0.0057		0.0234		0.0072		0.0118		0.0149		0.0248	
PCB 021	0	U	0	U	0.003												0	U	0	U	0	U	0.0101		0	U	0	U	0	U	0	U	0.0144		0	U
PCB 022	0.0822		0.0651		0.1543												0.0487		0.0474		0.0768		0.0571		0.0867		0.6446		0.1217		0.1926		0.3585		0.3852	
PCB 024																																						
PCB 024/027	0.0146		0.014		0.0112												0.009		0.0149		0.0113		0.008		0.0159		0.0504		0.0137		0.0218		0.029		0.0511	
PCB 025	0.0533		0.0473		0.0706												0.0404		0.0473		0.0357		0.0301		0.0424		0.2556		0.0528		0.0952		0.1525		0.1751	
PCB 026	0.0842		0.0721		0.0804												0.0501		0.0544		0.0548		0.0464		0.0673		0.341		0.078		0.1433		0.2034		0.2712	
PCB 027																																						
PCB 028																																						
PCB 028/031	0.6618		0.5524		0.6221		4.2		6.1		7.4		16		5.8		0.3385		0.3448		0.4713		0.4097		0.4764		2.861		0.6231		0	U	1.4889		1.9949	
PCB 029	0.0094		0	U	0.0127												0.0016		0.003		0.0108		0	U	0.0164		0	U	0	U	0	U	0	U	0.0158	
PCB 031																																						
PCB 033	0.138		0.0882		0.1865												0.0899		0.0785		0.1205		0.1113		0.1249		0.6917		0.1502		0.2657		0.307		0.4433	
PCB 037/042	0.1089		0.117		0.0731												0.053		0.046		0.0631		0.0633		0.094		0.4583		0.0879		0.138		0.2556		0.3447	
PCB 040	0.049		0.0402		0.0553												0.0394		0.0268		0.0285		0.0331		0.0426		0.1946		0.0354		0.0705		0.1119		0.148	
PCB 041/064/071	0.182		0.1551		0.1214												0.1197		0.137		0.1302		0.1348		0.1704		0.5869		0.1565		0.2771		0.4741		0.6629	
PCB 043	0.0525		0.0318		0.0314												0.0169		0.0545		0.0127		0.0132		0.0317		0.0766		0.057		0.0338		0.089		0.106	
PCB 044	0.173		0.1587		0.1511												0.1006		0.1052		0.1216		0.1183		0.1565		0.6598		0.1538		0.277		0.4794		0.6522	
PCB 045	0.0202		0.0491		0.0227												0.0078		0.0386		0.0152		0.038		0.0305		0.1258		0.0309		0.0445		0.1173		0.1702	
PCB 046	0.0146		0.0117		0.0072												0.0065		0.0467		0.0061		0.013		0.0121		0.0561		0.037		0.0457		0.0694		0.1085	
PCB 047																																						
PCB 048																																						
PCB 047/048	0.2029		0.1651		0.1654												0.0906		0.0804		0.1097		0.1307		0.154		0.441		0.1485		0.2588		0.3968		0.5401	
PCB 049	0.1293		0.1599		0.1492												0.0953		0.1137		0.1152		0.1201		0.161		0.5315		0.1691		0.2732		0.4253		0.6515	
PCB 051	0.0101		0.014		0.013												0.0066		0.0083		0.008		0.0058		0.0087		0.022		0.0067		0.0124		0.0183		0.0251	
PCB 052	0.1777		0.1725		0.1197												0.0812		0.1848		0.1006		0.0895		0.1162		0.603		0.1658		0.2554		0.4164		0.6466	
PCB 053	0.0201		0.0114		0.0396												0.0226		0.0257		0.0236		0.028		0.0287		0.0941		0.0296		0.0359		0.0923		0.1313	
PCB 056																																						
PCB 059																																						
PCB 060/092																																						
PCB 056/060	0.1221		0.1015		0.1419		0.66		1.5		1.4		3.1		1.4		0.0761		0.0834		0.0974		0.0944		0.1291		0.5848		0.1455		0.2079		0.383		0.4919	
PCB 063	0	U	0.0058		0.0185												0.0079		0.0082		0.0142		0.0093		0.0115		0.0611		0.0097		0.0194		0.0438		0.0378	
PCB 064/041																																						
PCB 066/095	0.6273		0.6336		0.7297												0.1928		0.2843		0.2588		0.2564		0.3896		1.5368		0.6136		1.0648		0.8994		1.6938	
PCB 070																																						
PCB 070/076	0.2972		0	U	0.9414												0.1409		0.2245		0.1927		0.2129		0.2925		1.1558		0.3183		0.4999		0.6959		0.8665	

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI35		89GH6FI36		89GH6FI37		9003240P		9003449P		9003622P		9003779P		9004431P		90GH6FI38		90GH6FI39		90GH6FI40		90GH6FI41		90GH6FI42		90GH6FI43		90GH6FI44		90GH6FI45		90GH6FI46		90GH6FI47	
Sample Date	11/30/89		11/30/89		12/13/89		4/19/89		5/3/89		5/17/89		6/1/89		6/28/89		1/11/90		1/25/90		2/6/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90		4/17/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/L)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 071																																				
PCB 074	0.0743		0.0617		0.092												0.0471		0.0648		0.0718		0.0782		0.0999		0.3202		0.0785		0.1348		0.2125		0.2867	
PCB 076																																				
PCB 077/110	0.1147		0.1259		0.1058		0.61		1		1.1		2		0.96		0.0756		0.0818		0.086		0.0916		0.1134		0.3606		0.1082		0.1678		0.2944		0.3607	
PCB 081	0	U	0	U	0	U											0.0027		0.0016		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 082	0.0157		0.0148		0.0152												0.0102		0.0094		0.01		0.0088		0.0132		0.0498		0.0111		0.0266		0.0357		0.0525	
PCB 083	0	U	0	U	0.0085												0.0043		0.0052		0.006		0.002		0	U	0.0094		0	U	0	U	0.0156		0.0127	
PCB 084																																				
PCB 084/092	0.0324		0.0483		0.0495												0.0418		0.0357		0.0482		0.0239		0.0448		0.1434		0.0405		0.0375		0.1291		0.1747	
PCB 085	0.0185		0.0189		0.0175												0.0104		0.0104		0.0113		0.0118		0.0213		0.0586		0.0165		0.0275		0.0471		0.0582	
PCB 087	0.0465		0.0447		0.0323												0.0229		0.019		0.0255		0.024		0.0381		0.0992		0.0294		0.0472		0.0805		0.0911	
PCB 087/081																																				
PCB 089	0	U	0	U	0	U											0	U	0	U	0	U	0.0038		0.0176		0.0189		0.0134		0.0063		0.0199		0.0192	
PCB 091	0	U	0	U	0	U											0	U	0	U	0	U	0	U	0.0098		0.1624		0.0219		0.0731		0.0389		0.1829	
PCB 097	0.0433		0.0372		0.03												0.0211		0.0201		0.0253		0.0238		0.0318		0.098		0.0271		0.047		0.0765		0.0911	
PCB 099	0.0378		0.039		0.0345												0.0258		0.0264		0.0284		0.0301		0.0376		0.114		0.033		0.0564		0.0941		0.1201	
PCB 100	0.0252		0.0039		0.0106												0.0164		0.0082		0.0041		0.0038		0.0126		0.0582		0.0056		0.0098		0.0183		0.0239	
PCB 101	0.0847		0.094		0.062		0.3		0.54		0.46		0.87		0.39		0.0468		0.0461		0.0528		0.0536		0.0714		0.2233		0.0701		0.107		0.1816		0.221	
PCB 101/090																																				
PCB 105																																				
PCB 105/132/153	0.1686		0.1619		0.1144												0.0706		0.0694		0.0837		0.0753		0.1008		0.3951		0.1148		0.182		0.2992		0.4111	
PCB 107	0.0493		0.0623		0.0124												0.0074		0.0106		0.0038		0.0128		0.0043		0.0478		0.0166		0.0346		0.0431		0.0271	
PCB 114																																				
PCB 114/134	0.0137		0.0205		0.0477												0.0206		0.014		0.0054		0.0081		0.0145		0.0743		0.0151		0.0231		0.027		0.0345	
PCB 118	0.0711		0.0742		0.0603		0.39		0.53		0.59		1.2		0.6		0.038		0.0402		0.0456		0.0453		0.056		0.2417		0.0599		0.1114		0.185		0.2359	
PCB 119	0.0083		0.0067		0.0079												0.0049		0.0067		0.006		0.0075		0.0098		0.0228		0.0084		0.0115		0.0172		0.0206	
PCB 124/135/144/147	0.0348		0.0312		0.0114												0.0084		0.0108		0.0164		0.0109		0.0193		0.0493		0.0152		0.0267		0.0356		0.0303	
PCB 128	0.0145		0.015		0.0123												0.0078		0.0081		0.0087		0.0079		0.0105		0.0476		0.0103		0.0173		0.0313		0.0408	
PCB 129/178	0.0059		0.0053		0.006												0.0037		0.0055		0.0047		0.0031		0.0043		0.0244		0.0062		0.0064		0.0123		0.0154	
PCB 130	0	U	0	U	0.0088												0	U	0	U	0.0066		0	U	0.0132		0.063		0.0147		0.025		0.0474		0.0588	
PCB 131	0.0006		0	U	0.0291												0.0036		0.0009		0.0006		0.0004		0.0006		0.0069		0.0009		0.0014		0.0019		0.0024	
PCB 132/168																																				
PCB 135/144																																				
PCB 136	0	U	0	U	0	U											0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137																																				
PCB 137/176	0.0023		0.0023		0.0033												0.0014		0.0005		0.0027		0.001		0.0031		0.0128		0.0031		0.0055		0.0074		0.0097	
PCB 138/158/163	0.1104		0.1433		0.0939												0.067		0.0613		0.0679		0.0612		0.0747		0.2847		0.086		0.123		0.203		0.2792	
PCB 138/163							0.29		0.48		0.38		1		0.45																					
PCB 141	0.0153		0.0159		0.0109												0.0083		0.0077		0.0083		0.0061		0.0094		0.0381		0.0096		0.0133		0.0259		0.0339	
PCB 146	0.0446		0.0396		0.0653												0.0228		0.0258		0.032		0.0267		0.0388		0.1499		0.0336		0.0672		0.1001		0.1537	
PCB 149	0.0573		0.0742		0.0411		0.23		0.32		0.32		0.53		0.22		0.0308		0.0353		0.033		0.0325		0.0359		0.1504		0.0456		0.0749		0.115		0.1484	
PCB 149/123																																				
PCB 151	0.0223		0.0215		0.0212												0.011		0.0116		0.0126		0.0104		0.0128		0.049		0.0138		0.0269		0.0343		0.0494	
PCB 153/184																																				
PCB 156/171																																				
PCB 156/171/202	0.0104		0.0135		0.015												0.0078		0.0056		0.0101		0.0128		0.0129		0.0416		0.0146		0.017		0.0261		0.0294	
PCB 157/200	0	U	0	U	0.0052												0.0038		0.0022		0.0031		0	U	0	U	0.0005		0.0038		0	U	0	U	0	U	0	U
PCB 157																																				
PCB 158																																				

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	89GH6FI35		89GH6FI36		89GH6FI37		9003240P		9003449P		9003622P		90037.79P		9004431P		90GH6FI38		90GH6FI39		90GH6FI40		90GH6FI41		90GH6FI42		90GH6FI43		90GH6FI44		90GH6FI45		90GH6FI46		90GH6FI47	
Sample Date	11/30/89		11/30/89		12/13/89		4/19/89		5/3/89		5/17/89		6/1/89		6/28/89		1/11/90		1/25/90		2/6/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90		4/17/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 167	0.0042		0.0033		0.0026												0.0017		0.0027		0.0031		0.0027		0.0033		0.0131		0 0027		0 0049		0.011		0.0122	
PCB 169	0	U	0	U	0	U											0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																				
PCB 172																																				
PCB 170/190	0.0291		0 0382		0.029												0.0227		0.0165		0.0308		0.0488		0 0527		0.0786		0.0349		0.0332		0.0527		0.1294	
PCB 172/197	0.0063		0.0056		0 0034												0.0023		0.0019		0.0028		0 0035		0.0043		0.0139		0.0041		0 0065		0.0103		0.0144	
PCB 173	0	U	0.0027		0	U											0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0022		0	U
PCB 174	0.0192		0.0188		0.0156												0.0088		0.0089		0 011		0 0098		0.0118		0.057		0.0146		0 0231		0.0352		0.0388	
PCB 175	0.0067		0.0002		0	U											0	U	0.0006		0.0011		0	U	0	U	0	U	0.0013		0 0052		0.0047		0.0035	
PCB 176																																				
PCB 177	0.015		0.0121		0.0182												0.0112		0.0074		0.0078		0.0227		0.0136		0.0412		0.0125		0.0168		0.0227		0.0317	
PCB 178/126																																				
PCB 180	0.0508		0.0491		0.042		0.12		0.25		0.17		0.5		0 2		0.0249		0.0209		0.0262		0.0247		0.0335		0 1267		0.0336		0.0515		0 0804		0.1035	
PCB 182/187	0 0265		0.0257		0.0202												0.017		0.0136		0.0171		0 0133		0.0179		0.0694		0.0192		0 0288		0.0445		0.0647	
PCB 183	0.0125		0.0127		0 0116												0.0062		0 0061		0 0076		0.0058		0.0094		0 0417		0.0096		0.0181		0.0265		0 0365	
PCB 185	0	U	0	U	0.0031												0.0019		0.0015		0.002		0	U	0.0005		0.0064		0.0015		0 0014		0.0038		0.019	
PCB 189	0.0028		0.0015		0	U											0	U	0	U	0 0007		0.0071		0.0044		0.0012		0.0017		0 0002		0.0014		0.0028	
PCB 190																																				
PCB 191	0	U	0	U	0	U											0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0025		0.0028		0.0017												0.0012		0.001		0 0011		0.0014		0.0018		0.0076		0 0021		0.003		0.0056		0.0058	
PCB 194	0.0114		0 0083		0.0063												0.0115		0 0044		0.005		0.0075		0.0122		0 029		0.0087		0.0116		0.0178		0.0219	
PCB 195																																				
PCB 195/208	0.02		0 0178		0.0182												0.0112		0 0097		0.0108		0.0109		0.0173		0.0566		0.0168		0.025		0.0375		0.0464	
PCB 196/203	0.022		0 0191		0.0216												0 0143		0.0117		0.0163		0.0121		0 0162		0.0675		0.019		0.0273		0 0411		0 0548	
PCB 197																																				
PCB 198	0	U	0.0025		0	U											0.0007		0	U	0	U	0.0009		0		0.0043		0.001		0.0012		0.0027		0 0031	
PCB 199	0.0104		0.0069		0.0014												0.0012		0.0019		0.001		0.0035		0 0062		0.0109		0 0037		0.0046		0.0065		0.0114	
PCB 201	0.0171		0.0162		0.02												0.0123		0.0108		0.0146		0.0107		0.0147		0.0618		0 0178		0.0247		0.0375		0.0511	
PCB 202																																				
PCB 203/196																																				
PCB 205	0.0171		0.0152		0.0062												0.0021		0.0027		0.0025		0.0087		0.0118		0.0184		0 0075		0.0099		0.0163		0.0176	
PCB 206	0.0104		0.0082		0 0114												0.0075		0.0084		0.0076		0.013		0.0114		0.0409		0 0121		0.0151		0.0234		0.0287	
PCB 207	0	U	0	U	0.0053												0.0059		0.0015		0	U	0 0025		0	U	0.0034		0	U	0.001		0.0015		0.0024	
PCB 208																																				
PCB 209	0.0079		0.007		0.0128												0.0086		0.0077		0.0067		0.0039		0.0088		0.0225		0 0055		0.0078		0.0166		0.0144	
Total Suspended PCBs (by congener sum) =	5.17		4.52		6.05		6.80		10.72		11.82		25.20		10.02		2.81		3.30		3.51		3.92		4.40		17.58		4.75		6.70		11.39		16.55	
Total Congeners Analyzed (Susp) =	93		93		93		8		8		8		8		8		93		93		93		93		93		93		93		93		93		93	
Total Congeners Detected (Susp) =	76		75		79		8		8		8		8		8		81		82		82		79		81		83		82		80		83		85	
Reported TPCBs (Susp) =							23.72		35.63		40.6		83.52		32.7																					

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	90GH6F148		90GH6F149		90GH6F150		CP		OA001176P		OA001181P		OA001182P		OA001627P		OA001630P		OA002397P		OA003240P		OA003246P		OA004475P		OA004477P		OB000382P		OB000384P		OB001109P		OB001113P		OB004145P	
Sample Date	4/24/90		4/24/90		5/1/90		8/15/89		7/11/89		7/27/89		7/27/89		8/23/89		8/9/89		10/3/89		9/19/89		9/7/89		10/17/89		11/1/89		11/15/89		12/6/89		1/17/90		2/14/90		3/14/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0	U	0	U	0	U																														
PCB 003	0.0079		0.0798		0	U																														
PCB 004																																				
PCB 004/010	0.0509		0.0284		0.0404																															
PCB 005																																				
PCB 005/008	0.7616		0.7363		0	U																														
PCB 006	0.0946		0.0951		0.1224																															
PCB 007	0.0153		0.0092		0.0157																															
PCB 008																																				
PCB 012/013	0.0075		0.0075		0.0035																															
PCB 016/032	0.8109		0.8082		0.8399																															
PCB 017	0.7331		0.6753		0.7655																															
PCB 018	0.8732		0.8872		1.0759																															
PCB 019	0.042		0.0426		0.068																															
PCB 021	0.0139		0.0157		0.01																															
PCB 022	0.7635		0.856		1.1235																															
PCB 024																																				
PCB 024/027	0.1091		0.1054		0.1221																															
PCB 025	0.3271		0.3298		0.42																															
PCB 026	0.6081		0.6093		0.6969																															
PCB 027																																				
PCB 028																																				
PCB 028/031	4.2964		4.2214		5.4029		3.2		7		7.7		8.2		7.2		8.3		3.6		4.9		4.3		4.3		7.5		1.6		0.17		0.6		0.18		11	
PCB 029	0.0376		0.0279		0.0388																															
PCB 031																																				
PCB 033	0.8977		0.9096		0.9842																															
PCB 037/042	0.8053		0.8115		1.0057																															
PCB 040	0.2748		0.2804		0.3779																															
PCB 041/064/071	1.4091		1.1964		1.5588																															
PCB 043	0.1		0.1275		0.1416																															
PCB 044	1.3423		1.3649		1.7684																															
PCB 045	0.2518		0.2447		0.3168																															
PCB 046	0.1688		0.1086		0.2012																															
PCB 047																																				
PCB 048																																				
PCB 047/048	0.9314		0.9682		1.1885																															
PCB 049	1.1642		1.1859		1.5009																															
PCB 051	0.0501		0.055		0.0679																															
PCB 052	1.2907		1.3149		1.544																															
PCB 053	0.2084		0.2132		0.3062																															
PCB 056																																				
PCB 059																																				
PCB 060/092																																				
PCB 056/060	0.8741		0.8992		1.2913		0.67		0.97		1.1		1.2		1.3		1.5		0.79		0.9		1		0.91		1.3		0.25		0.05		0	U	0.03		2.7	
PCB 063	0.0853		0.086		0.1232																															
PCB 064/041																																				
PCB 066/095	2.3282		3.0247		3.8316																															
PCB 070																																				
PCB 070/076	1.6166		1.7516		2.9093																															

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	90GH6F148		90GH6F149		90GH6F150		CP		OA001176P		OA001181P		OA001182P		OA001627P		OA001630P		OA002397P		OA003240P		OA003246P		OA004475P		OA004477P		OB000382P	OB000384P	OB001109P	OB001113P	OB004145P
Sample Date	4/24/90		4/24/90		5/1/90		6/15/89		7/11/89		7/27/89		7/27/89		8/23/89		9/9/89		10/3/89		9/19/89		9/7/89		10/17/89		11/1/89		11/15/89	12/6/89	1/17/90	2/14/90	3/14/90
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	Suspended	Suspended	Suspended	Suspended
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Result	Result	Result	Result
PCB 071																																	
PCB 074	0.5093		0.5272		0.7181																												
PCB 076																																	
PCB 077/110	0.6262		0.6436		0.7944		0.15		0.8		0.91		1		1.2		1.3		0.75		0.8		0.89		0.83		1.1		0.28	0.09	0.04	0.09	2.9
PCB 081	0.0099		0.0065		0.0078																												
PCB 082	0.0943		0.1024		0.1309																												
PCB 083	0.0366		0.0289		0.0447																												
PCB 084																																	
PCB 084/092	0.3546		0.3473		0.4881																												
PCB 085	0.1094		0.1118		0.1536																												
PCB 087	0.1662		0.1681		0.226																												
PCB 087/081																																	
PCB 089	0.0199		0.0179		0.0434																												
PCB 091	0.0696		0.0766		0.3149																												
PCB 097	0.1617		0.1694		0.2255																												
PCB 099	0.2026		0.2135		0.2911																												
PCB 100	0.115		0.0573		0.1034																												
PCB 101	0.3786		0.3765		0.5239		0.49		0.42		0.45		0.51		0.56		0.63		0.37		0.41		0.44		0.41		0.5		0.13	0.5	0.2	0.05	1.2
PCB 101/090																																	
PCB 105																																	
PCB 105/132/153	0.6307		0.6743		0.9774																												
PCB 107	0.0694		0.0702		0.0871																												
PCB 114																																	
PCB 114/134	0.0697		0.0677		0.1137																												
PCB 118	0.3577		0.398		0.507		0.54		0.53		0.54		0.57		0.57		0.64		0.29		0.38		0.39		0.45		0.6		0.16			0.03	1
PCB 119	0.0303		0.0294		0.0399																												
PCB 124/135/144/147	0.0731		0.0738		0.0905																												
PCB 128	0.0738		0.0802		0.1318																												
PCB 129/178	0.0271		0.0333		0.0394																												
PCB 130	0.095		0.1058		0.1266																												
PCB 131	0.0039		0.0042		0.006																												
PCB 132/168																																	
PCB 135/144																																	
PCB 136	0	U	0.1039		0	U																											
PCB 137																																	
PCB 137/176	0.0148		0.016		0.0223																												
PCB 138/158/163	0.4349		0.429		0.5793																												
PCB 138/163							0	U	0.43		0.5		0.46		0.49		0.56		0.27		0.35		0.34		0.36		0.5		0.14	0.5	0.2	0.05	1.2
PCB 141	0.055		0.0581		0.0759																												
PCB 146	0.2717		0.293		0.3906																												
PCB 149	0.2303		0.25		0.3234		0.84		0.3		0.3		0.29		0.29		0.34		0.18		0.22		0.22		0.25		0.31		0.1	0.04	0.2	0.03	0.53
PCB 149/123																																	
PCB 151	0.0745		0.0808		0.108																												
PCB 153/184																																	
PCB 156/171																																	
PCB 156/171/202	0.0527		0.0601		0.1222																												
PCB 157/200	0.0007		0.014		0.0066																												
PCB 157																																	
PCB 158																																	

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	90GH6F148		90GH6F149		90GH6F150		CP		OA001176P		OA001181P		OA001182P		OA001627P		OA001630P		OA002397P		OA003240P		OA003246P		OA004475P		OA004477P		OB000382P		OB000384P		OB001109P		OB001113P		OB004145P	
Sample Date	4/24/90		4/24/90		5/1/90		6/15/89		7/11/89		7/27/89		7/27/89		8/23/89		8/9/89		10/3/89		9/19/89		9/7/89		10/17/88		11/1/89		11/15/89		12/6/89		1/17/90		2/14/90		3/14/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 167	0.0193		0.0234		0.0267																															
PCB 169	0	U	0	U	0	U																														
PCB 170																																				
PCB 172																																				
PCB 170/190	0.1803		0.147		0.1714																															
PCB 172/197	0.024		0.0265		0.0319																															
PCB 173	0.0011		0	U	0	U																														
PCB 174	0.0734		0.0788		0.1245																															
PCB 175	0.0067		0	U	0.0104																															
PCB 176																																				
PCB 177	0.048		0.0661		0.1112																															
PCB 178/126																																				
PCB 180	0.1762		0.1889		0.2653		0	U	0.24		0.41		0.21		0.22		0.25		0.15		0.18		0.17		0.16		0.26		0.07		0.02		0	U	0.02	
PCB 182/187	0.1022		0.1095		0.1575																															
PCB 183	0.0557		0.0617		0.0787																															
PCB 185	0.0336		0.0103		0.0166																															
PCB 189	0.0033		0.0063		0.0061																															
PCB 190																																				
PCB 191	0	U	0	U	0	U																														
PCB 193	0.0106		0.009		0.0126																															
PCB 194	0.0391		0.0436		0.0659																															
PCB 195																																				
PCB 195/208	0.0753		0.0912		0.129																															
PCB 196/203	0.0975		0.1033		0.1616																															
PCB 197																																				
PCB 198	0.0019		0.0035		0.005																															
PCB 199	0.0178		0.0112		0.0236																															
PCB 201	0.0824		0.0947		0.142																															
PCB 202																																				
PCB 203/196																																				
PCB 205	0.0144		0.006		0.0187																															
PCB 206	0.0581		0.0731		0.1087																															
PCB 207	0.0053		0.0075		0	U																														
PCB 208																																				
PCB 209	0.0246		0.027		0.0417																															
Total Suspended PCBs (by congener sum) =	29.92		30.95		39.39		5.89		10.69		11.91		12.44		11.83		13.52		6.40		8.14		7.75		7.67		12.07		2.73		1.37		1.24		0.48		20.53	
Total Congeners Analyzed (Susp) =	93		93		93		8		8		8		8		8		8		8		8		8		8		8		8		7		7		8		7	
Total Congeners Detected (Susp) =	89		88		85		6		8		8		8		8		8		8		8		8		8		8		8		7		5		8		7	
Reported TPCBs (Susp) =							71.91		36.11		39.94		40.95		39.05		45.15		22.75		26.54		25.53		26.4		40.97		8.75		0.99		0.17		0.57		69.75	

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	OB004147P		OB004149P		OB004150P		SW050002		SW050003		SW050004		SW050005		SW050006		SW050007		SW050008		SW050008				SW050009		SW050010		SW050011		SW050012		SW050013		SW050014	
Sample Date	4/4/90		4/19/90		4/19/90		9/27/00		11/29/00		1/18/01		3/27/01		4/8/01		4/13/01		4/17/01		4/17/01				4/30/01		5/1/01		5/11/01		6/22/01		6/23/01		5/30/01	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended				Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.038	R	R1		0	U	0	U	0	U	0	U	0	U	0	U
PCB 003																																				
PCB 004							0.088		0	U	0	U	0	U	0.028	Q	0	U	0	U	0.017	R	R1		0.03	Q	0	U	0	U	0	U	0	U	0	U
PCB 004/010																																				
PCB 005							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.01	R	R1		0	U	0	U	0	U	0	U	0	U	0	U
PCB 005/008																																				
PCB 006							0.029		0	U	0	U	0.01		0.015	Q	1.1		0	U	1.2	R	R1		0.057		0.034		0.25		0.2		0.15		0.059	
PCB 007							0.024		0	U	0	U	0	U	0	U	0	U	0	U	0.011	R	R1		0.056		0.023	Q	0	U	0	U	0	U	0	U
PCB 008							0.055		0	U	0	U	0.024		0.041		0.16		0	U	0.032	R	R1		0	U	0	U	0	U	0	U	0	U	0	U
PCB 012/013																																				
PCB 016/032							0.043		0.014	LOQ	0	U	0.023		0.045		0.21		0.069		0.2	R	R1		0.086		0.019	Q	0.16		0.22		0.11		0.096	
PCB 017							0.064		0	U	0	U	0.024		0.038		0.16		0	U	0.098	UJ	R1		0.11		0.035		0.25		0.32		0.19		0.12	
PCB 018							0.23	V	0	U	0	U	0	U	0	U	0	U	0.076		0.12	J	R1		0	U	0	U	1.8	BJ	1.9	BJ	0	U	0.22	
PCB 019							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.027	UJ	R1		0	U	0	U	0	U	1.6	J	0	U	0	U
PCB 021																																				
PCB 022							0.033		0	U	0	U	0.023		0.023		0.61	B	0.68		1.1	J	R1		0.22		0.036		0	U	0	U	0	U	0	U
PCB 024							0.068	V	0	U	0.018	T	0.25		1.5	J	7.9		7.7		9.7	J	R1		1.6	J	0.36		3	J	2.4	J	0.98		0.25	
PCB 024/027																																				
PCB 025							0	U	0.02	LOQ	0	U	0	U	0	U	0.16		0.12		0.019	UJ	R1		0	U	0	U	0	U	0.16		0	U	0.051	Q
PCB 026							0.026		0	U	0	U	0.015		0.018	Q	0.12		0.063		0.18	J	R1		0.042		0.018	Q	0.094		0.14		0.074		0.062	
PCB 027							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.011	UJ	R1		0	U	0	U	0	U	0	U	0	U	0	U
PCB 028							0.09		0	U	0	U	0.052		0.076		0.39		0.23		0.34	J	R1		0.25		0.091		0.67		0.74		0.39		0.31	
PCB 028/031	11		1.9		1.9																															
PCB 029							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0092	UJ	R1		0	U	0	U	0	U	0.025	Q	0.011	Q	0	U
PCB 031							0.14		0	U	0.032	T	0.059		0.084		0.3		0.2		0.55	J	R1		0.23		0.13		1.3	J	0.66		0	U	0.28	
PCB 033							0.072		0	U	0	U	0.036		0.046		0.27		0.084		0.17	J	R1		0.14		0.053		0.28		0.37		0.21		0.19	
PCB 037/042							0.058		0.15		0.015	T	0.027		0.018	Q	0.064		0.055		0.03	QJ	R1		0.086		0.041		0.24		0.19		0.12		0.15	
PCB 040							0.014		0	U	0	U	0	U	0	U	0	U	0	U	0.0051	UJ	R1		0.013	Q	0.0076	Q	0.038		0.039		0.022		0.027	
PCB 041/064/071																																				
PCB 043																																				
PCB 044							0.11	V	0	U	0.013	T	0.046		0.028		0.15		0.049		0.02	QJ	R1		0.073		0.037		0.23		0.22		0.12		0.11	
PCB 045							0.024		0	U	0.017	T	0.022		0	U	0	U	0	U	0.017	QJ	R1		0.051		0.009	Q	0.22		0.23		0.15		0.096	
PCB 046							0	U	0	U	0	U	0	U	0	U	0.35		0	U	1.1	J	R1		0.27		0.028	Q	0.46		0.021	Q	0	U	0.027	Q
PCB 047							0.033		0	U	0	U	0	U	0.076		0	U	0	U	0.018	QJ	R1		0.048		0.031		0.16		0.057		0.095		0.073	
PCB 048							0.076	V	0	U	0	U	0	U	0.05		0.5		2.2		1.4	J	R1		0	U	0	U	0	U	0	U	0	U	0	U
PCB 047/048																																				
PCB 049							0.05		0	U	0	U	0.038		0.035	Q	0.15		0.15		0.17	J	R1		0.087		0.045		0.31		0.24		0.14		0.12	
PCB 051																																				
PCB 052							0.066		0	U	0	U	0	U	0.053		0	U	0	U	0.016	UJ	R1		0.11	J	0.07	J	0	U	0.4		0.14		0.16	
PCB 053							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.012	UJ	R1		0	U	0	U	0	U	0	U	0	U	0	U
PCB 056							0.046		0	U	0	U	0.036		0.037	Q	0.071	Q	0	U	0.028	UJ	R1		0.098		0.055	Q	0.43		0.32		0.15		0.12	
PCB 059							0.0085		0	U	0	U	0	U	0	U	0.0091	Q	0	U	0.0066	UJ	R1		0.0081	Q	0.0074	Q	0.1		0.011	Q	0	U	0.014	Q
PCB 060/092							0	U	0	U	0	U	0	U	0	U	0.054		0	U	0.025	QJ	R1		0	U	0	U	0	U	0	U	0	U	0	U
PCB 056/060	2.7		0.48		0.48																															
PCB 063							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0079	UJ	R1		0	U	0	U	0	U	0	U	0	U	0	U
PCB 064/041							0.033		0	U	0	U	0	U	0.013	Q	0.14		0	U	0.012	UJ	R1		0.044		0.024	Q	0.12		0	U	0	U	0.078	
PCB 066/095							0.059		0	U	0.01	T	0.052		0.055		0.26		0.14		0.089	J	R1		0.13		0.064		0.42		0.39		0.25		0.21	
PCB 070							0.046		0.0067	LOQ	0.0055	T	0	U	0.038		0.18		0.096		0.13	J	R1		0.13		0.049		0.46		0.29		0.14		0.15	
PCB 070/076																																				

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	OB004147P		OB004149P		OB004150P		SW050002		SW050003		SW050004		SW050005		SW050006		SW050007		SW050008		SW050008			SW050009		SW050010		SW050011		SW050012		SW050013		SW050014	
Sample Date	4/4/90		4/19/90		4/19/90		9/27/00		1/29/00		1/18/01		3/27/01		4/8/01		4/13/01		4/17/01		4/17/01			4/30/01		5/1/01		5/11/01		5/22/01		5/23/01		5/30/01	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended			Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 071							0.022		0	U	0	U	0.016		0.0084	Q	0.2		0.038		0.036	J	R1	0.033		0.015	Q	0.074		0.055		0.029		0.053	
PCB 074							0.034		0	U	0	U	0.032		0.0048	Q	0	U	0	U	0.0042	UJ	R1	0.031		0.034		0.11		0.1		0.056		0.088	
PCB 076							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0036	UJ	R1	0.091		0	U	0.25		0.078		0.087		0.063	
PCB 077/110	2.9		0.53		0.53		0.034		0	U	0	U	0.033		0.036	Q	0.14		0.032	Q	0.068	J	R1	0.085		0.045	Q	0.24		0.2		0.11		0.095	
PCB 081																																		
PCB 082							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.011	UJ	R1	0	U	0	U	0.02	Q	0.015	Q	0	U	0.025	Q
PCB 083																																		
PCB 084							0.014		0.0084	LOQ	0	U	0	U	0.0066	Q	0.019	Q	0	U	0.0064	UJ	R1	0	U	0	U	0.048		0	U	0	U	0	U
PCB 084/092																																		
PCB 085							0	U	0	U	0	U	0	U	0	U	0.019		0.01	Q	0.0082	QJ	R1	0.017		0.011	Q	0.055		0.038		0.021		0.016	
PCB 087																																		
PCB 087/081							0.018		0	U	0	U	0.027		0.014	Q	0.04	Q	0.02	Q	0.024	QJ	R1	0.022	Q	0.017	Q	0.06		0.048		0.028	Q	0.028	Q
PCB 089																																		
PCB 091							0	U	0	U	0	U	0	U	0	U	0.016	Q	0.0099	Q	0.0078	UJ	R1	0	U	0	U	0	U	0	U	0	U	0.078	
PCB 097							0.0076		0	U	0	U	0.012		0.009	Q	0.036		0.018		0.026	J	R1	0.024		0.011		0	U	0	U	0	U	0.022	
PCB 099							0.018		0	U	0	U	0.012		0.01	Q	0.046		0.042		0.05	J	R1	0.028	Q	0.022	Q	0.089		0.074		0.04		0.039	
PCB 100																																		
PCB 101	1.2		0.27		0.25																													
PCB 101/090							0.023		0	U	0	U	0.027		0.018	Q	0.087		0.068		0.087	J	R1	0.037		0.027	Q	0.11		0.1		0.056		0.057	
PCB 105							0	U	0	U	0.012	T	0	U	0	U	0	U	0.013	Q	0.015	QJ	R1	0	U	0	U	0	U	0.036		0.022	Q	0	U
PCB 105/132/153																																		
PCB 107							0	U	0	U	0	U	0	U	0	U	0.014	Q	0	U	0.011	UJ	R1	0	U	0	U	0.012	Q	0.013	Q	0	U	0	U
PCB 114							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0061	UJ	R1	0.022		0.011	Q	0	U	0.028		0.013	Q	0	U
PCB 114/134																																		
PCB 118	1		0.21		0.19		0.014		0	U	0	U	0.012		0.019	Q	0.073		0.029		0.039	J	R1	0.046		0.021		0.093		0.096		0.052		0.053	
PCB 119							0	U	0	U	0	U	0	U	0	U	0.0055	Q	0	U	0.0051	UJ	R1	0	U	0	U	0.0078	Q	0.013	Q	0.013	Q	0.0064	Q
PCB 124/135/144/147																																		
PCB 128							0	U	0	U	0	U	0.017		0	U	0.019	Q	0	U	0.016	UJ	R1	0	U	0	U	0.024	Q	0.02	Q	0	U	0	U
PCB 129/178																																		
PCB 130																																		
PCB 131																																		
PCB 132/168							0.039		0	U	0	U	0	U	0.077		0.031	Q	0	U	0.014	UJ	R1	0.041	Q	0.035	Q	0.21		0.041	Q	0.023	Q	0.087	
PCB 135/144							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.022	UJ	R1	0	U	0	U	0.03	Q	0.023	Q	0	U	0	U
PCB 136							0	U	0	U	0	U	0	U	0	U	0.014	Q	0.007	Q	0.0075	QJ	R1	0.012	Q	0	U	0.017	Q	0.014	Q	0.0089	Q	0.0073	Q
PCB 137							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.01	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137/176																																		
PCB 138/158/163																																		
PCB 138/163	1.2		0.2		0.18		0.021		0	U	0	U	0	U	0.019	Q	0.085		0.046	Q	0.066	J	R1	0.035	Q	0.028	Q	0.19		0.066		0.048	Q	0.045	Q
PCB 141							0	U	0	U	0	U	0	U	0	U	0.013	Q	0	U	0.0094	QJ	R1	0.011	Q	0	U	0.021	Q	0.014	Q	0	U	0	U
PCB 146							0	U	0	U	0	U	0.0094		0	U	0.017	Q	0.013	Q	0.016	QJ	R1	0	U	0	U	0.081		0.023		0.01	Q	0.012	Q
PCB 149	0.53		0.13		0.12																													
PCB 149/123							0.014		0	U	0	U	0	U	0.021	Q	0.058		0.036	Q	0.046		R1	0.028	Q	0.017	Q	0.059		0.058		0.032	Q	0.034	Q
PCB 151							0	U	0	U	0	U	0	U	0	U	0.023	Q	0.013	Q	0.018	Q	R1	0	U	0	U	0.023	Q	0.016	Q	0	U	0	U
PCB 153/184							0.021		0	U	0	U	0.03		0.018	Q	0.069		0.052		0.062		R1	0.092		0.022	Q	0.13		0.082		0.044	Q	0.041	Q
PCB 156/171							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 156/171/202																																		
PCB 157/200																																		
PCB 157							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 158							0	U	0	U	0	U	0	U	0	U	0.011	Q	0	U	0	U	R1	0.012	Q	0	U	0.066		0.013	Q	0	U	0	U

Table H-6. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended)

Sample Name	OB004147P		OB004149P		OB004150P		SW050002		SW050003		SW050004		SW050005		SW050006		SW050007		SW050008		SW050008			SW050009		SW050010		SW050011		SW050012		SW050013		SW050014	
Sample Date	4/4/90		4/19/90		4/19/90		9/27/00		11/29/00		1/18/01		3/27/01		4/8/01		4/13/01		4/17/01		4/17/01			4/30/01		5/1/01		5/11/01		5/22/01		6/23/01		5/30/01	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended			Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 167							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 169							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170							0	U	0	U	0	U	0	U	0	U	0.022	Q	0.014	Q	0.018	Q	R1	0	U	0	U	0.023	Q	0.019	Q	0.014	Q	0	U
PCB 172							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170/190																																		
PCB 172/197																																		
PCB 173																																		
PCB 174							0	U	0	U	0	U	0	U	0	U	0.017	Q	0	U	0.018	Q	R1	0.017	Q	0	U	0.03	Q	0.03	Q	0	U	0.014	Q
PCB 175																																		
PCB 176							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 178/126							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 180	0.61		0.8		0.08		0	U	0	U	0	U	0	U	0	U	0.034	Q	0.032	Q	0.037	Q	R1	0.023	QJ	0	U	0.049	Q	0.045	Q	0.026	Q	0.022	Q
PCB 182/187							0	U	0	U	0	U	0	U	0	U	0.03	Q	0.024	Q	0.031	Q	R1	0	U	0	U	0.044	Q	0.022	Q	0.028	Q	0.02	Q
PCB 183							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 185							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 189							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 190							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 191																																		
PCB 193																																		
PCB 194							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0.019	QJ	0	U	0	U	0	U	0	U	0	U
PCB 195							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 195/208																																		
PCB 196/203																																		
PCB 197							0	U	0	U	0	U	0.034		0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 198																																		
PCB 199							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 201							0	U	0	U	0	U	0	U	0	U	0.015	Q	0.017	Q	0.02	Q	R1	0	U	0	U	0.039	Q	0.036	Q	0.021	Q	0.015	Q
PCB 202							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 203/196							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0.054	Q	0.039	Q	0.032	Q	0	U
PCB 205																																		
PCB 206							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.02	Q	R1	0	U	0	U	0	U	0.019	Q	0	U	0	U
PCB 207																																		
PCB 208							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209							0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.026	Q	R1	0	U	0	U	0.034	Q	0.035	Q	0	U	0	U
Total Suspended PCBs (by congener sum) =	21.14		4.52		3.73		1.87		0.20		0.12		1.00		2.58		14.46		12.45		17.78			4.70		1.58		13.28		12.65		4.26		3.89	
Total Congeners Analyzed (Susp) =	8		8		8		91		91		91		91		91		91		91		91			91		91		91		91		91		91	
Total Congeners Detected (Susp) =	8		8		8		39		5		8		28		34		49		35		71			45		37		52		57		41		46	
Reported TPCBs (Susp) =	69.75		13.62		13.36		1.9																											

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	89GH6RI01		89GH6RI02		89GH6RI03		89GH6RI04		89GH6RI05		89GH6RI06		89GH6RI07		89GH6RI08		89GH6RI09		89GH6RI10		89GH6RI11		89GH6RI12		89GH6RI13		89GH6RI14		89GH6RI15		89GH6RI16		89GH6RI17		89GH6RI18		89GH6RI19		89GH6RI20		89GH6RI21	
Sample Date	1/19/89		4/13/89		4/19/89		4/19/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/13/89		6/21/89		6/28/89		7/5/89		7/12/89		7/20/89		7/25/89		7/31/89		8/9/89		8/14/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0.8391		0.2295		0.161		1.0111		0.0065		0.0544		0.0346		0.132		0.0652		0.01		0.0852		0.0855		0.0411		0.0463		0.0452		0.0714		0.0246		0.0391		0.0212		0	U	0.0309	
PCB 003	0.0482		0.0329		0.1455		0.3081		0.0531		0.0523		0	U	0.3851		0	U	0.0482		0	U	0	U	0	U	0	U	0	U	0.0841		0.0324		0.1049		0.0546		0	U	0	U
PCB 004																																										
PCB 004/010	0.1145		0.0813		0.0212		0.1547		0.1338		0.1599		0.157		0.1683		0.1768		0.1574		0.0781		0.1664		0.1881		0.2434		0.1803		0.1748		0.1814		0.1899		0.1928		0.1679		0.2157	
PCB 005																																										
PCB 005/008	0.7403		0.435		0.1337		1.8624		1.0425		1.3985		1.4069		1.4239		1.1927		0.5204		0.6535		1.1508		1.0422		1.4143		1.0629		1.0803		1.0045		1.0648		1.1994		1.0247		1.1733	
PCB 006	0.1172		0.1072		0.0102		0.2111		0.1215		0.168		0.1718		0.2339		0.2138		0.0719		0.1328		0.2339		0.1759		0.3177		0.175		0.1959		0.2215		0.2082		0.2746		0.2108		0.2704	
PCB 007	0.0044		0.0052		0.0041		0.0679		0.017		0.0245		0.0218		0.0314		0.0251		0.0133		0.013		0.0275		0.0195		0.0248		0.0193		0.0198		0.0182		0.0187		0.0257		0.0186		0.0264	
PCB 008																																										
PCB 012/013	0	U	0.0267		0	U	0.0302		0.0041		0.0347		0.0272		0.0368		0.0129		0.0168		0.0077		0.0085		0	U	0.0189		0	U	0.0112		0.0168		0.0081		0.0239		0.0212		0.0141	
PCB 016/032	0.2806		0.1874		0.0453		1.0817		1.0025		1.3182		1.1431		1.4471		1.1756		0.5479		0.6207		1.1207		1.4337		1.7881		1.1791		1.2483		1.2413		1.1658		1.4753		1.2514		1.3071	
PCB 017	0.2329		0.1477		0.0194		0.6236		0.5511		0.8245		0.7404		0.8626		0.7491		0.3365		0.3918		0.6903		1.0061		1.1084		0.8471		0.838		0.8639		0.8334		1.0247		0.8697		0.9973	
PCB 018	0.3071		0.2213		0.041		1.0071		1.0969		1.9845		1.6258		1.3536		1.3145		0.5383		0.6091		1.1538		1.5581		1.9748		1.2911		1.5397		1.4454		1.4811		1.7244		1.4883		1.6762	
PCB 019	0.0593		0.0256		0.0064		0.0829		0.0561		0.0753		0.0715		0.1268		0.1218		0.0308		0.0559		0.1097		0.1484		0.1973		0.15		0.176		0.1256		0.1648		0.1732		0.1399		0.1774	
PCB 021	0.1172		0	U	0	U	0.0107		0	U	0	U	0.0011		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0011		0	U	0	U	0	U	0	U	0	U
PCB 022	0.1337		0.0993		0.0271		0.7736		0.5084		0.6854		0.5786		0.7831		0.5697		0.3191		0.3483		0.5431		0.7354		0.8817		0.5918		0.6145		0.6183		0.6077		0.7683		0.6474		0.6776	
PCB 024																																										
PCB 024/027	0.0408		0.0301		0.0058		0.1045		0.084		0.1013		0.0962		0.1438		0.1172		0.0534		0.0713		0.1368		0.1751		0.1973		0.1527		0.1477		0.1685		0.1486		0.1986		0.1657		0.1918	
PCB 025	0.0302		0.0459		0.0179		0.191		0.1545		0.2204		0.2221		0.2746		0.253		0.1375		0.1743		0.2375		0.2223		0.3145		0.2055		0.2809		0.2931		0.2232		0.317		0.3089		0.3193	
PCB 026	0.1283		0.0633		0.0092		0.325		0.271		0.4469		0.4476		0.4857		0.4228		0.2193		0.2688		0.3761		0.4496		0.5747		0.4129		0.3637		0.4992		0.3812		0.5547		0.5053		0.5694	
PCB 027																																										
PCB 028																																										
PCB 028/031	0.6647		0.5252		0.1059		2.8032		1.9515		2.611		2.4351		3.001		2.3613		1.3778		1.5787		2.3442		2.8029		3.4294		2.4345		2.5919		2.6156		2.5551		3.1698		2.6719		2.9818	
PCB 029	0.0033		0	U	0.0006		0.0268		0.0052		0.0209		0.0176		0.0416		0.0365		0.022		0.0054		0	U	0.0218		0	U	0.0512		0.0061		0.0388		0.0476		0.0137		0.0137		0.0135	
PCB 031																																										
PCB 033	0.3679		0.1099		0.0436		0.8217		0.665		0.9345		0.7601		0.7995		0.7778		0.5349		0.3183		0.5307		0.7017		0.8909		0	U	0.64		0.64		0.6159		0.8347		0.6809		0.7001	
PCB 037/042	0.0577		0.0977		0.0144		0.4156		0.2698		0.372		0.3307		0.3824		0.2978		0.2138		0.1857		0.2664		0.3428		0.4301		0.3067		0.3142		0.3486		0.2967		0.3912		0.3527		0.3554	
PCB 040	0.049		0.0228		0.0026		0.2033		0.1368		0.168		0.1426		0.199		0.1582		0.096		0.1038		0.1515		0.1908		0.2377		0.1709		0.1803		0.1873		0.1648		0.2075		0.1876		0.193	
PCB 041/064/071	0.1229		0.0902		0.0251		0.8723		0.444		0.5929		0.4968		0.6119		0.5433		0.3423		0.3546		0.5253		0.6571		0.8061		0.5211		0.6288		0.6369		0.5781		0.7297		0.622		0.6582	
PCB 043	0.0055		0.0136		0	U	0.0669		0.0791		0.1026		0.0702		0.0352		0.0648		0.0566		0.0485		0.0528		0.0433		0.0519		0.0434		0.081		0.0599		0.0732		0.0745		0.0555		0.0591	
PCB 044	0.1462		0.1395		0.0363		0.8563		0.5424		0.7226		0.6021		0.7735		0.6478		0.3974		0.4323		0.6106		0.7467		0.9156		0.67		0.7262		0.7341		0.6869		0.837		0.7681		0.7745	
PCB 045	0.0651		0.0347		0.0047		0.1793		0.1375		0.1655		0.1501		0.1846		0.1596		0.0838		0.0916		0.1481		0.2065		0.2491		0.1748		0.191		0.1897		0.1742		0.2109		0.1903		0.2017	
PCB 046	0.0109		0.011		0.0045		0.0878		0.0655		0.087		0.0704		0.1009		0.0856		0.0424		0.0522		0.0799		0.0976		0.1273		0.0893		0.099		0.0978		0.0954		0.1078		0.0927		0.0996	
PCB 047																																										
PCB 048																																										
PCB 047/048	0.0767		0.0873		0.0303		0.6071		0.3203		0.4436		0.3144		0.4535		0.378		0.2447		0.2762		0.3861		0.3879		0.4663		0.3427		0.4516		0.4037		0.3976		0.4704		0.4491		0.4291	
PCB 049	0.0895		0.0946		0.0055		0.2954		0.3915		0.5601		0.4186		0.2546		0.4592		0.311		0.3463		0.4688		0.4802		0.5874		0.4313		0.5516		0.5034		0.499		0.5624		0.523		0.5287	
PCB 051	0	U	0.0135		0.0331		0.0671		0.0347		0.0432		0.0365		0.053		0.0429		0.0294		0.0304		0.0471		0.0526		0.061		0.0564		0.0524		0.0453		0.039		0.0498		0.0524		0.0541	
PCB 052	0.236		0.1724		0.0339		0.7253		0.4911		0.688		0.5679		0.6337		0.5786		0.4041		0.4257		0.5831		0.6		0.741		0.5486		0.6315		0.6062		0.5775		0.6957		0.6484		0.651	
PCB 053	0	U	0.0256		0.0075		0.1737		0.1062		0.1364		0.1137		0.1743		0.113		0.0562		0.0945		0.1385		0.1676		0.1987		0.1396		0.1845		0.1572		0.1734		0.172		0.1628		0.1806	
PCB 056																																										
PCB 059																																										
PCB 060/092	0.0938		0.0503		0.0213		0.8738		0.2294		0.3044		0.2271		0.3596		0.2574		0.1612		0.1768		0.2114		0.2997		0.3663		0.2631		0.298		0.3191		0.2815		0.3618		0.3099		0.2849	
PCB 056/060																																										
PCB 063	0.0071		0.0065		0.0007		0.0477		0.0195		0.0234		0.0284		0.0523		0.0287		0.0155		0.0276		0	U	0.033		0.0495		0.0289		0.0386		0.0369		0.0389		0.0384		0.0425		0.0369	
PCB 064/041																																										
PCB 066/095	0.1992		0.1372		0	U	1.346		0.4392		0.6424		0	U	0.7605		0.4962		0.3769		0.4013		0.506		0.6021		0.7939		0.5372		0.6445		0.6552		0.5706		0.7019		0.6606		0.6249	
PCB 070																																										
PCB 070/076	0.1342		0.093		0.0406		1.1346		0.3787		0.5427		0.9885		0.6273		0.4184		0.2823		0.3221		0.3996		0.4989		0.6863		0.4475		0.509		0.537		0.4699		0.5738		0.5299		0.5022	
PCB 071																																										
PCB 074	0.0615		0.0421		0.0081		0.4326		0.1464		0.1981		0.1623		0.2401		0.1479		0.1143		0.1346		0.1849		0.2033		0.2755		0.1845		0.2001		0.207		0.1823		0.2002		0.1878		0.1865	
PCB 076																																										
PCB 077/110	0.0754		0.0428		0.0236		0.3224		0.119		0.168		0.1149		0.1764		0.1313		0.1165		0.1226		0.1247		0.1399		0.1847		0.1362		0.1604		0.1991		0.1396		0.1931		0.1797		0.1631	
PCB 081	0.0119		0.0118		0.0032		0.0052		0.0027		0.0065		0.0053		0.0045		0.0024		0.0024		0.0035		0.0038		0.0022		0.0015		0.0058		0.0041		0.0052		0.0033		0.0066		0.0074		0.006	
PCB 082	0.0085		0.0038		0	U	0.0729		0.0131		0.0239		0.0146		0.0166		0.0151		0.0089		0.0188		0.0151		0.0159		0.0204		0.0146		0.0182		0.0167		0.0188		0.019		0.0196		0.0174	
PCB 083	0	U	0	U	0	U	0.016		0.0061		0.0092		0.0038		0.005		0.003		0.006		0.0047		0.009		0.0059		0.0073		0.0064		0.0062		0.0062		0.0091		0.0078		0.0068		0.0066	
PCB 084																																										
PCB 084/092	0.0106		0.0189		0.0216		0.2111		0.0938		0.1339		0.1079		0.1191		0.1006		0.0966		0.0995		0.1181		0.1149		0.1095		0.11		0.1403		0.1171		0.1343		0.1421		0.1211		0.1249	
PCB 085	0.0074		0.0045		0.0042		0.0931		0.0193		0.0254		0.0105		0.0297		0.0225		0.0156		0.0198		0.022		0.0237		0.032		0.0224		0.0309		0.0297		0.0273		0.0309		0.0299		0.0263	
PCB 087	0.0373		0.0197		0.0128		0.1266		0.0238		0.0173		0.0154		0.0509		0.0407		0.0182		0.04		0.0426		0.043		0.0567		0.0419		0.0545		0.0532		0.0489		0.0591		0.056		0.0491	
PCB 087/081																																										
PCB 089	0.0276		0	U	0	U	0.0139		0.0062		0.0098		0.0093		0.0113		0.0087		0.007		0.0032		0	U	0.0043		0.0043		0.0035		0.0071		0.0051		0.0051		0.0074		0.0043		0.0056	
PCB 091	0.0027		0.0046		0.0089		0.0864		0.02		0.0396		0.0421		0.0504		0.037		0.0256		0.0225		0.0158		0.0289		0.0509		0.0265		0.0394		0.0322		0.0384		0.037		0.034		0.0431	

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	89GH6RI01		89GH6RI02		89GH6RI03		89GH6RI04		89GH6RI05		89GH6RI06		89GH6RI07		89GH6RI08		89GH6RI09		89GH6RI10		89GH6RI11		89GH6RI12		89GH6RI13		89GH6RI14		89GH6RI15		89GH6RI16		89GH6RI17		89GH6RI18		89GH6RI19		89GH6RI20		89GH6RI21	
Sample Date	1/19/89		4/13/89		4/19/89		4/19/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/13/89		6/21/89		6/28/89		7/5/89		7/12/89		7/20/89		7/25/89		7/31/89		8/9/89		8/14/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 097	0.0428		0.014		0.0096		0.0908		0.0263		0.0404		0.0361		0.0453		0.0379		0.0254		0.0356		0.0406		0.0417		0.0546		0.0369		0.0501		0.0497		0.0425		0.0489		0.0496		0.0426	
PCB 099	0.0309		0.012		0.0066		0.1185		0.0412		0.0666		0.0483		0.0565		0.045		0.0412		0.0425		0.0458		0.0454		0.0595		0.0422		0.0569		0.0561		0.0491		0.0571		0.0593		0.0506	
PCB 100	0.0073		0	U	0.0136		0.0325		0.0182		0.029		0.0264		0.0283		0.0187		0.0216		0.0135		0.0149		0.022		0.033		0.0187		0.0295		0.0264		0.0232		0.0276		0.028		0.0223	
PCB 101	0.0568		0.036		0.0214		0.2042		0.077		0.1111		0.0858		0.1069		0.0861		0.0758		0.081		0.0881		0.0947		0.1367		0.0903		0.1052		0.1052		0.0941		0.1191		0.1141		0.1031	
PCB 101/090																																											
PCB 105																																											
PCB 105/132/153	0.0708		0.0472		0.0223		0.7206		0.0768		0.1382		0.0844		0.0736		0.0829		0.0813		0.0798		0.1067		0.0654		0.0794		0.0617		0.0976		0.075		0.0767		0.0805		0.0873		0.0714	
PCB 107	0.099		0	U	0.0049		0.0228		0.0183		0.0136		0.007		0.0088		0.0152		0.016		0.0089		0.0061		0.0103		0.0153		0.0077		0.0154		0.0142		0.0088		0.0096		0.0134		0.0098	
PCB 114																																											
PCB 114/134	0	U	0	U	0	U	0.0283		0.0073		0.0128		0.0106		0.0211		0.0116		0.0134		0	U	0.0093		0.0065		0	U	0.0055		0.0164		0	U	0	U	0.0068		0.0078		0.0074	
PCB 118	0.1232		0.0145		0.007		0.1939		0.0424		0.0756		0.0443		0.0419		0.0485		0.0362		0.0411		0.049		0.0452		0.0583		0.0408		0.0612		0.0536		0.0501		0.0522		0.0548		0.0514	
PCB 119	0.0129		0	U	0	U	0.0142		0.0094		0.0056		0.0033		0.0181		0.0074		0.0054		0.0109		0.0039		0.008		0.012		0.0072		0.0041		0.0128		0.0075		0.0132		0.0071		0.0062	
PCB 124/135/144/147	0.0114		0.0076		0.0027		0.0788		0.0174		0.0079		0.0026		0.0079		0.013		0.0187		0.0182		0.0215		0.0063		0.0133		0.0062		0.0134		0.0105		0.0105		0.0116		0.0124		0.0104	
PCB 128	0.0098		0	U	0.0005		0.0254		0.0111		0.0064		0.0034		0.009		0.0053		0.0039		0.0048		0	U	0.0038		0.0055		0.0032		0.0068		0.0052		0.0053		0.0048		0.0053		0.0042	
PCB 129/178	0.0078		0	U	0.0016		0.103		0.004		0.0054		0.0041		0.005		0.0045		0.0063		0.0041		0.006		0.0026		0.0045		0.0023		0.0056		0.0035		0.0047		0.0037		0.0033		0.0033	
PCB 130	0.0014		0	U	0	U	0.0115		0.0082		0.0101		0.0058		0.0044		0.0061		0.0043		0.0084		0	U	0.0044		0.0078		0	U	0.01		0.0103		0.0078		0.0081		0.0091		0.0073	
PCB 131	0.0053		0.0011		0	U	0.0057		0.0008		0.001		0.0018		0	U	0.0034		0.0048		0.0412		0	U	0.0074		0	U	0	U	0.0065		0	U	0.0715		0.0004		0.0004		0.0006	
PCB 132/168																																											
PCB 135/144																																											
PCB 136	0.0459		0.0106		0.0028		0.0475		0	U	0.0315		0	U	0	U	0	U	0	U	0.0065		0	U	0	U	0.0311		0	U	0	U	0.026		0.0083		0.0245		0	U	0.022			
PCB 137																																											
PCB 137/176	0.0059		0	U	0.0003		0.0433		0.0018		0.002		0.0018		0.0016		0.0022		0.0027		0.0016		0.0011		0	U	0.0021		0	U	0.0022		0.0022		0.0015		0.0014		0.0015		0.0012	
PCB 138/158/163	0	U	0	U	0.0233		0.3601		0.0701		0.1712		0.142		0.0473		0.0618		0.0691		0.0554		0.2641		0	U	0.0691		0	U	0.0744		0.0546		0.0758		0.0528		0.0579		0.045	
PCB 138/163																																											
PCB 141	0.0144		0.0103		0.0036		0.1511		0.008		0	U	0.0113		0	U	0.0068		0.0116		0.0087		0.0166		0.0057		0.0085		0.006		0.0102		0	U	0.0092		0.0077		0	U	0.0069	
PCB 146	0.0433		0.01		0.0072		0.0629		0.0221		0.0492		0.0224		0.0229		0.0298		0.0247		0.0332		0.0292		0.0011		0.0046		0.0011		0.0468		0.0775		0.06		0.0225		0.0261		0.0239	
PCB 149	0.0828		0.0285		0.0134		0.3126		0.0385		0.0541		0.0384		0.0299		0.0399		0.0487		0.0377		0.0589		0.032		0.0459		0.0311		0.0482		0.0361		0.0426		0.0422		0.0453		0.0349	
PCB 149/123																																											
PCB 151	0.0478		0.0123		0.0067		0.1729		0.0139		0.0209		0.0168		0.0118		0.0148		0.0181		0.0165		0.0267		0.0123		0.0191		0.0129		0.0187		0.013		0.0175		0.0156		0.0168		0.0137	
PCB 153/184																																											
PCB 156/171																																											
PCB 156/171/202	0.0144		0	U	0.002		0.1249		0.0056		0.0112		0.0064		0.0054		0.0055		0.0061		0.0063		0.0084		0.0046		0.0024		0.0014		0.008		0.0064		0.0076		0.005		0.0064		0.0051	
PCB 157/200	0.0691		0	U	0	U	0.062		0	U	0	U	0	U	0	U	0	U	0.0002		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 157																																											
PCB 158																																											
PCB 167	0.0125		0	U	0	U	0.0046		0.0018		0.0014		0.0012		0.0017		0.0019		0.0003		0.0011		0	U	0	U	0	U	0	U	0.0013		0.0007		0.0004		0.0007		0	U	0	U		
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																											
PCB 172																																											
PCB 170/190	17.7493		0.4024		0.0181		0.3507		0	U	0	U	0	U	0.0193		0	U	0	U	0.0868		0	U	0.0048		0.0254		0.0019		0.0409		0.0206		0	U	0.0102		0.0098		0.0071			
PCB 172/197	0.0517		0	U	0	U	0.0602		0.0041		0.0057		0.0002		0.0019		0	U	0.0008		0.0006		0.0059		0	U	0.0018		0	U	0.0037		0.0012		0.0016		0.0024		0	U	0	U		
PCB 173	0	U	0	U	0	U	0.0049		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.228		0.0088		0.0046		0.2857		0.0015		0.0148		0.01		0.0079		0.0088		0.0043		0.0084		0.0135		0.0087		0.011		0.0072		0.0119		0.0138		0.0106		0.0115		0.0113		0.0091	
PCB 175	0.0172		0	U	0	U	0.0181		0.0037		0.0019		0.0017		0	U	0.0031		0.0044		0	U	0	U	0.0015		0	U	0	U	0	U	0.004		0	U	0	U	0.0038		0.0017			
PCB 176																																											
PCB 177	0.0505		0.0046		0.0009		0.0795		0.0053		0.0086		0.0052		0.0031		0.0054		0.0085		0.0054		0.0053		0.0046		0.0071		0.0045		0.0076		0.0097		0.0066		0.0054		0.0063		0.0047	
PCB 178/126																																											

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	89GH6RI01		89GH6RI02		89GH6RI03		89GH6RI04		89GH6RI05		89GH6RI06		89GH6RI07		89GH6RI08		89GH6RI09		89GH6RI10		89GH6RI11		89GH6RI1289GH6RI13		89GH6RI14		89GH6RI15		89GH6RI16		89GH6RI17		89GH6RI1889GH6RI1989GH6RI2089GH6RI21					
Sample Date	1/19/89		4/13/89		4/19/89		4/19/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/13/89		6/21/89		6/28/89		7/5/89		7/12/89		7/20/89		7/25/89		7/31/89		8/9/89		8/14/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 180	0.057		0.0166		0.0062		0.6863		0.0134		0.0245		0.0172		0.0176		0.0181		0.0225		0.0305		0.0273		0.0134		0.0248		0.0132		0.0252		0.0223		0.0205		0.021		0.021		0.0129	
PCB 182/187	0	U	0.0118		0.0071		0.4169		0.0133		0.0196		0.0138		0.0135		0.0146		0.0183		0.0157		0.0249		0.0097		0.0158		0.0105		0.0174		0.0123		0.0144		0.0137		0.0131		0.01	
PCB 183	0.0456		0.0055		0.0028		0.23		0.0081		0.0103		0.0066		0.0067		0.0072		0.0085		0.0076		0.0106		0.0055		0.0087		0.0049		0.0095		0.0086		0.0082		0.0083		0.0065		0.008	
PCB 185	0	U	0	U	0.0023		0.0646		0.0027		0.0032		0.0008		0.0021		0.0028		0.0045		0.0046		0	U	0	U	0	U	0	U	0.0026		0.0013		0.0064		0.0013		0	U	0	U
PCB 189	0.0356		0	U	0	U	0.0064		0.0002		0.0016		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0014		0	U	0.001		0	U	0	U
PCB 190																																											
PCB 191	0	U	0	U	0	U	0.0156		0	U	0	U	0	U	0	U	0	U	0.0008		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0148		0	U	0	U	0.0445		0.004		0.0024		0.0031		0.0006		0.0005		0.0039		0	U	0	U	0	U	0	U	0	U	0.002		0.0013		0.001		0.0008		0	U	0	U
PCB 194	0.0183		0	U	0	U	0.2059		0.0026		0.0035		0.0024		0.001		0.008		0.0021		0.0017		0.0036		0.0013		0.002		0.0013		0.0028		0.0025		0.0027		0.0012		0.0033		0.0014	
PCB 195									-																																	
PCB 195/208	0.099		0	U	0.0012		0.2362		0.0022		0.0067		0.0038		0.0035		0.0045		0.0025		0.0035		0.0058		0.003		0.0057		0.0024		0.0063		0.0046		0.0052		0.005		0.0038		0.0032	
PCB 196/203	0.299		0	U	0.0012		0.4635		0.0059		0.0107		0.0052		0.0015		0.0065		0.0084		0.0066		0.0222		0.0053		0.0088		0.0044		0.0114		0.0102		0.0084		0.0101		0.0024		0.0049	
PCB 197																																										
PCB 198	0.2639		0	U	0	U	0.0191		0.0003		0.0011		0.0005		0.0035		0	U	0.0008		0	U	0	U	0	U	0	U	0	U	0	U	0.0101		0	U	0.051		0	U	0	U	0	U
PCB 199	0.013		0	U	0.001		0.0277		0.0014		0.0068		0.0092		0.0014		0.0007		0.0026		0.0011		0	U	0	U	0.0006		0	U	0.0024		0.0009		0.0013		0.0013		0	U	0.0006	
PCB 201	0.262		0	U	0	U	0.4069		0.0055		0.011		0.0063		0	U	0.0041		0.0081		0.0089		0.009		0.0053		0.0336		0.0049		0.0102		0.0446		0.0184		0.0135		0.0071		0.0062	
PCB 202																																										
PCB 203/196																																										
PCB 205	0.0158		0	U	0	U	0.0147		0.0006		0.0006		0	U	0	U	0	U	0.0005		0.0007		0	U	0	U	0	U	0	U	0.0008		0	U	0.0002		0	U	0.0003		0.0002	
PCB 206	0.053		0	U	0.0004		0.1242		0.0072		0.0112		0.0028		0.0022		0.0025		0.0038		0.0016		0.0022		0.0017		0.0039		0.0018		0.0054		0.0025		0.0031		0.0027		0.0045		0.003	
PCB 207	0.0613		0	U	0	U	0.0133		0.0048		0	U	0	U	0	U	0	U	0	U	0.0003		0.0065		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 208																																										
PCB 209	0.036		0.0037		0.0002		0.0022		0.0001		0.0014		0.0006		0.0008		0.0011		0.0002		0.0016		0	U	0.0084		0	U	0	U	0.0034		0	U	0	U	0	U	0.0005		0.0012		0.002	
Total Dissolved PCBs (by congener sum) =	**25.96**		**4.27**		**1.34**		**27.60**		**12.87**		**18.35**		**15.71**		**18.73**		**15.46**		**9.12**		**9.99**		**14.96**		**17.20**		**21.74**		**14.55**		**17.19**		**17.04**		**16.42**		**19.66**		**17.18**		**18.22**	
Total Congeners Analyzed (Diss) =	**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**	
Total Congeners Detected (Diss) =	**82**		**60**		**68**		**92**		**86**		**85**		**82**		**80**		**80**		**86**		**82**		**70**		**74**		**75**		**69**		**85**		**81**		**82**		**84**		**76**		**80**	
Reported TPCBs (Diss) =																																										

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	89GH6RI2289		GH6RI2389		GH6RI2489		GH6RI2589		GH6RI2689		GH6RI2789		GH6RI2889		GH6RI2989		GH6RI3089		GH6RI3189		GH6RI3289		GH6RI3389		GH6RI3489		GH6RI3589		GH6RI3689		GH6RI3789		9003240F		9003449F		9003622F		9003779F		9004431F	
Sample Date	8/23/89		8/29/89		9/6/89		9/13/89		9/20/89		9/27/89		10/4/89		10/12/89		10/18/89		10/24/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		12/13/89		4/19/89		5/3/89		5/17/89		6/1/89		6/28/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0.0363		0	U	0.0659		0.078		0.0286		0.0782		0.0893		0.1114		0.0395		0	U	0.0332		0.1036		0.1052		0.0765		0.0499		0.0848											
PCB 003	0	U	0	U	0.0961		0	U	0	U	0	U	0	U	0	U	0.1191		0	U	0.0334		0	U	0.077		0	U	0	U	0	U										
PCB 004																																									
PCB 004/010	0.1777		0.2024		0.1593		0.1681		0.1115		0.105		0.1217		0.1143		0.1104		0	U	0.1132		0.0715		0.055		0.0506		0.0516		0.0614											
PCB 005																																									
PCB 005/008	1.2069		1.1461		0.9396		1.0273		0.8295		0.797		0.9583		0.9052		0.8466		0		0.8459		0.5349		0.4031		0.3267		0.349		0.4603											
PCB 006	0	U	0.2296		0.1844		0.2008		0.1461		0.1397		0.1653		0.1508		0.1656		0	U	0.1461		0.1153		0.0691		0.0501		0.0504		0.0833											
PCB 007	0.0234		0.0284		0.0229		0.0186		0.0157		0.0203		0.0224		0.0215		0.0152		0	U	0.0198		0.0169		0.0124		0.018		0.014		0.0226											
PCB 008																																									
PCB 012/013	0.0135		0.0167		0.0206		0.0132		0.0124		0.0156		0.0164		0.0143		0.0201		0	U	0.0213		0.0114		0.0121		0.0133		0.0108		0.0187											
PCB 016/032	1.1712		1.1093		0.8757		1.0189		0.8737		0.6939		0.8919		0.7826		0.8639		0	U	0.7639		0.4525		0.2113		0.1324		0.1285		0.2739											
PCB 017	0.9475		0.8672		0.6526		0.7988		0.6204		0.5456		0.687		0.5763		0.6016		0	U	0.5826		0.3102		0.156		0.0965		0.0852		0.2441											
PCB 018	1.5255		1.4345		1.1142		1.2409		0.9647		0.8247		1		0.8695		0.8954		0	U	0.8075		0.4482		0.2375		0.1459		0.1299		0.3168											
PCB 019	0.1268		0.1314		0.1035		0.1262		0.0955		0.0793		0.0972		0.0851		0.0989		0	U	0.0766		0.0464		0.0307		0.0197		0.0133		0.0286											
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0098											
PCB 022	0.6961		0.6384		0.5053		0.5673		0.5208		0.4113		0.4942		0.4259		0.4229		0	U	0.4321		0.2214		0.1116		0.0714		0.0656		0.2433											
PCB 024																																									
PCB 024/027	0.1579		0.1605		0.114		0.1434		0.1122		0.1016		0.1201		0.1031		0.1008		0	U	0.0982		0.0519		0.0272		0.0295		0.0185		0.0543											
PCB 025	0.2823		0.2352		0.2117		0.2247		0.1947		0.1682		0.1728		0.1747		0.1845		0	U	0.2097		0.109		0.05		0.0371		0.0362		0.1783											
PCB 026	0.4451		0.4004		0.3369		0.4001		0.3348		0.2711		0.2939		0.3067		0.2988		0	U	0.3327		0.1726		0.0896		0.0474		0.0468		0.1491											
PCB 027																																									
PCB 028																																									
PCB 028/031	2.9839		2.7234		2.1818		2.4477		2.1855		1.7597		2.0358		1.8571		1.9323		0	U	1.9644		1.0987		0.5864		0.362		0.3152		0.8936		1.3		2.6		2.6		1.8		3.4	
PCB 029	0.0529		0.0415		0.0337		0.0443		0.0511		0.0265		0.0387		0.0379		0.0302		0	U	0.0494		0.0165		0.0099		0.0093		0.0076		0	U										
PCB 031																																									
PCB 033	0.7246		0.6507		0.483		0.5905		0.5449		0.4162		0.5213		0.4551		0.4499		0	U	0.429		0.2331		0.1095		0.0711		0.0718		0.2103											
PCB 037/042	0.3548		0.3503		0.3055		0.33		0.3294		0.2345		0.2527		0.2297		0.2597		0	U	0.2256		0.1046		0.0625		0.0265		0.0404		0.0712											
PCB 040	0.1775		0.1764		0.145		0.1497		0.1476		0.1077		0.1196		0.1117		0.1142		0	U	0.1328		0.0578		0.0377		0.0241		0.0203		0.0404											
PCB 041/064/071	0.643		0.6011		0.4854		0.562		0.5564		0.3982		0.4623		0.4172		0.4401		0	U	0.4425		0.2088		0.1432		0.0622		0.0672		0.1933											
PCB 043	0.0581		0.058		0.0451		0.0419		0.0397		0.0307		0.0425		0.0361		0.0286		0	U	0.0398		0.0224		0.0227		0.0075		0.006		0.0232											
PCB 044	0.7943		0.7366		0.698		0.6665		0.6421		0.469		0.5374		0.4927		0.5131		0	U	0.5081		0.2552		0.1389		0.0716		0.1063		0.2014											
PCB 045	0.193		0.1855		0.1415		0.1684		0.1518		0.117		0.1337		0.125		0.1186		0	U	0.1309		0.0734		0.0378		0.019		0.022		0.0595											
PCB 046	0.1026		0.098		0.0713		0.094		0.0864		0.0663		0.0761		0.072		0.0709		0	U	0.0692		0.035		0.0222		0.03		0.0542		0.0258											
PCB 047																																									
PCB 048																																									
PCB 047/048	0.4607		0.4212		0.3441		0.3786		0.367		0.2762		0.3265		0.2951		0.3445		0	U	0.3352		0.1972		0.1155		0.1006		0.0938		0.2215											
PCB 049	0.5409		0.5066		0.4105		0.4693		0.4428		0.3349		0.3889		0.3654		0.3456		0	U	0.409		0.2029		0.1284		0.0651		0.0526		0.1519											
PCB 051	0.0531		0.0464		0.036		0.039		0.0359		0.0299		0.0329		0.028		0.0412		0	U	0.033		0.0273		0.0158		0.0241		0.0326		0.0673											
PCB 052	0.6924		0.6405		0.5124		0.566		0.5289		0.4155		0.472		0.4422		0.4455		0	U	0.4746		0.2627		0.1692		0.0946		0.1141		0.2078											
PCB 053	0.1868		0.1694		0.1427		0.1541		0.1382		0.1115		0.1367		0.1235		0.116		0	U	0.1131		0.062		0.032		0.0081		0.0114		0.0796											
PCB 056																																									
PCB 059																																									
PCB 060/092	0.3103		0.3032		0.2601		0.2638		0.275		0.1793		0.2201		0.2133		0.2188		0	U	0.237		0.1022		0.0612		0.0343		0.0388		0.1175		0.18		0.4		0.3		0.22		0.36	
PCB 056/060																																									
PCB 063	0.0318		0.0356		0.0292		0.0288		0.0294		0.0199		0.0228		0.0227		0.0205		0	U	0.0283		0.0155		0.0095		0.0023		0.0037		0.0116											
PCB 064/041																																									
PCB 066/095	0.7015		0.6493		0.5655		0.5805		0.6147		0.4365		0.4924		0.4871		0.3734		0	U	0.5695		0.2855		0.1526		0.0836		0.1168		0.1844											
PCB 070																																									
PCB 070/076	0.5836		0.5038		0.4334		0.4571		0.4928		0.3428		0.3941		0.3915		0.4096		0	U	0.4455		0.2121		0.0941		0.0474		0.0732		0.3618											
PCB 071																																									
PCB 074	0.1688		0.1891		0.1596		0.1663		0.1673		0.1141		0.1295		0.1219		0.1438		0	U	0.1497		0.0604		0.0386		0.0189		0.0229		0.0544											
PCB 076																																									
PCB 077/110	0.1722		0.1737		0.1627		0.1554		0.1775		0.1186		0.134		0.1364		0.1302		0	U	0.1511		0.0731		0.0564		0.0333		0.0463		0.0817		0.21		0.3		0.21		0.24		0.25	
PCB 081	0.0045		0.0054		0.0034		0.0017		0.0051		0	U	0.0025		0.0041		0	U	0	U	0.0045		0.0038		0	U	0.001		0.0019		0	U										
PCB 082	0.0226		0.0167		0.0171		0.0159		0.0185		0.0137		0.0152		0.0132		0.0142		0	U	0.0166		0.0079		0.0049		0.0021		0.0022		0.0153											
PCB 083	0.0044		0.0032		0.0039		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0111		0.0022		0	U	0.0016		0	U	0	U										
PCB 084																																									
PCB 084/092	0.1441		0.1321		0.1053		0.1134		0.1214		0.0717		0.0912		0.0864		0.0817		0	U	0.1055		0.0512		0.026		0.0185		0.0224		0.0047											
PCB 085	0.0278		0.027		0.0245		0.0253		0.0293		0.0182		0.0209		0.0218		0.0214		0	U	0.0241		0.0109		0.0079		0.0038		0.0056		0.016											
PCB 087	0.0548		0.0494		0.0465		0.0437		0.0499		0.0329		0.0394		0.0387		0.0492		0	U	0.0424		0.0246		0.0168		0.0109		0.017		0.0259											
PCB 087/081																																									
PCB 089	0.0092		0.0133		0.0098		0.0119		0.012		0.0125		0.0114		0.0102		0.006		0	U	0.0054		0.0053		0.008		0	U	0.0084		0.0207											
PCB 091	0.0375		0.0258		0.024		0.0311		0.0388		0.0228		0.0271		0.024		0.0215		0	U	0.0142		0.0075		0	U	0	U	0	U	0.0085											

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	89GH6RI2289		89GH6RI2389		89GH6RI2489		89GH6RI2589		89GH6RI2689		89GH6RI2789		89GH6RI2889		89GH6RI2989		89GH6RI3089		89GH6RI3189		89GH6RI3289		89GH6RI3389		89GH6RI3489		89GH6RI3589		89GH6RI3689		89GH6RI3789		9003240F		9003449F		9003622F		9003779F		9004431F	
Sample Date	8/23/89		8/29/89		9/6/89		9/13/89		9/20/89		9/27/89		10/4/89		10/12/89		10/18/89		10/24/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		12/13/89		4/19/89		5/3/89		5/17/89		6/1/89		6/28/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 097	0.0454		0.0439		0.0437		0.0404		0.0469		0.0304		0.0347		0.0352		0.0343		0	U	0.0403		0.0215		0.0129		0.0041		0.0148		0.0148									
PCB 099	0.055		0.0509		0.0476		0.0501		0.0529		0.0377		0.0398		0.0444		0.0415		0	U	0.048		0.0232		0.0164		0.009		0.0119		0.0182									
PCB 100	0.0222		0.0226		0.0223		0.0221		0.0203		0.0159		0.0167		0.0164		0.0309		0	U	0.0187		0.0113		0.0036		0.0027		0	U	0.0038									
PCB 101	0.117		0.1007		0.0932		0.096		0.1071		0.0757		0.0877		0.0848		0.0855		0	U	0.0897		0.0493		0.0316		0.0213		0.0265		0.0382		0.13		0.18		0.12				0.13	
PCB 101/090																																										
PCB 105																																										
PCB 105/132/153	0.1024		0.0734		0.0853		0.07		0.0793		0.0571		0.0762		0.0574		0.0652		0	U	0.0833		0.0455		0.03		0.0196		0.0267		0.0373									
PCB 107	0.0117		0.01		0.015		0.009		0.0111		0.0092		0.0087		0.0085		0.0087		0	U	0.0114		0.0049		0.0055		0.0006		0.0089		0.0207									
PCB 114																																										
PCB 114/134	0.0098		0.0182		0.8386		0.0091		0.0098		0.007		0.0076		0.0078		0.007		0	U	0.0111		0.0117		0.0026		0.0021		0.0268		0.0059									
PCB 118	0.0596		0.0506		0.0587		0.0503		0.0528		0.0372		0.0425		0.0433		0.0411		0	U	0.0598		0.0261		0.0182		0.0087		0.0113		0.0283		0.09		0.13		0.09		0.1		0.1	
PCB 119	0.0106		0.0071		0.0111		0.0062		0.0078		0.008		0.0057		0.0067		0.0057		0	U	0.0097		0.0038		0.003		0.003		0.0058		0	U								
PCB 124/135/144/147	0.0168		0.0099		0.009		0.0068		0.0127		0.01		0.0121		0.0102		0.0106		0	U	0.0116		0.0091		0.0055		0.0055		0.0073		0.01									
PCB 128	0.0075		0.0064		0.0068		0.005		0.0062		0.004		0.0045		0.0044		0.0072		0	U	0.0065		0.0031		0.0025		0.0015		0.0017		0.0014									
PCB 129/178	0.0044		0.0026		0.0033		0.0022		0.0043		0.003		0.0033		0.0033		0.0174		0	U	0.0029		0.0025		0.0011		0.001		0.0016		0.0022									
PCB 130	0.0072		0.0057		0.0063		0.0158		0.0121		0.0071		0.0083		0.0096		0.0055		0	U	0.0073		0.002		0	U	0	U	0	U	0.0045									
PCB 131	0.0009		0.0084		0	U	0	U	0.0005		0.0004		0.0005		0.0004		0.0007		0	U	0.0024		0.0058		0.0005		0.0006		0.0064		0.0004									
PCB 132/168																																										
PCB 135/144																																										
PCB 136	0	U	0	U	0	U	0	U	0.0263		0	U	0.0193		0	U	0.0218		0	U	0	U	0	U	0	U	0	U	0	U	0	U								
PCB 137																																										
PCB 137/176	0.0023		0.0016		0.0022		0	U	0.0025		0.0018		0.0018		0.0017		0.0011		0	U	0.0016		0.0013		0	U	0.0004		0.0006		0.0013									
PCB 138/158/163	0.0629		0.0601		0.0742		0.0512		0.0891		0.0434		0.05		0.0484		0.0574		0	U	0.0571		0.0396		0.0324		0.0626		0.0282		0.0314									
PCB 138/163																																	0.09		0.14		0.07		0.11		0.08	
PCB 141	0.0112		0.0074		0.0084		0.0054		0.0086		0.006		0.0073		0.006		0.0073		0	U	0.0071		0.0051		0.0028		0.0028		0.0044		0.0042									
PCB 146	0.033		0.0292		0	U	0.0261		0.0306		0.0188		0.0226		0.0241		0.0204		0	U	0.0306		0.0182		0.0078		0.0036		0.0063		0.0048									
PCB 149	0.063		0.0346		0.041		0.0346		0.0407		0.0318		0.0404		0.0319		0.0352		0	U	0.0383		0.0287		0.0164		0.0118		0.0157		0.0249		0.08		0.09		0.06		0.08		0.06	
PCB 149/123																																										
PCB 151	0.0258		0.0132		0.0183		0.0129		0.0164		0.0136		0.0166		0.0128		0.0152		0	U	0.0138		0.0124		0.0061		0.0056		0.0079		0.025									
PCB 153/184																																										
PCB 156/171																																										
PCB 156/171/202	0.0065		0.0051		0.0054		0.0014		0.0065		0.0039		0.0044		0.0046		0.003		0	U	0.0058		0.0037		0.0015		0.0019		0.0028		0.0029									
PCB 157/200	0	U	0.0012		0	U	0	U	0	U	0	U	0	U	0	U	0.0003		0	U	0	U	0	U	0	U	0.0006		0	U	0	U	0	U								
PCB 157																																										
PCB 158																																										
PCB 167	0.0014		0.0006		0.0009		0	U	0.0015		0.0009		0.0009		0.0009		0.001		0	U	0.0011		0.0006		0.0003		0.0007		0	U	0	U								
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U								
PCB 170																																										
PCB 172																																										
PCB 170/190	0.0108		0.0278		0	U	0.0439		0.071		0.0713		0.0434		0.0634		0.0154		0	U	0.0145		0.0369		0.0244		0.0706		0.0145		0.0383									
PCB 172/197	0.0015		0.001		0.0027		0	U	0.002		0.0014		0	U	0.0009		0.0004		0	U	0.0012		0.0004		0	U	0	U	0	U	0	U								
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U								
PCB 174	0.0112		0.0089		0.0131		0.0086		0.0114		0.0077		0.0082		0.008		0.0078		0	U	0.0081		0.0059		0.0031		0.0025		0.0038		0.006									
PCB 175	0	U	0.0007		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0026		0	U	0	U	0.0003		0	U	0	U								
PCB 176																																										
PCB 177	0.0064		0.0038		0.0051		0.0045		0.0068		0.004		0.0043		0.0045		0.0132		0	U	0.0054		0.0046		0.0023		0.0032		0.0023		0.003									
PCB 178/126																																										

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	89GH6RI2289		GH6RI2389		GH6RI2489		GH6RI2589		GH6RI2689		GH6RI2789		GH6RI2889		GH6RI2989		GH6RI3089		GH6RI3189		GH6RI3289		GH6RI3389		GH6RI3489		GH6RI3589		GH6RI3689		GH6RI3789		9003240F		9003449F		9003622F		9003779F		9004431F	
Sample Date	8/23/89		8/29/89		9/6/89		9/13/89		9/20/89		9/27/89		10/4/89		10/12/89		10/18/89		10/24/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		12/13/89		4/19/89		5/3/89		5/17/89		6/1/89		6/28/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 180	0.024		0.0149		0.019		0.0137		0.02		0.0125		0.0157		0.013		0.0124		0	U	0.0153		0.0182		0.0063		0.0078		0.0078		0	U	0.05		0.07		0.03				0.02	
PCB 182/187	0.0166		0.0115		0.0151		0.0098		0.0125		0.0079		0.01		0.0092		0.0088		0	U	0.0126		0.0097		0.0045		0.0039		0.0058		0.0054											
PCB 183	0.008		0.0058		0.0066		0.0047		0.007		0.005		0.0049		0.0052		0.0047		0	U	0.0056		0.0041		0.0021		0.0018		0.0029		0.0048											
PCB 185	0.0017		0.0013		0.0048		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0031		0.0014		0.0014		0.0097		0.0009		0	U										
PCB 189	0	U	0	U	0.0047		0	U	0	U	0	U	0	U	0	U	0.0052		0	U	0	U	0	U	0	U	0	U	0	U	0	U										
PCB 190																																											
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0021		0	U	0	U	0	U	0	U	0	U	0	U	0	U										
PCB 193	0	U	0.0005		0.0007		0	U	0	U	0	U	0	U	0	U	0.0007		0	U	0.0008		0.0004		0	U	0	U	0	U	0.0008											
PCB 194	0.0012		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0011		0	U	0.0009		0.0007		0	U	0	U	0	U	0	U										
PCB 195																																											
PCB 195/208	0.0046		0.004		0.0042		0.0027		0.0026		0.0031		0.0025		0.0021		0.0027		0	U	0.003		0.0021		0.0014		0.0074		0.0014		0	U										
PCB 196/203	0.006		0.0026		0.0066		0.0043		0.0052		0.0027		0.0028		0.0029		0	U	0	U	0.0048		0.0025		0.0026		0.0018		0.0022		0.0007											
PCB 197																																											
PCB 198	0	U	0	U	0	U	0	U	0	U	0	U	0.0018		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0001											
PCB 199	0.0011		0.0012		0.0013		0	U	0.0014		0.0003		0	U	0	U	0	U	0	U	0.0009		0.0005		0	U	0	U	0.0002		0	U										
PCB 201	0.0054		0.0022		0.0053		0.0043		0.0057		0.0018		0.0041		0.0039		0.004		0	U	0.0049		0.0027		0	U	0	U	0.0017		0.0007											
PCB 202																																											
PCB 203/196																																											
PCB 205	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0032		0.001		0	U	0	U	0	U	0	U	0	U	0	U	0	U										
PCB 206	0.0019		0	U	0.001		0	U	0	U	0	U	0	U	0.001		0.0013		0	U	0.0013		0.0005		0	U	0	U	0.0013		0	U										
PCB 207	0.0004		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0001		0	U	0	U	0	U	0	U	0	U										
PCB 208																																											
PCB 209	0.0009		0	U	0.0014		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0005		0.0015		0	U	0	U	0.0004		0	U										
Total Dissolved PCBs (by congener sum) =	17.88		16.78		14.83		15.23		13.93		10.97		12.92		11.88		12.13		0.00		12.32		6.81		4.00		2.63		2.69		5.92		2.13		3.91		3.48		2.55		4.41	
Total Congeners Analyzed (Diss) =	93		93		93		93		93		93		93		93		93		93		93		93		93		93		93		93		8		8		8		6		8	
Total Congeners Detected (Diss) =	80		79		79		70		76		74		75		77		80		0		84		81		71		72		73		70		8		8		8		6		8	
Reported TPCBs (Diss) =																																	8		15.95		14.66		10.44		17.56	

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE. WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	90GH6RI3890		90GH6RI3990		90GH6RI4090		90GH6RI4190		90GH6RI4290		90GH6RI4390		90GH6RI4490		90GH6RI4590		90GH6RI4690		90GH6RI4790		90GH6RI4890		90GH6RI4990		90GH6RI50		CF		OA001176		OA001181		OA001182		OA001627		OA001630		OA002397		OA003240		OA003246	
Sample Date	1/11/90		1/25/90		2/6/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90		4/17/90		4/24/90		4/24/90		5/1/90		6/15/89		7/11/89		7/27/89		7/27/89		8/23/89		8/9/89		10/3/89		9/19/89		9/7/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/L)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0.091		0.1041		0.0447		0.056		0.0885		0.0407		0.0293		0	U	0.0604		0.0429		0.0889		0.0815		0.036																		
PCB 003	0	U	0	U	0.0102		0.0889		0	U	0.0691		0.0703		0	U	0.1705		0.0836		0.1854		0.1296		0.0687																		
PCB 004																																												
PCB 004/010	0.0501		0.0552		0.0399		0.0505		0.0377		0.0394		0.0222		0.0482		0.0591		0.0726		0.0907		0.0897		0.1186																		
PCB 005																																												
PCB 005/008	0.3122		0.373		0.2735		0.286		0.2235		0.3716		0.1971		0.3449		0.427		0.5112		0.7215		0.7192		0.9975																		
PCB 006	0.0623		0.0704		0.0445		0.0568		0.0477		0.0555		0.0294		0.0554		0.0763		0.0924		0.1205		0.1335		0.1655																		
PCB 007	0.019		0.019		0.0118		0.0134		0.0097		0.0234		0.0054		0.0112		0.0097		0.0119		0.0193		0.0187		0.0169																		
PCB 008																																												
PCB 012/013	0.0205		0.0115		0.0159		0.008		0.0182		0.0093		0.0058		0.0096		0.0092		0.0101		0.0066		0.0447		0.0069																		
PCB 016/032	0.1274		0.1992		0.1499		0.1889		0.1781		0.2193		0.1096		0.219		0.2922		0.4345		0.7215		0.7364		1.1757																		
PCB 017	0.0827		0.1802		0.1156		0.1444		0.1557		0.1526		0.081		0.1533		0.2087		0.3048		0.4651		0.4974		0.7907																		
PCB 018	0.13		0.1851		0.1466		0.1742		0.2062		0.2235		0.1181		0.2242		0.3185		0.4568		0.7499		0.7644		1.2329																		
PCB 019	0.0164		0.0176		0.0261		0.0198		0.0239		0.0226		0.0132		0.0241		0.0351		0.0501		0.0657		0.0732		0.1249																		
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U																		
PCB 022	0.0637		0.0852		0.0743		0.0936		0.1088		0.1482		0.0612		0.101		0.1456		0.2343		0.431		0.4047		0.5605																		
PCB 024																																												
PCB 024/027	0.0168		0.0266		0.0365		0.0334		0.0304		0.0329		0.0159		0.0374		0.0384		0.0604		0.0963		0.0908		0.1379																		
PCB 025	0.0237		0.0463		0.0424		0.0545		0.0533		0.0901		0.0321		0.073		0.0694		0.1098		0.1574		0.157		0.1989																		
PCB 026	0.0431		0.0794		0.0669		0.0896		0.1258		0.1068		0.0448		0.0974		0.1103		0.1896		0.288		0.2806		0.3519																		
PCB 027																																												
PCB 028																																												
PCB 028/031	0.3539		0.5198		0.4444		0.5214		0.53		0.6779		0.2873		0.5387		0.6893		1.0419		1.6433		1.6585		2.374		0.46		2.7		2.6		2.8		2.4		2.8		1.9		2.4		2.1	
PCB 029	0.0274		0.0159		0.0122		0.0126		0.0021		0.0279		0.0042		0	U	0.0098		0.0056		0.0104		0.0273		0.0317																		
PCB 031																																												
PCB 033	0.0548		0.0794		0.0744		0.0948		0.105		0.1397		0.0601		0.1236		0.1426		0.227		0.4255		0.4266		0.5886																		
PCB 037/042	0.026		0.0426		0.0364		0.047		0.0627		0.0766		0.0284		0.0562		0.1155		0.1455		0.2354		0.2576		0.3118																		
PCB 040	0.0197		0.0332		0.0272		0.0222		0.0294		0.0364		0.0167		0.0245		0.046		0.0653		0.1184		0.1154		0.1592																		
PCB 041/064/071	0.0396		0.0677		0.0727		0.0806		0.1025		0.1527		0.0601		0.0867		0.1399		0.2488		0.4		0.4044		0.5427																		
PCB 043	0.0025		0.0137		0.0121		0.0077		0.0079		0.0142		0.0106		0.0321		0.0182		0.0217		0.0187		0.022		0.0358																		
PCB 044	0.0683		0.1012		0.086		0.1065		0.1337		0.1667		0.0742		0.125		0.2059		0.2857		0.4855		0.4909		0.6715																		
PCB 045	0.0406		0.0293		0.037		0.0354		0.0296		0.0338		0.0198		0.0417		0.0479		0.065		0.1149		0.101		0.1735																		
PCB 046	0.0127		0.0393		0.0454		0.0468		0.0193		0.0142		0.0073		0.0404		0.0309		0.0326		0.0521		0.05		0.0912																		
PCB 047																																												
PCB 048																																												
PCB 047/048	0.0703		0.1134		0.0763		0.0914		0.0981		0.7124		0.0573		0.1158		0.0909		0.1538		0.2894		0.2931		0.3311																		
PCB 049	0.0595		0.0962		0.0845		0.09		0.1041		0.132		0.0634		0.1237		0.124		0.1961		0.3279		0.3248		0.421																		
PCB 051	0.0143		0.019		0.0164		0.0212		0.0225		0.2206		0.0112		0.0167		0.0146		0.0174		0.0343		0.0374		0.043																		
PCB 052	0.0881		0.1142		0.1022		0.1455		0.133		0.2387		0.1053		0.1767		0.2048		0.2393		0.358		0.3668		0.5709																		
PCB 053	0	U	0.0158		0.0245		0.0329		0.02		0.0509		0.0199		0.0338		0.0425		0.0421		0.0971		0.0694		0.1527																		
PCB 056																																												
PCB 059																																												
PCB 060/092	0.0338		0.0325		0.037		0.0432		0.0544		0.0736		0.0312		0.0542		0.074		0.1211		0.2359		0.2485		0.2838		0.14		0.26		0.24		0.23		0.25		0.27		0.2		0.3		0.24	
PCB 056/060																																												
PCB 063	0.0069		0.0066		0.0048		0.0033		0.008		0.0103		0.003		0.006		0.0091		0.0153		0.0376		0.0269		0.0273																		
PCB 064/041																																												
PCB 066/095	0.1013		0.0987		0.0894		0.1006		0.1512		0.2029		0.1006		0.1333		0.1757		0.2784		0.4891		0.5064		0.5521																		
PCB 070																																												
PCB 070/076	0.0647		0.0598		0.0573		0.0619		0.1151		0.1928		0.0518		0.0817		0.1154		0.212		0.3662		0.3966		0.4595																		
PCB 071																																												
PCB 074	0.0176		0.0253		0.0239		0.0237		0.0362		0.0521		0.0193		0.0323		0.0471		0.072		0.1436		0.1366		0.1807																		
PCB 076																																												
PCB 077/110	0.0441		0.0469		0.0414		0.0443		0.0549		0.0601		0.0343		0.0459		0.0544		0.0916		0.1558		0.158		0.1618				0.24		0.24		0.25		0.25		0.25		0.2		0.34		0.22	
PCB 081	0	U	0	U	0	U	0	U	0	U	0	U	0.0018		0.0017		0.0022		0.0026		0.0051		0.0056		0	U																	
PCB 082	0.003		0.0031		0.0026		0.0103		0.0028		0.0073		0.0032		0.0045		0.0035		0.0089		0.0147		0.0117		0.0139																		
PCB 083	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.001		0.0055		0.0054		0.0039																		
PCB 084																																												
PCB 084/092	0.018		0.0115		0.022		0.0239		0.0219		0.0311		0.0218		0.0227		0.0251		0.0553		0.0918		0.096		0.1141																		
PCB 085	0.0043		0.0116		0.0029		0.0031		0.0084		0.0098		0.0049		0.0071		0.0084		0.0137		0.0255		0.026		0.0267																		
PCB 087	0.0219		0.0202		0.0151		0.0123		0.0199		0.0244		0.0113		0.0144		0.0163		0.0259		0.0451		0.0461		0.0562																		
PCB 087/081																																												
PCB 089	0.0098		0.0064		0.0157		0.0072		0.0121		0.0121		0.0064		0.0047		0.0093		0.006		0.0067		0.0045		0.007																		
PCB 091	0	U	0.009		0.0016		0.0063		0.0075		0.007		0.0047		0	U	0.0045		0.0126		0.0272		0.0218		0.0277																		

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	90GH6RI3890		90GH6RI3990		90GH6RI4090		90GH6RI4190		90GH6RI4290		90GH6RI4390		90GH6RI4490		90GH6RI4590		90GH6RI4690		90GH6RI4790		90GH6RI4890		90GH6RI4990		90GH6RI50		CF		OA001176		OA001181		OA001182		OA001627		OA001530		OA002397		OA003240		OA003246	
Sample Date	1/11/90		1/25/90		2/6/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90		4/17/90		4/24/90		4/24/90		5/1/90		6/15/89		7/11/89		7/27/89		7/27/89		8/23/89		8/9/89		10/3/89		9/19/89		9/7/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 097	0 0069		0 0084		0.0081		0.0093		0.0143		0.022		0.0079		0.0126		0 0135		0.0224		0.0403		0.0406		0.0436																		
PCB 099	0 0123		0 0131		0.0119		0.0109		0.0172		0 0198		0.009		0 0144		0 0152		0.0276		0.0507		0.0447		0.0489																		
PCB 100	0.0077		0.0063		0.0034		0.0042		0 0092		0 005		0.0019		0.0069		0.0061		0.0115		0.0156		0.0168		0.0217																		
PCB 101	0.0251		0.0256		0.0208		0.0265		0.0367		0 0443		0.0236		0.0285		0.0344		0.0581		0.0954		0.0901		0.093		0.05		0.13		0.13		0.14		0.13		0.14		0.11		0.19		0 11	
PCB 101/090																																											
PCB 105																																											
PCB 105/132/153	0.0249		0.0209		0.0197		0 026		0.0308		0.0305		0.026		0.0226		0.0297		0.0417		0.0682		0 0622		0.0722																		
PCB 107	0.0035		0.0065		0.0012		0.0033		0.0016		0.0056		0.002		0.004		0.0032		0.0052		0.0098		0 0087		0.0091																		
PCB 114																																											
PCB 114/134	0 0047		0.004		0.0021		0.0045		0.0033		0.0027		0.0031		0 0034		0.0032		0.0052		0.0076		0.0066		0.0085																		
PCB 118	0.0124		0.0135		0 0105		0 0119		0.0157		0.0178		0.0094		0.0143		0.0155		0.0259		0.048		0.0461		0.0428				0.11		0.11		0.12		0.1		0.1		0 07		0.12		0.07	
PCB 119	0.0082		0.0046		0 0032		0 0024		0.0056		0.0026		0.0017		0.0022		0.0026		0.0044		0 0085		0.011		0.0046																		
PCB 124/135/144/147	0.0055		0.0064		0.002		0.0032		0.0069		0.0063		0 0051		0.0045		0.0043		0.0067		0.0098		0 0055		0.0106																		
PCB 128	0.0014		0.0014		0.001		0.0013		0.0016		0.0019		0 0017		0.0019		0.002		0.0023		0 0048		0 0044		0.004																		
PCB 129/178	0.0012		0.0008		0 0013		0 0018		0.0013		0.002		0.0018		0.0008		0.0009		0.0021		0 0023		0.0024		0.0034																		
PCB 130	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0014		0	U	0.0042		0.0075		0.007		0.0069																		
PCB 131	0.0003		0.0003		0.0002		0 0004		0.0004		0.001		0 0003		0.0004		0.0004		0.0005		0 0007		0.0007		0.001																		
PCB 132/168																																											
PCB 135/144																																											
PCB 136	0	U	0	U	0	U	0	U	0.0134		0	U	0	U	0	U	0	U	0.0168		0	U	0.0231		0.0269																		
PCB 137																																											
PCB 137/176	0.0027		0.0023		0.0019		0.0029		0.0003		0 0006		0.0007		0.0007		0.0002		0.0014		0.0013		0.0009		0.0022																		
PCB 138/158/163	0.0249		0.0416		0.0228		0.0311		0.0323		0.0308		0.0271		0.0214		0 0247		0.0326		0	U	0.053		0.0586																		
PCB 138/163																													0.1		0.12		0.13		0.08		0.09		0.07		0 15		0 07	
PCB 141	0.0041		0.0027		0.0027		0.004		0.0036		0 0037		0.0048		0 0026		0 0027		0.0044		0.0047		0.0043		0.0088																		
PCB 146	0.0035		0.0044		0.0043		0.0041		0 0052		0.0055		0.0035		0.0055		0 0069		0.0115		0.0227		0.0217		0.0233																		
PCB 149	0.0183		0 0166		0.0116		0.0176		0 0158		0.0197		0.0176		0 014		0 014		0.0218		0.032		0.0277		0 0393		0.08		0.08		0.07		0 07		0.06		0.06		0 05		0 1		0 05	
PCB 149/123																																											
PCB 151	0.0076		0.0056		0.0055		0 0088		0 0062		0.0108		0.0086		0.0055		0.0052		0.0092		0.0117		0.0089		0.016																		
PCB 153/184																																											
PCB 156/171																																											
PCB 156/171/202	0.0013		0.0029		0.0015		0.0013		0.0028		0 003		0 0027		0 0014		0.0005		0.004		0.0047		0.0038		0 0035																		
PCB 157/200	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U																		
PCB 157																																											
PCB 158																																											
PCB 167	0 0007		0	U	0	U	0.0014		0	U	0.0008		0 0006		0.0004		0	U	0	U	0.0004		0.0005		0.0013																		
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U																		
PCB 170																																											
PCB 172																																											
PCB 170/190	0	U	0 0701		0	U	0	U	0 0031		0.0128		0 029		0.0142		0.0107		0 0112		0 0052		0.0055		0.02																		
PCB 172/197	0	U	0	U	0	U	0	U	0 0008		0	U	0	U	0	U	0	U	0	U	0 0004		0.0013		0.0012																		
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U																		
PCB 174	0.0036		0.003		0.0049		0.0043		0.0054		0.0057		0.0044		0.0031		0.0033		0.0056		0.0066		0.0073		0.0098																		
PCB 175	0	U	0	U	0	U	0	U	0	U	0.0004		0	U	0	U	0.0003		0	U	0	U	0	U	0	U																		
PCB 176																																											
PCB 177	0.0031		0.0024		0.0041		0.0032		0.003		0.0022		0.0025		0.0019		0 0012		0.0029		0.0041		0.0041		0.0048																		
PCB 178/126																																											

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	90GH6RI3890		90GH6RI3990		90GH6RI4090		90GH6RI4190		90GH6RI4290		90GH6RI4390		90GH6RI4490		90GH6RI4590		90GH6RI4690		90GH6RI4790		90GH6RI4890		90GH6RI4990		90GH6RI50		CF		OA001176		OA001181		OA001182		OA001627		OA001630		OA002397		OA003240		OA003246	
Sample Date	1/11/90		1/25/90		2/6/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90		4/17/90		4/24/90		4/24/90		5/1/90		6/15/89		7/11/89		7/27/89		7/27/89		8/23/89		8/9/89		10/3/89		9/19/89		9/7/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 180	0.0064		0.0058		0.006		0.0089		0.0092		0.0128		0.0067		0.0045		0.0054		0.0076		0.012		0.0112		0.0138				0.04		0.03		0.03		0.02		0.03		0.02		0.07			
PCB 182/187	0.0045		0.0031		0.0036		0.0042		0.0056		0.006		0.0075		0.0044		0.0037		0.0084		0.0088		0.0077		0.0112																		
PCB 183	0.0024		0.0015		0.002		0.0031		0.0041		0.0034		0.0037		0.0016		0.0019		0.0038		0.0037		0.0042		0.0061																		
PCB 185	0	U	0	U	0	U	0	U	0	U	0.0021		0.0038		0.0014		0.0009		0.0014		0	U	0	U	0	U																	
PCB 189	0	U	0	U	0	U	0	U	0.0002		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U																	
PCB 190																																												
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U																	
PCB 193	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0009																		
PCB 194	0	U	0.0005		0	U	0.0016		0.0008		0	U	0	U	0	U	0	U	0.0004		0.0017		0.002		0.0014																		
PCB 195																																											
PCB 195/208	0	U	0	U	0.001		0	U	0.0016		0.0011		0.0017		0.0008		0.0011		0.0013		0.0024		0.0025		0.0032																		
PCB 196/203	0.001		0	U	0.0021		0.002		0.0014		0.0019		0.0021		0.001		0.0009		0.0012		0.0028		0.0032		0.0053																		
PCB 197																																											
PCB 198	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0023		0	U	0	U	0	U	0	U	0.0002																		
PCB 199	0	U	0.0011		0.0008		0	U	0.0004		0	U	0	U	0	U	0	U	0.0003		0	U	0	U	0.0012																		
PCB 201	0.0019		0.001		0.0032		0.0023		0.0035		0.0022		0.0019		0.0017		0	U	0.003		0.004		0.0037		0.0049																		
PCB 202																																											
PCB 203/196																																											
PCB 205	0	U	0	U	0	U	0.0006		0.0002		0	U	0	U	0	U	0	U	0	U	0	U	0.0008		0	U																	
PCB 206	0	U	0	U	0	U	0	U	0.0005		0.0003		0.0003		0	U	0	U	0.0015		0.0011		0.0013		0.0007																		
PCB 207	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U																	
PCB 208																																												
PCB 209	0	U	0	U	0	U	0	U	0.0006		0	U	0.0001		0	U	0	U	0.0005		0.0026		0.0024		0.001																		
Total Dissolved PCBs (by congener sum) =	**2.46**		**3.36**		**2.73**		**3.26**		**3.46**		**5.27**		**2.18**		**3.55**		**4.71**		**6.74**		**10.97**		**11.10**		**15.03**		**0.73**		**3.66**		**3.54**		**3.77**		**3.29**		**3.74**		**2.62**		**3.67**		**2.86**	
Total Congeners Analyzed (Diss) =	**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**4**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**7**	
Total Congeners Detected (Diss) =	**67**		**70**		**71**		**72**		**78**		**75**		**76**		**72**		**73**		**80**		**78**		**81**		**82**		**4**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**7**	
Reported TPCBs (Diss) =																											**12.44**		**13.7**		**13.67**		**14.18**		**12.75**		**15.17**		**10.45**		**13.93**		**10.75**	

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	DA004475		DA004477		DB000382		DB000384		DB001109		DB001113		DB004145		DB004147		DB004149		DB004150		SW050002		SW050003		SW050004		SW050005		SW050006		SW050007		SW050008		SW050008			SW050009		SW050010		SW050011		SW050012		SW050013		SW050014	
Sample Date	10/17/89		11/1/89		11/15/89		12/6/89		1/17/90		2/14/90		3/14/90		4/4/90		4/19/90		4/19/90		9/27/00		11/29/00		1/18/01		3/27/01		4/8/01		4/13/01		4/17/01		4/17/01			4/30/01		5/1/01		5/11/01		5/22/01		5/23/01		5/30/01	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved			Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001																					9.6	L, V	26	L, V	21	V,L	0	U	0	U	0	U	0	U	R1	11	BJ	13	BJ	21	J	19	BJ	18	BJ	22	BJ
PCB 003																																															
PCB 004																					0.42		0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0.87	J	0.26		0.73		0.25	
PCB 004/010																																															
PCB 005																					0.51		0.3		0.51		0.15		0.074		0	U	0	U	R1	0.14		0.24		0.3	BJ	0.37		0.36		0.3	
PCB 005/008																																															
PCB 006																					0.11		0.055		0	U	0	U	0.17		0	U	0.03		0.11		R1	0.5		0.085		0	U	0	U	0	U	0	U
PCB 007																					0.1		0.052		0	U	0.016		0.028	Q	0.01	Q	0	U	0	U	R1	0.24		0.4		0	U	0.68	B	0.69	B	0	U
PCB 008																					0.23		0.033	LOQ	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 012/013																																															
PCB 016/032																					0.15		0.038		0	U	0	U	0.067		0.078		0	U	0	U	R1	0	U	0.058		0.072	J	0.12		0.12		0.11	
PCB 017																					0.33		0.05		0.041		0	U	0.062		0.078		0	U	0	U	R1	0.1		0.17		0.55	BJ	0.76		0.52		0.31	
PCB 018																					0.58	V	0.047		0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0.31	BJ	0	U	0.53	B	0.51	
PCB 019																					0	U	0.09		0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 021																																															
PCB 022																					0.14		0.059		0.044	B	0.014		0.26		0.25	B	0.023		0	U	R1	0.031		0.024		0.055	J	0	U	0	U	0	U
PCB 024																					0.84	V	0.074		0.072		0	U	1.5	J	2.9		1.2		0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 024/027																																															
PCB 025																					0.12		0	U	0	U	0	U	0.049	Q	0.056	Q	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0.28	
PCB 026																					0.14		0.027	LOQ	0	U	0	U	0.044		0.043		0.023	Q	0.021	Q	R1	0.021	Q	0.036	Q	0.043	J	0.072		0.092		0.061	
PCB 027																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 028																					0.43		0.05	LOQ	0.047	T	0.023		0.15		0.15		0.077		0.058	Q	R1	0.12		0.16		0.22	J	0.26		0.27		0.24	
PCB 028/031	1.6		1.9		0.69		0.5		0.43		0.56		0.69		0.96		0.91		1																													
PCB 029																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 031																					0.64		0.15		0.093		0	U	0	U	0.16		0	U	0	U	R1	0	U	0	U	0.64	J	0.35		0.41		0.36	
PCB 033																					0.27		0	U	0.074		0	U	0.08		0.07		0	U	0.12		R1	0.13		0.17		0.13	J	0.19		0.19		0.2	
PCB 037/042																					0.081		0	U	0	U	0	U	0.026	Q	0.022	Q	0.015	Q	0.011	Q	R1	0.03	Q	0	U	0.07	J	0.06		0.07		0.079	
PCB 040																					0.038		0.016	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	R1	0.0055	Q	0.012	Q	0.036	J	0.03		0.034		0.024	
PCB 041/064/071																																															
PCB 043																																															
PCB 044																					0.26	V	0.068		0.059		0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0.21	J	0.21		0.22		0	U
PCB 045																					0.1		0.13		0.22		0.054		0	U	0	U	0	U	0	U	R1	0.15		0.14		0.22	J	0.15		0.17		0.16	
PCB 046																					0.04		0.059	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 047																					0.14		0.076		0.07		0	U	0.047		0	U	0.012	Q	0.023	Q	R1	0.093		0.13		0.21	J	0.14		0.17		0.11	
PCB 048																					0.16	V	0.17		0	U	0	U	0.34		0.4		0.066		0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 047/048																																															
PCB 049																					0.24		0.068		0.02	T	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 051																																															
PCB 052																					0.3		0.07		0.079		0	U	0.17		0.12		0.085		0.15		R1	0.15	J	0.29	J	0.56	J	0.48		0.49		0.38	
PCB 053																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 056																					0	U	0	U	0	U	0	U	0.043	Q	0	U	0.028	UJ	0.028	UJ	R1	0	U	0	U	0.19	J	0.18		0.11		0	U
PCB 059																					0.023		0.014	LOQ	0.012	T	0	U	0	U	0	U	0.0066	UJ	0.0066	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 060/092	0.19		0.24		0.11		0.1		0.07		0.06		0.13		0.14		0.13		0.15																													
PCB 056/060																					0	U	0	U	0	U	0	U	0	U	0.016	Q	0.016	UJ	0.016	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 063																					0	U	0	U	0	U	0	U	0	U	0	U	0.0079	UJ	0.0079	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 064/041																					0.092		0	U	0	U	0	U	0.031	Q	0	U	0.012	UJ	0.012	UJ	R1	0.055		0.038		0	U	0	U	0	U	0	U
PCB 066/095																					0.24		0.034		0	U	0.013		0.087		0.084		0.029	UJ	0.03	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 070																					0.15		0.024		0.01	T	0	U	0.063		0	U	0.041	UJ	0.028	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 070/076																																															
PCB 071																					0.081		0.0083	LOQ	0.015	T	0	U	0.024		0.019	Q	0.017	QJ	0.014	QJ	R1	0.019	Q	0.027		0.085	J	0.071		0.072		0.044	
PCB 074																					0.12		0	U	0	U	0	U	0.011	Q	0.0075	Q	0.0064	QJ	0.018	J	R1	0.039		0.058		0	U	0	U	0	U	0	U
PCB 076																					0.022		0.023		0.029		0	U	0	U	0	U	0.0036	UJ	0.0036	UJ	R1	0.011		0.05		0	U	0	U	0	U	0	U
PCB 077/110	0.21		0.28		0.15		0.13		0.11		0.1		0.16		0.14		0.13		0.13		0.08		0	U	0.024	T	0	U	0.038	Q	0.035	Q	0.034	QJ	0.019	UJ	R1	0.041	Q	0.05	Q	0.089	J	0.054	Q	0.058	Q	0.042	Q
PCB 081																																															
PCB 082																					0.025		0	U	0	U	0	U	0	U	0	U	0.011	UJ	0.011	UJ	R1	0	U	0	U	0	U	0	U	0.012	Q	0	U
PCB 083																																															
PCB 084																					0.059		0.057		0	U	0	U	0	U	0	U	0.0064	UJ	0.0064	UJ	R1	0	U	0	U	0.1	BJ	0	U	0	U	0	U
PCB 084/092																																															
PCB 085																					0.01		0	U	0	U	0	U	0.0046	Q	0.0048	Q	0.0075	QJ	0.0097	QJ	R1	0.031		0.048		0	U	0	U	0	U	0	U
PCB 087																																															
PCB 087/081																					0	U	0	U	0	U	0	U	0	U	0	U	0.018	QJ	0.014	UJ	R1	0	U	0	U	0.033	QJ	0	U	0	U	0	U
PCB 089																																															
PCB 091																					0.043		0	U	0	U	0	U	0	U	0	U	0.0078	UJ	0.0078	UJ	R1	0	U	0	U	0.2	BJ	0	U	0	U	0	U

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved).

Sample Name	DA004475		DA004477		DB000382		DB000384		DB001109		DB001113		DB004145		DB004147		DB004149		DB004150		SW050002		SW050003		SW050004		SW050005		SW050006		SW050007		SW050008		SW050008			SW050009		SW050010		SW050011		SW050012		SW050013		SW050014	
Sample Date	10/17/89		11/1/89		11/15/89		12/6/89		1/17/90		2/14/90		3/14/90		4/4/90		4/19/90		4/19/90		9/27/00		11/29/00		1/18/01		3/27/01		4/8/01		4/13/01		4/17/01		4/17/01			4/30/01		5/1/01		5/11/01		5/22/01		5/23/01		5/30/01	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved			Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l):	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 097																					0.029		0	U	0.02	B	0.011		0.03		0.016		0.012	J	0.006	QJ	R1	0	U	0.0064	Q	0.024	J	0	U	0	U	0.018	
PCB 099																					4.6	L	4	L	0	U	0	U	0.018	Q	0.019	Q	0.024	QJ	0.0096	QJ	R1	1.2		0.95		0	U	0	U	0	U	0	U		
PCB 100																																																	
PCB 101	0.11		0.15		0.09		0.08		0.07		0.06		0.09		0.08		0.07		0.08																															
PCB 101/090																					0.089		0.023	LOQ	0.014	T	0	U	0.03		0.035		0.05	J	0.019	QJ	R1	0.012	Q	0.026	Q	0.066	J	0.027	Q	0.039		0.023	Q
PCB 105																					0.0085		0	U	0	U	0	U	0	U	0	U	0.0076	UJ	0.0076	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 105/132/153																																																	
PCB 107																					0	U	0	U	0	U	0	U	0.087		0	U	0.012	QJ	0.011	UJ	R1	0	U	0	U	0.013	QJ	0	U	0	U	0	U
PCB 114																					0.0072		0	U	0	U	0	U	0	U	0	U	0.0061	UJ	0.0061	UJ	R1	0.013	Q	0	U	0	U	0	U	0	U	0	U
PCB 114/134																																																	
PCB 118	0.09		0.11		0.06		0.05		0.05		0.04		0.06		0.05						0.089		0	U	0.018	T	0	U	0.039		0.012	Q	0.028	J	0.0064	UJ	R1	0.017	Q	0.028		0.038	J	0.03		0.028		0.013	Q
PCB 119																					0.0058		0	U	0	U	0	U	0	U	0	U	0.0051	UJ	0.0051	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 124/135/144/147																																																	
PCB 128																					0	U	0	U	0	U	0	U	0	U	0	U	0.016	UJ	0.016	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 129/178																																																	
PCB 130																																																	
PCB 131																																																	
PCB 132/168																					0.015		0	U	0.053		0	U	0.94		0	U	0.014	UJ	0.014	UJ	R1	0.058		0.048		0	U	0.042	Q	0.041	Q	0.018	Q
PCB 135/144																					0	U	0	U	0	U	0	U	0	U	0	U	0.022	UJ	0.022	UJ	R1	0.027	Q	0.13		0	U	0	U	0	U	0	U
PCB 136																					0	U	0	U	0	U	0	U	0	U	0	U	0.006	UJ	0.006	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137																					0	U	0	U	0	U	0	U	0	U	0	U	0.01	UJ	0.01	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137/176																																																	
PCB 138/158/163																																																	
PCB 138/163	0.08		0.11		0.06		0.05		0.05		0.05		0.06								0.051		0	U	0.053	T	0	U	0.026	Q	0.023	Q	0.021	QJ	0.017	UJ	R1	0.04	Q	0.041	Q	0	U	0	U	0	U	0	U
PCB 141																					0	U	0	U	0.01	T	0	U	0	U	0	U	0.0086	UJ	0.0086	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 146																					0	U	0	U	0	U	0	U	0	U	0	U	0.0073	UJ	0.0073	UJ	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 149	0.05		0.08		0.05		0.04		0.06		0.04		0.04																																					
PCB 149/123																					0.062		0	U	0.092		0	U	0.036	Q	0.019	Q	0.024	Q	0	U	R1	0.025	Q	0.051		0.015	QJ	0.057		0.048		0.036	Q
PCB 151																					0	U	0.014		0	U	0	U	0.018	Q	0	U	0	U	0	U	R1	0	U	0	U	0.065	J	0	U	0.016	Q	0	U
PCB 153/184																					0.061		0.047		0.063	B	0	U	0.026	Q	0.022	Q	0.025	Q	0	U	R1	0.026	Q	0.034	Q	0	U	0	U	0	U	0	U
PCB 156/171																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 156/171/202																																																	
PCB 157/200																																																	
PCB 157																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 158																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0.0091	QJ	0	U	0	U	0	U
PCB 167																					0	U	0	U	0	U	0.017		0.031	Q	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 169																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0.024	Q	0	U	0	U	0	U	0	U	0	U
PCB 170																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 172																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170/190																																																	
PCB 172/197																																																	
PCB 173																																																	
PCB 174																					0.016		0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 175																																																	
PCB 176																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0.055	Q	0.021	Q	0	U	0	U	0	U	0	U
PCB 178/126																					0.064		0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U

Table H-7. Lower Fox River Historic Water Column Congener Data for OU3 (Dissolved)

Sample Name	DA004475		DA004477		DB000382		DB000384		DB001109		DB001113		DB004145		DB004147		DB004149		DB004150		SW050002		SW050003		SW050004		SW050005		SW050006		SW050007		SW050008		SW050008			SW050009		SW050010		SW050011		SW050012		SW050013		SW050014	
Sample Date	10/17/89		11/1/89		11/15/89		12/6/89		1/17/90		2/14/90		3/14/90		4/4/90		4/19/90		4/19/90		9/27/00		11/29/00		1/18/01		3/27/01		4/8/01		4/13/01		4/17/01		4/17/01			4/30/01		5/1/01		5/11/01		5/22/01		5/23/01		5/30/01	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved			Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 180	0.02		0.03		0.02		0.02		0.02		0.02										0.023		0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 182/187																					0.023		0	U	0	U	0	U	0	U	0	U	0	U	R1	0.028	Q	0	U	0	U	0	U	0	U	0	U
PCB 183																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 185																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 189																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 190																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 191																																															
PCB 193																																															
PCB 194																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 195																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0.014	QJ	0	U	0	U	0	U
PCB 195/208																																															
PCB 196/203																																															
PCB 197																					0	U	0	U	0	U	0	U	0.046	Q	0	U	0	U	0	U	R1	0	U	0	U	0.048	QJ	0	U	0	U	0	U
PCB 198																																															
PCB 199																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 201																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0.015	Q	0.022	Q	0	U
PCB 202																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0.017	Q	0.015	QJ	0	U	0	U	0	U
PCB 203/196																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U
PCB 205																																															
PCB 206																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 207																																															
PCB 208																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	R1	0	U	0	U	0	U	0	U	0	U	0	U	0	U
Total Dissolved PCBs (by congener sum) =	**2.35**		**2.90**		**1.23**		**0.97**		**0.86**		**0.93**		**1.23**		**1.37**		**1.24**		**1.36**		**22.06**		**31.93**		**22.74**		**0.30**		**4.70**		**4.65**		**2.08**		**0.90**			**14.43**		**16.54**		**26.50**		**23.61**		**23.51**		**25.57**	
Total Congeners Analyzed (Diss) =	**8**		**8**		**8**		**8**		**8**		**8**		**7**		**5**		**4**		**4**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**			**91**		**91**		**91**		**91**		**91**		**91**	
Total Congeners Detected (Diss) =	**8**		**8**		**8**		**8**		**8**		**8**		**7**		**5**		**4**		**4**		**52**		**32**		**26**		**8**		**35**		**26**		**43**		**39**			**32**		**31**		**33**		**24**		**27**		**23**	
Reported TPCBs (Diss) =	**9.38**		**10.88**		**4.41**		**3.81**		**2.57**		**3.5**		**5.05**		**6.26**		**5.47**		**6.35**		**22**																												

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-8. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended and Dissolved, HRGC/MS Method)

Sample Name	SW050002		SW050003		SW050009		SW050010		SW050011		SW050012		SW050013		SW050014		SW050002		SW050009		SW050010		SW050011		SW050012		SW050013		SW050014	
Sample Date	9/27/00		11/29/00		4/30/01		5/1/01		5/11/01		5/22/01		5/23/01		5/30/01		9/27/00		4/30/01		5/1/01		5/11/01		5/22/01		5/23/01		5/30/01	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.2	UJ	0.2	UJ	0	U	0	U	0	U
PCB 004	0.120227		0	U	0	U	0	U	0	U	0.2112313		0	U	0	U	0.3		0	U	0.2	UJ	0.2	UJ	0	U	0.21		0.24	
PCB 005	0.4568626		0	U	1.5175301		0.3358779		2.3352361		1.7516744		0.8953553		0.6521739		0.32		0	U	0	U	0	U	0.44		0.3		0.36	
PCB 006	0.1538905		0	U	0.4133961		0	U	0.6227296		0.4224626		0.2294348		0	U	0.14		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 007	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 008	0.2933539		0	U	1.5175301		0.3358779		2.3352361		1.7516744		0.8953553		0.6521739		0.2		0	U	0	U	0	U	0.44		0.3		0.36	
PCB 016/032	0.0961816		0	U	0	U	0	U	0	U	0.4997424		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 017	0.2837357		0	U	0.3401361		0	U	0.389206		0.5667182		0.391718		0.2445652		0.33		0	U	0	U	0	U	0.25		0.32		0.38	
PCB 018	0.3895354		0	U	0.4238619		0	U	0.4307213		0.618238		0.4252938		0.2880435		0.47		0	U	0	U	0	U	0.36		0.38		0.45	
PCB 019	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022	0.2500721		0	U	0.5075877		0	U	0.5708355		0.7212777		0.4029099		0.2771739		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 024	0.0961816		0	U	0	U	0	U	0	U	0.2421432		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 025	0.1394633		0	U	0.2093145		0	U	0.2179554		0.303967		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 026	0.2644994		0	U	0.3610675		0	U	0.363259		0.5667182		0.3581421		0.2173913		0.17		0	U	0	U	0	U	0	U	0	U	0	U
PCB 027	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 028	1.2022699		0	U	1.5175301		0.3307888		1.7644006		2.5759918		1.5109121		0.9782609		0.45		0	U	0	U	0.27		0.36		0.37		0.47	
PCB 029	0.2644994		0	U	0.3610675		0	U	0.363259		0.5667182		0.3581421		0.2173913		0.17		0	U	0	U	0	U	0	U	0	U	0	U
PCB 031	0.9137251		0	U	1.4652015		0.3155216		1.6606124		2.1638331		1.343033		0.8695652		0.47		0.24		0.23		0.33		0.44		0.42		0.54	
PCB 033	0.2981629		0	U	0.6279435		0	U	0.778412		1.1334364		0.6155568		0.375		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 037/042	0.5001443		0	U	0.6279435		0	U	0.778412		1.3807315		0.6155568		0.3804348		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 040	0.2260267		0	U	0.3192046		0	U	0.3061754		0.5048944		0.4029099		0.2608696		0.1		0	U	0	U	0	U	0	U	0	U	0.2	
PCB 044	0.4039627		0	U	0.4029304		0	U	0.3995848		0.618238		0.4868495		0.326087		0.17		0	U	0	U	0	U	0	U	0.21		0.27	
PCB 045	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 046	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 047	0.4039627		0	U	0.4029304		0	U	0.3995848		0.618238		0.4868495		0.326087		0.17		0	U	0	U	0	U	0	U	0.21		0.27	
PCB 048	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 049	0.36549		0	U	0.455259		0	U	0.4722366		0.6697579		0.5316172		0.3586957		0.15		0	U	0	U	0	U	0.23		0.23		0.3	
PCB 052	0.4712898		0	U	0.4133961		0	U	0.4151531		0.6697579		0.5092334		0.3478261		0.24		0.21		0	U	0.22		0.24		0.24		0.35	
PCB 053	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 056	0.2067904		0	U	0.3087389		0	U	0.2802283		0.4739825		0.3077784		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 059	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 060/092	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 063	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 064/041	0.3751082		0	U	0.5389848		0	U	0.5345096		0.8243174		0.6379407		0.2608696		0.1		0	U	0	U	0	U	0	U	0	U	0.2	
PCB 066/095	0.5770895		0	U	0.5232862		0	U	0.5033731		1.0355487		0.5036374		0.3423913		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 070	0.6251803		0	U	1.0989011		0.2748092		1.141671		1.5455951		1.0072748		0.7065217		0.14		0	U	0	U	0	U	0.22		0	U	0.29	
PCB 071	0.2260267		0	U	0.3192046		0	U	0.3061754		0.5048944		0.4029099		0.2608696		0.1		0	U	0	U	0	U	0	U	0	U	0.2	
PCB 074	0.6251803		0	U	1.0989011		0.2748092		1.141671		1.5455951		1.0072748		0.7065217		0.14		0	U	0	U	0	U	0.22		0	U	0.29	
PCB 076	0.6251803		0	U	1.0989011		0.2748092		1.141671		1.5455951		1.0072748		0.7065217		0.14		0	U	0	U	0	U	0.22		0	U	0.29	
PCB 077/110	0.2644994		0	U	0.5075877		0.0310433		0.4670472		0.613086		0.4588696		0.3315217		0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 082	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 084	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 085	0.2644994		0	U	0.381999		0	U	0.3528801		0.4327666		0.3469502		0.2554348		0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 087/081	0.1250361		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 091	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 097	0.1250361		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 099	0.1298451		0	U	0	U	0	U	0	U	0.314271		0.2462227		0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 101/090	0.3462537		0	U	0	U	0	U	0	U	0.4430705		0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 105	*0*	*U, ND*	*0.0582998*		*0.0784929*		*0.0264631*		*0.0726518*		*0.0824317*		*0.0871517*		*0.0461957*		*0*	*U, ND*	*0*	*U*	*0*	*U*	*0*	*U*	*0*	*U*	*0*	*U*	*0*	*U*
PCB 107	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 114	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 118	0.1538905		0.1218995		0.1988488		0.0712468		0.1868189		0.2318393		0.1734751		0.125		0	U, ND	0	U	0.025		0.022		0.025		0.022		0.04	
PCB 119	0.1250361		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 128	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 132/168	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 135/144	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U

Table H-8. Lower Fox River Historic Water Column Congener Data for OU3 (Suspended and Dissolved, HRGC/MS Method)

Sample Name	SW050002		SW050003		SW050009		SW050010		SW050011		SW050012		SW050013		SW050014		SW050002		SW050009		SW050010		SW050011		SW050012		SW050013		SW050014	
Sample Date	9/27/00		11/29/00		4/30/01		5/1/01		5/11/01		5/22/01		5/23/01		5/30/01		9/27/00		4/30/01		5/1/01		5/11/01		5/22/01		5/23/01		5/30/01	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 136	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 138/163	0.2115995		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 141	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 146	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 149/123	0.0961816		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 151	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 153/184	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 156/171	0	U, ND	0.0243799		0	U	0	U	0	U	0.0247295		0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 157	0	U, ND	0.0243799		0	U	0	U	0	U	0.0247295		0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 158	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 167	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 169	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170	0	U, ND	0	U	0.0313972		0.0223919		0.0378827		0.0448223		0.0335758		0.0304348		0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 172	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 176	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 178/126	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 180	0	U, ND	0.0349799		0.0994244		0.0508906		0.0985989		0.1391036		0.1007275		0.0815217		0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 182/187	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 183	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 185	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 189	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 190	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 194	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 195	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 197	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 199	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 201	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 202	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 203/196	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 206	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 208	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U
Total Suspended PCBs (by congener sum) =	**12.70**		**0.26**		**18.17**		**2.34**		**20.87**		**28.38**		**16.76**		**10.63**															
Total Congeners Analyzed (Susp) =	**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**															
Total Congeners Detected (Susp) =	**38**		**5**		**31**		**12**		**31**		**38**		**31**		**28**															
Reported TPCBs (Susp) =	**12.69597**																													
Total Dissolved PCBs (by congener sum) =																	**4.47**		**0.45**		**0.66**		**1.24**		**3.45**		**3.21**		**5.50**	
Total Congeners Analyzed (Diss) =																	**91**		**91**		**91**		**91**		**91**		**91**		**91**	
Total Congeners Detected (Diss) =																	**20**		**2**		**4**		**6**		**12**		**12**		**18**	
Reported TPCBs (Diss) =																	**4.47**													

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE WDNR May 1995 Report indicates that 60 congeners were analyzed for these data, however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 2000-01 FRG Fox River Surface Water Survey.

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#10P		#11P		#12P		#13P		#14P		#15P		#16P		#17P		#18P		#19P		#1P		#20P		#21P		#22P		#23P		#24P		#25P		#26P	
Sample Date	6/1/89		6/6/89		6/13/89		6/28/89		6/28/89		7/12/89		7/12/89		7/20/89		7/25/89		7/31/89		1/19/89		8/9/89		8/14/89		8/23/89		8/29/89		9/6/89		9/13/89		9/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001																																				
PCB 003																																				
PCB 004																																				
PCB 004/010																																				
PCB 005																																				
PCB 005/008																																				
PCB 006																																				
PCB 007																																				
PCB 008																																				
PCB 012/013																																				
PCB 016/032																																				
PCB 017																																				
PCB 018																																				
PCB 019																																				
PCB 021																																				
PCB 022																																				
PCB 024																																				
PCB 024/027																																				
PCB 025																																				
PCB 026																																				
PCB 027																																				
PCB 028																																				
PCB 028/031	9.5259		11.2868		9.5634		8.717		9.1155		5.2082		4.7604		6.0079		5.8803		7.1028		0.189		8.1534		8.1446		7.7041		6.7075		4.5824		5.6209		4.9225	
PCB 029																																				
PCB 031																																				
PCB 033																																				
PCB 037/042																																				
PCB 040																																				
PCB 041/064/071																																				
PCB 043																																				
PCB 044																																				
PCB 045																																				
PCB 046																																				
PCB 047																																				
PCB 048																																				
PCB 047/048																																				
PCB 049																																				
PCB 051																																				
PCB 052																																				
PCB 053																																				
PCB 056																																				
PCB 059																																				
PCB 060/092																																				
PCB 056/060	1.492		2.204		1.7296		2.393		1.997		1.1495		1.2875		1.5304		1.2562		1.7087		0.0529		1.9032		2.0735		1.5928		1.2239		0.92		1.1519		0.9625	
PCB 063																																				
PCB 064/041																																				
PCB 066/095																																				
PCB 070																																				
PCB 070/076																																				
PCB 071																																				
PCB 074																																				
PCB 076																																				
PCB 077/110	0.9299		1.5858		1.3119		1.427		1.0115		0.8039		0.8443		0.9944		0.9587		1.1743		0.071		1.3966		1.5595		1.1081		0.8686		0.6589		0.8157		0.6846	
PCB 081																																				

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#10P		#11P		#12P		#13P		#14P		#15P		#16P		#17P		#18P		#19P		#1P		#20P		#21P		#22P		#23P		#24P		#25P		#26P	
Sample Date	6/1/89		6/6/89		6/13/89		6/28/89		6/28/89		7/12/89		7/12/89		7/20/89		7/25/89		7/31/89		1/19/89		8/9/89		8/14/89		8/23/89		8/29/89		9/6/89		9/13/89		9/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 082																																				
PCB 083																																				
PCB 084																																				
PCB 084/092																																				
PCB 085																																				
PCB 087																																				
PCB 087/081																																				
PCB 089																																				
PCB 091																																				
PCB 097																																				
PCB 099																																				
PCB 100																																				
PCB 101	0.5422		0.9708		0.8108		0.9085		0.638		0.55		0.5016		0.5839		0.6096		0.8133		0.0537		0.9508		1.1797		0.6831		0.5321		0.4053		0.5532		0.4148	
PCB 101/090																																				
PCB 105																																				
PCB 105/132/153																																				
PCB 107																																				
PCB 114																																				
PCB 114/134																																				
PCB 118	0.6007		0.5559		0.575		0.4888		0.8592		0.3936		0.4442		0.5215		0.3834		0.5098		0.0203		0.497		0.5878		0.5658		0.6319		0.3987		0.5023		0.4237	
PCB 119																																				
PCB 124/135/144/147																																				
PCB 128																																				
PCB 129/178																																				
PCB 130																																				
PCB 131																																				
PCB 132/168																																				
PCB 135/144																																				
PCB 136																																				
PCB 137																																				
PCB 137/176																																				
PCB 138/158/163	0.7342		0.5814		0.6732		0.5205		0.837		0.3915		0.4618		0.6015		0.4636		0.5562		0.0715		0.6048		0.7041		0.6142		0.663		0.417		0.5267		0.4457	
PCB 138/163																																				
PCB 141																																				
PCB 146																																				
PCB 149	0.3984		0.3212		0.3523		0.2741		0.4384		0.2422		0.2282		0.2731		0.2266		0.3062		0.0273		0.3183		0.3955		0.327		0.3744		0.2355		0.292		0.2699	
PCB 149/123																																				
PCB 151																																				
PCB 153/184																																				
PCB 156/171																																				
PCB 156/171/202																																				
PCB 157/200																																				
PCB 157																																				
PCB 158																																				
PCB 167																																				
PCB 169																																				
PCB 170																																				
PCB 172																																				
PCB 170/190																																				
PCB 172/197																																				
PCB 173																																				
PCB 174																																				

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#10P		#11P		#12P		#13P		#14P		#15P		#16P		#17P		#18P		#19P		#1P		#20P		#21P		#22P		#23P		#24P		#25P		#26P	
Sample Date	6/1/89		6/6/89		6/13/89		6/28/89		6/28/89		7/12/89		7/12/89		7/20/89		7/25/89		7/31/89		1/19/89		8/9/89		8/14/89		8/23/89		8/29/89		9/6/89		9/13/89		9/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175																																				
PCB 176																																				
PCB 177																																				
PCB 178/126																																				
PCB 180	0.3526		0.3633		0.344		0.3656		0.351		0.249		0.1648		0.2669		0.2493		0.2655		0.0175		0.2779		0.3091		0.3044		0.2611		0.1794		0.2385		0.1923	
PCB 182/187																																				
PCB 183																																				
PCB 185																																				
PCB 189																																				
PCB 190																																				
PCB 191																																				
PCB 193																																				
PCB 194																																				
PCB 195																																				
PCB 195/208																																				
PCB 196/203																																				
PCB 197																																				
PCB 198																																				
PCB 199																																				
PCB 201																																				
PCB 202																																				
PCB 203/196																																				
PCB 205																																				
PCB 206																																				
PCB 207																																				
PCB 208																																				
PCB 209																																				
Total Suspended PCBs (by congener sum) =	**14.58**		**17.87**		**15.36**		**15.09**		**15.25**		**8.99**		**8.69**		**10.78**		**10.03**		**12.44**		**0.50**		**14.10**		**14.95**		**12.90**		**11.26**		**7.80**		**9.70**		**8.32**	
Total Congeners Analyzed (Susp) =	**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**	
Total Congeners Detected (Susp) =	**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**	
Reported TPCBs (Susp) =	**50.87**		**63.66**		**54.29**		**63.42**		**63.52**		**36.79**		**35.48**		**45.31**		**39.34**		**53.38**		**3.45**		**60.33**		**64.93**		**51.04**		**43.87**		**31.47**		**38.72**		**34.46**	

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data, however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#27P		#28P		#29P		#2P		#30P		#31P		#32P		#33P		#34P		#35P		#36P		#37P		#38P		#39P		#3P		#40P		#41P		#42P		#43P	
Sample Date	9/27/89		10/4/89		10/12/89		4/19/89		10/18/89		10/24/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		1/11/90		1/25/90		1/25/90		4/19/89		2/6/90		2/21/90		3/6/90		3/21/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001																																						
PCB 003																																						
PCB 004																																						
PCB 004/010																																						
PCB 005																																						
PCB 005/008																																						
PCB 006																																						
PCB 007																																						
PCB 008																																						
PCB 012/013																																						
PCB 016/032																																						
PCB 017																																						
PCB 018																																						
PCB 019																																						
PCB 021																																						
PCB 022																																						
PCB 024																																						
PCB 024/027																																						
PCB 025																																						
PCB 026																																						
PCB 027																																						
PCB 028																																						
PCB 028/031	3.2804		4.49		4.3833		1.0096		7.0141		4.6332		7.5208		3.3025		1.5937		0.6618		0.5524		0.6221		0.3385		0.3448		4.4806		0.4713		0.4097		0.4764		2.861	
PCB 029																																						
PCB 031																																						
PCB 033																																						
PCB 037/042																																						
PCB 040																																						
PCB 041/064/071																																						
PCB 043																																						
PCB 044																																						
PCB 045																																						
PCB 046																																						
PCB 047																																						
PCB 048																																						
PCB 047/048																																						
PCB 049																																						
PCB 051																																						
PCB 052																																						
PCB 053																																						
PCB 056																																						
PCB 059																																						
PCB 060/092																																						
PCB 056/060	0.7545		1.0267		1.0668		0.1839		1.3478		0.7902		1.2936		0.6293		0.3305		0.1221		0.1015		0.1419		0.0761		0.0834		0.894		0.0974		0.0944		0.1291		0.5848	
PCB 063																																						
PCB 064/041																																						
PCB 066/095																																						
PCB 070																																						
PCB 070/076																																						
PCB 071																																						
PCB 074																																						
PCB 076																																						
PCB 077/110	0.5955		0.7341		0.803		0.1381		0.8741		0.597		0.7945		0.4531		0.257		0.1147		0.1259		0.1058		0.0756		0.0818		0.5916		0.086		0.0916		0.1134		0.3606	
PCB 081																																						

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#27P		#28P		#29P		#2P		#30P		#31P		#32P		#33P		#34P		#35P		#36P		#37P		#38P		#39P		#3P		#40P		#41P		#42P		#43P	
Sample Date	9/27/89		10/4/89		10/12/89		4/19/89		10/18/89		10/24/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		1/11/90		1/25/90		1/25/90		4/19/89		2/6/90		2/21/90		3/6/90		3/21/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 082																																				
PCB 083																																				
PCB 084																																				
PCB 084/092																																				
PCB 085																																				
PCB 087																																				
PCB 087/081																																				
PCB 089																																				
PCB 091																																				
PCB 097																																				
PCB 099																																				
PCB 100																																				
PCB 101	0.3433		0.4443		0.4684		0.0966		0.5535		0.3471		0.5047		0.2871		0.1595		0.0847		0.094		0.062		0.0468		0.0461		0.3699		0.0528		0.0536		0.0714		0.2233	
PCB 101/090																																				
PCB 105																																				
PCB 105/132/153																																				
PCB 107																																				
PCB 114																																				
PCB 114/134																																				
PCB 118	0.3029		0.4452		0.4233		0.0641		0.5154		0.3625		0.5465		0.2844		0.1504		0.0711		0.0742		0.0603		0.038		0.0402		0.3086		0.0456		0.0453		0.056		0.2417	
PCB 119																																				
PCB 124/135/144/147																																				
PCB 128																																				
PCB 129/178																																				
PCB 130																																				
PCB 131																																				
PCB 132/168																																				
PCB 135/144																																				
PCB 136																																				
PCB 137																																				
PCB 137/176																																				
PCB 138/158/163	0.3717		0.4628		0.4836		0.1154		0.6049		0.3999		0.5709		0.3132		0.1881		0.1104		0.1433		0.0939		0.067		0.0613		0.4488		0.0679		0.0612		0.0747		0.2847	
PCB 138/163																																				
PCB 141																																				
PCB 146																																				
PCB 149	0.1914		0.2856		0.2566		0.0642		0.3186		0.2318		0.3488		0.1612		0.0937		0.0573		0.0742		0.0411		0.0308		0.0353		0.2198		0.033		0.0325		0.0359		0.1504	
PCB 149/123																																				
PCB 151																																				
PCB 153/184																																				
PCB 156/171																																				
PCB 156/171/202																																				
PCB 157/200																																				
PCB 157																																				
PCB 158																																				
PCB 167																																				
PCB 169																																				
PCB 170																																				
PCB 172																																				
PCB 170/190																																				
PCB 172/197																																				
PCB 173																																				
PCB 174																																				

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#27P		#28P		#29P		#2P		#30P		#31P		#32P		#33P		#34P		#35P		#36P		#37P		#38P		#39P		#3P		#40P		#41P		#42P		#43P	
Sample Date	9/27/89		10/4/89		10/12/89		4/19/89		10/18/89		10/24/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		1/11/90		1/25/90		1/25/90		4/19/89		2/6/90		2/21/90		3/6/90		3/21/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175																																						
PCB 176																																						
PCB 177																																						
PCB 178/126																																						
PCB 180	0.154		0.195		0.1958		0.0395		0.2633		0.1788		0.2525		0.1362		0.082		0.0508		0.0491		0.042		0.0249		0.0209		0.173		0.0262		0.0247		0.0335		0.1267	
PCB 182/187																																						
PCB 183																																						
PCB 185																																						
PCB 189																																						
PCB 190																																						
PCB 191																																						
PCB 193																																						
PCB 194																																						
PCB 195																																						
PCB 195/208																																						
PCB 196/203																																						
PCB 197																																						
PCB 198																																						
PCB 199																																						
PCB 201																																						
PCB 202																																						
PCB 203/196																																						
PCB 205																																						
PCB 206																																						
PCB 207																																						
PCB 208																																						
PCB 209																																						
Total Suspended PCBs (by congener sum) =	**5.99**		**8.08**		**8.08**		**1.71**		**11.49**		**7.54**		**11.83**		**5.57**		**2.85**		**1.27**		**1.21**		**1.17**		**0.70**		**0.71**		**7.49**		**0.88**		**0.81**		**0.99**		**4.83**	
Total Congeners Analyzed (Susp) =	**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**	
Total Congeners Detected (Susp) =	**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**	
Reported TPCBs (Susp) =	**24.07**		**32.8**		**33.08**		**7.23**		**43.33**		**28.79**		**43.27**		**20.71**		**11.1**		**5.17**		**4.52**				**2.81**		**3.26**		**30.49**		**3.51**		**3.92**		**4.4**		**17.58**	

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data, however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#44P		#45P		#46P		#47P		#48P		#49P		#4P		#50P		#5P		#6P		#7P		#8P		#9P		89GG25R96		89GG25S70		89GG25S90		89GG26D10		89GG26S10	
Sample Date	3/28/90		4/4/90		4/11/90		4/17/90		4/24/90		4/24/90		4/19/89		5/1/90		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		5/5/89		5/4/89		5/5/89		5/5/89		5/5/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001																											0	U	0	U	1.6141		0.2506		0.0517	
PCB 003																											0	U	0.0404		0.1012		0.0484		0.0888	
PCB 004																																				
PCB 004/010																											0	U	0.1929		0.2186		0.1497		0.1994	
PCB 005																																				
PCB 005/008																											0.1733		7.1264		6.8317		4.1672		4.6209	
PCB 006																											0.0254		0.8808		1.2882		0.8116		0.8367	
PCB 007																											0.0057		0.0987		0.1267		0.0739		0.0827	
PCB 008																																				
PCB 012/013																											0	U	0	U	0.0293		0.0389		0.0059	
PCB 016/032																											0.0222		4.3905		5.5961		3.1595		4.0794	
PCB 017																											0.0219		2.8378		3.558		1.9683		2.588	
PCB 018																											0.044		4.0157		5.0881		2.8005		3.6708	
PCB 019																											0	U	0.2268		0.2717		0.1472		0.2044	
PCB 021																											0	U	0.0158		0.0046		0.008		0.0008	
PCB 022																											0.0226		5.3671		5.5075		3.1089		3.9717	
PCB 024																																				
PCB 024/027																											0	U	0.5366		0.4979		0.2727		0.3578	
PCB 025																											0.0133		1.4778		1.8749		1.3345		1.5693	
PCB 026																											0	U	2.1953		3.3816		2.2465		2.8124	
PCB 027																																				
PCB 028																																				
PCB 028/031	0.6231				1.4889		1.9949		4.2964		4.2214		6.8263		5.4029		7.4873		11.762		10.2041		8.9244		4.7898		0.095		17.2943		25.0155		13.7439		17.4818	
PCB 029																											0	U	0	U	0.0763		0.0708		0.035	
PCB 031																																				
PCB 033																											0.0335		4.9259		5.9921		3.1004		4.0742	
PCB 037/042																											0	U	2.6343		3.1271		2.0607		2.4424	
PCB 040																											0.0148		1.028		1.3652		0.8775		1.1608	
PCB 041/064/071																											0.0112		4.5779		7.3562		3.5818		4.5856	
PCB 043																											0	U	0.415		0.4428		0.2637		0.3205	
PCB 044																											0.4698		4.5244		5.7606		3.6253		4.6447	
PCB 045																											0.0053		0.8272		0.9626		0.675		0.7978	
PCB 046																											0	U	0.7029		0.7428		0.3867		0.5141	
PCB 047																																				
PCB 048																																				
PCB 047/048																											0.0041		2.9984		3.4692		2.6054		3.3491	
PCB 049																											0.0149		3.4267		4.4133		1.6979		2.207	
PCB 051																											0	U	0.2938		0.2861		0.191		0.2672	
PCB 052																											0.0327		3.8283		5.5874		3.0808		3.9782	
PCB 053																											0.0042		0.688		0.957		0.5688		0.6808	
PCB 056																																				
PCB 059																																				
PCB 060/092																																				
PCB 056/060	0.1455		0.2079		0.383		0.4919		0.8741		0.8992		1.2845		1.2913		1.7121		2.4361		2.3204		1.5061		0.8627		0.0171		4.3914		4.8274		2.7205		3.4864	
PCB 063																											0	U	0.3989		0.6599		0.3355		0.431	
PCB 064/041																																				
PCB 066/095																											0.0605		7.3889		9.392		5.2018		6.8001	
PCB 070																																				
PCB 070/076																											0.0362		5.5149		6.6282		3.6151		4.9085	
PCB 071																																				
PCB 074																											0.0052		2.1819		2.8159		1.4698		1.9149	
PCB 076																																				
PCB 077/110	0.1082		0.1678		0.2944		0.3607		0.6262		0.6436		0.8217		0.7944		0.9647		1.2447		1.3631		0.8032		0.5434		0.0372		1.9543		2.5934		1.6443		1.9986	
PCB 081																											0	U	0.0273		0.0595		0.031		0.0275	

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#44P		#45P		#46P		#47P		#48P		#49P		#4P		#50P		#5P		#6P		#7P		#8P		#9P		89GG25R96		89GG25S70		89GG25S90		89GG26D10		89GG26S10	
Sample Date	3/28/90		4/4/90		4/11/90		4/17/90		4/24/90		4/24/90		4/19/89		5/1/90		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		5/5/89		5/4/89		5/5/89		5/5/89		5/5/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 082																											0.0057		0.3074		0.4122		0.2554		0.2738	
PCB 083																											0	U	0.1117		0.1971		0.129		0.1657	
PCB 084																																				
PCB 084/092																											0.0114		1.595		1.8071		0.9364		1.271	
PCB 085																											0.0042		0.2823		0.4761		0.3232		0.4182	
PCB 087																											0.009		0.6834		0.8489		0.4708		0.6156	
PCB 087/081																																				
PCB 089																											0	U	0.0671		0.0855		0.0473		0.0624	
PCB 091																											0	U	0.3927		0.5443		0.29		0.5096	
PCB 097																											0.0037		0.5301		0.6852		0.4041		0.5151	
PCB 099																											0.0092		0.6586		0.8597		0.5576		0.7042	
PCB 100																											0	U	0.215		0.3174		0.1717		0.2335	
PCB 101	0.0701		0.107		0.1816		0.221		0.3786		0.3765		0.4562		0.5239		0.6021		0.9002		0.7905		0.5599		0.3391		0.0295		1.119		1.3842		0.8723		1.1012	
PCB 101/090																																				
PCB 105																																				
PCB 105/132/153																											0.0467		2.0681		2.3348		1.2735		1.3751	
PCB 107																											0	U	0.1739		0.2584		0.1537		0.168	
PCB 114																																				
PCB 114/134																																				
PCB 118	0.0599		0.1114		0.185		0.2359		0.3577		0.398		0.3584		0.507		0.5133		0.9654		0.7066		0.5638		0.3584		0.0114		1.1942		1.5584		0.8323		0.8809	
PCB 119																											0	U	0.1437		0.1267		0.0913		0.1254	
PCB 124/135/144/147																											0.0142		0.1707		0.2154		0.1254		0.1311	
PCB 128																											0	U	0.1245		0.1857		0.1516		0.1582	
PCB 129/178																											0	U	0.0863		0.0988		0.0589		0.0614	
PCB 130																											0	U	0.125		0.1344		0.0773		0.0876	
PCB 131																											0.2726		0.0765		0.1354		0.1877		0.103	
PCB 132/168																																				
PCB 135/144																																				
PCB 136																											0.0215		0	U	0.0271		0	U	0	U
PCB 137																																				
PCB 137/176																											0	U	0.0396		0.0395		0.0233		0.0179	
PCB 138/158/163	0.086		0.123		0.203		0.2792		0.4349		0.429		0.4592		0.5793		0.5492		1.0266		0.7695		0.6198		0.6886		0.289		1.0837		1.3451		0.7617		0.7849	
PCB 138/163																																				
PCB 141																											0.0096		0	U	0	U	0.1404		0.1467	
PCB 146																											0	U	0.9917		0.7666		0.5097		0.5116	
PCB 149	0.0456		0.0749		0.115		0.1484		0.2303		0.25		0.2327		0.3234		0.3065		0.6762		0.4656		0.3882		0.2516		0.0345		0.6101		0.7096		0.4453		0.45	
PCB 149/123																																				
PCB 151																											0.02		0.2203		0.2762		0.1702		0.1753	
PCB 153/184																																				
PCB 156/171																																				
PCB 156/171/202																											0	U	0.2004		0.2465		0.1727		0.1541	
PCB 157/200																											0	U	0.041		0.0493		0.0233		0.0273	
PCB 157																																				
PCB-158																																				
PCB 167																											0.0002		0.04		0.099		0.0488		0.0507	
PCB 169																											0	U	0	U	0	U	0	U	0	U
PCB 170																																				
PCB 172																																				
PCB 170/190																											0.7717		0.4801		0.4421		0.3018		0.284	
PCB 172/197																											0	U	0.0709		0.0806		0.0422		0.0442	
PCB 173																											0	U	0.0036		0.0046		0.0035		0.0018	
PCB 174																											0.0086		0.2058		0.2501		0.1473		0.1492	

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	#44P		#45P		#46P		#47P		#48P		#49P		#4P		#50P		#5P		#6P		#7P		#8P		#9P		89GG25R96		89GG25S70		89GG25S90		89GG26D10		89GG26S10	
Sample Date	3/28/90		4/4/90		4/11/90		4/17/90		4/24/90		4/24/90		4/19/89		5/1/90		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		5/5/89		5/4/89		5/5/89		5/5/89		5/5/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175																											0	U	0	U	0	U	0	U	0	U
PCB 176																																				
PCB 177																											0	U	0.1641		0.0995		0.0613		0.0641	
PCB 178/126																																				
PCB 180	0.0336		0.0515		0.0804		0.1035		0.1762		0.1889		0.2164		0.2653		0.236		0.4229		0.3673		0.2464		0.1692		0.0164		0.5356		0.5886		0.3557		0.3708	
PCB 182/187																											0.0161		0.3281		0.3756		0.235		0.2428	
PCB 183																											0.0075		0.1625		0.1956		0.126		0.1291	
PCB 185																											0.0013		0.0408		0.0762		0.0254		0.0246	
PCB 189																											0	U	0.0108		0.0197		0.0101		0.0095	
PCB 190																																				
PCB 191																											0	U	0	U	0.0087		0	U	0	U
PCB 193																											0	U	0.0293		0.0294		0.0306		0.0312	
PCB 194																											0	U	0.1449		0.1571		0.0767		0.0848	
PCB 195																																				
PCB 195/208																											0	U	0.2805		0.3252		0.2255		0.2705	
PCB 196/203																											0	U	0.3483		0.3803		0.2221		0.2684	
PCB 197																																				
PCB 198																											0	U	0	U	0.0158		0.0084		0.009	
PCB 199																											0	U	0.0256		0.0275		0.0187		0.0322	
PCB 201																											0.0411		0.3071		0.3342		0.1893		0.2322	
PCB 202																																				
PCB 203/196																																				
PCB 205																											0	U	0.0945		0.0705		0.0613		0.0287	
PCB 206																											0	U	0.2466		0.2862		0.1408		0.2267	
PCB 207																											0	U	0.0231		0.0264		0.0197		0.0287	
PCB 208																																				
PCB 209																											0	U	0.1696		0.1852		0.0931		0.1019	
Total Suspended PCBs (by congener sum) =	1.17		0.84		2.93		3.84		7.37		7.41		10.66		9.69		12.37		19.43		16.99		13.61		8.00		3.78		116.81		149.05		84.49		105.36	
Total Congeners Analyzed (Susp) =	8		7		8		8		8		8		8		8		8		8		8		8		8		93		93		93		93		93	
Total Congeners Detected (Susp) =	8		7		8		8		8		8		8		8		8		8		8		8		8		48		84		90		89		89	
Reported TPCBs (Susp) =	4.74		6.7		11.39		16.54		29.91		30.95		42.43		39.39		48.66		96.3		72.41		56.36		31.66											

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	89GG26S30		89GG26S50		89GG26S70		89GG31D81		89GG31S01		89GG31S21		89GG31S41		89GG31S81		89GG32S01		89GG41R96		89GG41S01		89GG41S21		89GG41S41		89GG41S61		89GG41S81		89GG42S01		89GG56D61		89GG56R96	
Sample Date	5/5/89		5/5/89		5/6/89		6/8/89		6/7/89		6/8/89		6/7/89		6/8/89		6/8/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		9/20/89		9/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0.1291		0.8106		0.2616		0	U	0	U	1.703		0.0323		0	U	0.0625		0	U	0.2164		0	U	0	U	0	U	0	U	0	U	0.699		0	U
PCB 003	0.2597		0.1827		0	U	0.0463		0.0825		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.9923		0	U	0	U
PCB 004																																				
PCB 004/010	0.1722		0.1262		0.1631		0.07		0.0674		0.0624		0.0493		0.0293		0.1762		0	U	0.0369		0.0585		0.0957		0.0626		0.104		0.132		0.0377		0.1215	
PCB 005																																				
PCB 005/008	3.0953		2.9505		4.0076		2.9255		2.7954		2.7884		1.8156		1.3131		3.0417		7.4899		1.3229		1.9707		2.9607		1.7344		3.0777		3.9026		1.0228		1.6537	
PCB 006	0.6451		0.5213		0.8379		0.4556		0.3824		0.3651		0.2131		0.1813		0.5064		1.2243		0.2537		0.3086		0.5303		0.3883		0.6789		0.5989		0.2208		0	U
PCB 007	0.0639		0.0545		0.0875		0.0436		0.0357		0.0395		0.0268		0.0146		0.0531		0.0975		0.017		0.0289		0.0466		0.026		0.0349		0.0697		0.0194		0.0223	
PCB 008																																				
PCB 012/013	0.0458		0.0052		0	U	0	U	0	U	0	U	0	U	0	U	0.0296		0	U	0.0051		0.0078		0.0049		0.0107		0.0234		0.0195		0.0112		0	U
PCB 016/032	3.2809		2.9576		3.936		1.7742		1.4911		1.4576		1.083		0.8651		1.7806		1.2258		0.9619		1.4741		2.2601		1.3686		2.4041		2.3885		1.0122		0.6793	
PCB 017	2.0759		1.8458		2.5149		0.9904		0.8099		0.8612		0.566		0.5201		1.0199		0.8057		0.5535		0.8459		1.331		0.8476		1.458		1.6042		0.6839		0.393	
PCB 018	3.0659		2.7478		3.7098		1.681		1.2823		1.244		0.8992		0.7259		1.5976		2.7022		0.9266		1.3916		2.1481		1.4022		2.3724		2.4519		1.0756		0.7029	
PCB 019	0.1533		0.1844		0.1659		0.0737		0.0564		0.068		0.0719		0.0314		0.0951		0	U	0.037		0.0634		0.1063		0.0655		0.1112		0.1465		0.0554		0	U
PCB 021	0.0008		0.0064		0.0104		0.0133		0	U	0	U	0.0034		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0409		0	U	0	U
PCB 022	3.0163		2.7517		3.5598		2.4119		2.0377		1.9881		1.5498		1.2914		2.2454		0.9692		1.1408		1.7431		2.5068		1.4003		2.5966		2.8986		1.1787		0.3744	
PCB 024																																				
PCB 024/027	0.27		0.2596		0.341		0.1512		0.1329		0.1217		0.1004		0.0822		0.1612		0	U	0.092		0.1666		0.2524		0.1415		0.2387		0.2545		0.1379		0	U
PCB 025	1.4187		1.341		1.4003		0.7531		0.5096		0.6253		0.4996		0.4539		0.8549		0.2266		0.3522		0.7314		1.3748		0.6456		1.4231		1.8331		0.4998		0.0421	
PCB 026	2.3443		2.0716		3.9797		1.0714		0.8765		0.9146		0.7213		0.6637		1.4503		0.1605		0.5378		1.0149		1.8396		0.9286		1.9628		2.067		0.7187		0.0657	
PCB 027																																				
PCB 028																																				
PCB 028/031	13.7041		13.1125		15.9123		8.2737		11.3734		7.7989		6.0462		4.9934		9.1455		2.4921		4.4642		6.8534		10.6611		6.0861		11.0761		12.7072		5.9543		1.4528	
PCB 029	0.0369		0.0491		0.0607		0.0447		0.0337		0.0448		0.0308		0.0176		0.035		0	U	0.0148		0.0406		0.058		0.014		0.0501		0.0324		0.0181		0	U
PCB 031																																				
PCB 033	2.9703		2.9722		3.6192		3.1392		2.247		2.0307		1.5427		1.3938		1.8445		0.8372		1.2415		1.7988		2.4104		1.3282		2.5137		2.8249		1.0602		0.6161	
PCB 037/042	2.1992		1.984		2.5061		1.1267		0.88		0.8046		0.6863		0.6289		1.0578		0	U	0.7432		0.9213		1.5202		0.9557		1.5821		1.7639		0.7946		0.0545	
PCB 040	0.9756		0.9167		1.0975		0.4557		0.3513		0.3665		0.3539		0.3785		0.494		0.0795		0.3382		0.5281		0.7881		0.4778		0.7775		0.7018		0.4221		0	U
PCB 041/064/071	3.7486		5.3633		4.6088		0		1.8881		1.6381		1.3349		1.2124		2.1773		0	U	0	U	1.8646		13.5384		0	U	0	U	3.0287		3.0076		0	U
PCB 043	0.2905		0.24		0.394		0.2025		0.1728		0.132		0.1247		0.0699		0.246		0.1215		0.104		0.1699		0.2765		0.1606		0.2663		0.3295		0	U	0	U
PCB 044	4.0159		3.6983		4.7884		2.6011		2.3992		1.5978		1.3539		1.1012		2.1713		0.6272		1.3439		1.9642		2.9265		1.943		3.832		3.1468		1.9161		0.4698	
PCB 045	0.7367		0.5973		0.7878		0.394		0.2714		0.3285		0.1702		0.2415		0.3362		0.1395		0.1879		0.3717		0.5412		0.3478		0.5377		0.5932		0.2891		0.0384	
PCB 046	0.4231		0.3842		0.5364		0.2407		0.1756		0.1903		0.1447		0.0828		0.2252		0	U	0.1174		0.2062		0.2591		0.187		0.4481		0.3311		0.1594		0	U
PCB 047																																				
PCB 048																																				
PCB 047/048	2.8129		2.6182		2.9386		1.4876		1.2903		1.1146		0.9081		0.7093		1.3811		0.3091		0.8301		1.3738		1.8657		1.1708		2.2049		1.9437		1.0178		0.124	
PCB 049	1.7787		1.6264		3.6533		1.5956		1.5161		1.3134		1.0943		0.8571		1.6854		0.1245		0.9785		1.5194		2.2761		1.4485		2.4509		2.5373		1.4827		0.1612	
PCB 051	0.2161		0.1932		0.2257		0.0929		0.0592		0.0727		0.0589		0.0355		0.0914		0	U	0.0617		0.0932		0.1466		0.0925		0.1559		0.1738		0.1018		0	U
PCB 052	3.6277		3.2253		4.4435		1.6727		1.4736		1.3886		1.1541		0.809		1.7311		0.5176		1.0023		1.3878		2.2514		1.6225		2.5529		2.8277		2.0536		0.3496	
PCB 053	0.692		0.64		0.8603		0.3458		0.3765		0.3604		0.2807		0.1384		0.4617		0	U	0.2488		0.369		0.5495		0.372		0.5746		0.577		0.3109		0.1116	
PCB 056																																				
PCB 059																																				
PCB 060/092																																				
PCB 056/060	2.8103		2.6732		3.336		1.8157		1.5072		1.6022		1.3641		1.2078		1.7948		0.2296		1.111		1.6037		2.1148		1.2612		2.388		2.5326		1.2174		0.1636	
PCB 063	0.3558		0.332		0.4179		0.244		0.2641		0.1786		0.1502		0.1215		0.2021		0	U	0.1065		0.1418		0.2184		0.1433		0.2419		0.3394		0.1671		0	U
PCB 064/041																																				
PCB 066/095	6.0216		5.2902		6.2559		3.8151		3.4025		3.2867		2.8233		2.1888		3.5141		0.6887		1.9647		3.6314		4.4326		3.0981		5.2563		4.8502		0	U	0.6223	
PCB 070																																				
PCB 070/076	3.9208		4.1936		4.7886		2.9118		2.5289		2.5046		2.1206		1.7717		2.6373		0.6437		1.6544		3.165		3.4356		2.3464		4.0687		3.4048		0	U	0.393	
PCB 071																																				
PCB 074	1.5555		1.5521		1.8314		1.1436		1.1859		0.9495		0.7667		0.6407		1.0265		0.171		0.6814		0.9585		1.0972		0.7086		1.2541		1.5004		0.9361		0.0731	
PCB 076																																				
PCB 077/110	1.8499		1.5549		1.8887		0.9425		0.8137		0.8095		0.737		0.6559		0.9799		0.3031		0.617		0.8932		1.3062		0.9531		1.551		1.3315		0.9854		0.2504	
PCB 081	0.0251		0.0272		0.0325		0.018		0.0163		0.0153		0.0185		0.0106		0.0263		0	U	0	U	0.0345		0.0378		0.0285		0.0342		0.027		0.0265		0.1946	

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	89GG26S30		89GG26S50		89GG26S70		89GG31D81		89GG31S01		89GG31S21		89GG31S41		89GG31S81		89GG32S01		89GG41R96		89GG41S01		89GG41S21		89GG41S41		89GG41S61		89GG41S81		89GG42S01		89GG56D61		89GG56R96	
Sample Date	5/5/89		5/5/89		5/6/89		6/8/89		6/7/89		6/8/89		6/7/89		6/8/89		6/8/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		9/20/89		9/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 082	0.1956		0.176		0.2318		0.1364		0.1162		0.1174		0.0993		0.0913		0.1498		0.082		0.0686		0.1157		0.1766		0.1126		0.1783		0.2061		0.1315		0	U
PCB 083	0.1446		0.1352		0.1383		0.0787		0.0752		0.0448		0.0403		0.036		0.0721		0	U	0.0541		0.0818		0.0984		0.0705		0.1161		0.0751		0.0728		0.0298	
PCB 084																																						
PCB 084/092	1.241		1.0028		1.3242		0.6483		0.5082		0.4401		0.4213		0.306		0.6163		0.1725		0.3781		0.589		0.8132		0.6241		0.9468		0.7971		0.6493		0.1364	
PCB 085	0.3772		0.3403		0.3318		0.2033		0.1551		0.1546		0.136		0.1269		0.2088		0	U	0.0933		0.1912		0.2756		0.2008		0.3224		0.276		0.2051		0	U
PCB 087	0.5645		0.4948		0.6334		0.3053		0.2489		0.2411		0.2258		0.1868		0.3143		0.2911		0.2356		0.3038		0.432		0.3267		0.4966		0.4079		0.3133		0.2194	
PCB 087/081																																						
PCB 089	0.1098		0.0482		0.0535		0.0273		0.0165		0.0236		0.0304		0.0188		0.0328		0	U	0.0151		0.021		0.0345		0.0132		0.0361		0.0483		0.0187		0	U
PCB 091	0.4489		0.4568		0.3852		0.2363		0.1879		0.1142		0.113		0.1077		0.2577		0	U	0.0993		0.1539		0.1565		0.1786		0.3683		0.3267		0.2181		0	U
PCB 097	0.4616		0.4146		0.5204		0.2784		0.2289		0.2344		0.2022		0.1655		0.2708		0.1215		0.1693		0.2514		0.341		0.2467		0.3918		0.3627		0.2585		0.0521	
PCB 099	0.6449		0.5617		0.6999		0.3529		0.2778		0.2772		0.253		0.2133		0.352		0.0585		0.2273		0.3303		0.451		0.3183		0.4994		0.46		0.3212		0.0645	
PCB 100	0.1704		0.1437		0.2462		0.1273		0.1217		0.0712		0.0607		0.0624		0.145		0	U	0.0862		0.1232		0.1668		0.1016		0.1486		0.1382		0.098		0	U
PCB 101	1.0059		0.9238		1.1324		0.6015		0.4898		0.4633		0.4236		0.3652		0.5703		0.2986		0.3705		0.529		0.7225		0.5349		0.8204		0.7656		0.5557		0.2603	
PCB 101/090																																						
PCB 105																																						
PCB 105/132/153	1.0781		0.8645		1.3297		0.883		0.8733		0.7903		0.6625		0.5882		0.9593		0.5909		0.5167		0.7787		1.0344		0.8494		1.1338		1.2492		0.8793		0.6454	
PCB 107	0.1082		0.0919		0.1833		0.1097		0.0483		0.0831		0.0703		0.0686		0.0611		0.1423		0.0329		0.0401		0.077		0.0407		0.0971		0.1409		0.0599		0	U
PCB 114																																						
PCB 114/134	0.1594		0.1646		0.2976		0.6557		0		0.1338		0.2675		0.1155		0.5873		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 118	0.6081		0.5323		0.782		0.5454		0.4748		0.5311		0.4504		0.409		0.5176		0.0772		0.3054		0.5249		0.705		0.4687		0.9472		0.8267		0.4874		0.0947	
PCB 119	0.1103		0.1325		0.1095		0.0616		0.05		0.0691		0.054		0.0612		0.0721		0	U	0.0531		0.0638		0.0465		0.0671		0.1955		0.0719		0.0545		0	U
PCB 124/135/144/147	0.0989		0.0904		0.1311		0.0775		0.0905		0.0776		0.0623		0.0622		0.0924		0.0736		0.0468		0.0524		0.0739		0.0584		0.1126		0.0734		0.0751		0.0427	
PCB 128	0.128		0.1064		0.1207		0.0899		0.1066		0.0861		0.07		0.0524		0.1072		0	U	0.0639		0.0843		0.1192		0.0942		0.1102		0.1461		0.0824		0	U
PCB 129/178	0.047		0.0415		0.0627		0.0471		0.0473		0.042		0.0304		0.0306		0.0531		0	U	0.0475		0.0409		0.0781		0.0717		0.0823		0.0515		0.0385		0	U
PCB 130	0.0662		0.0528		0.0836		0.0471		0.0384		0.026		0.0229		0.0484		0.058		0	U	0.0627		0.0557		0.064		0.0239		0.0283		0.1048		0.1157		0	U
PCB 131	0.0985		0.1119		0.1657		0.3193		1.0214		0.026		0	U	0.0205		0.1785		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 132/168																																						
PCB 135/144																																						
PCB 136	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.102		0	U	0.1155		0	U	0.0407		0.052		0.037		0.0603		0	U	0.0326		0.0347	
PCB 137																																						
PCB 137/176	0.0161		0.0159		0.0204		0.0175		0.0134		0.0225		0.0152		0.0105		0.0207		0	U	0.0013		0.01		0.0023		0.01		0.0141		0.0301		0.0101		0	U
PCB 138/158/163	0.8701		0.5237		0.7803		0.5766		0.5588		0.5016		0.4266		0.3823		0.6352		0	U	0.3207		0.4569		0.6538		0.9668		0.687		0.7536		0.555		0	U
PCB 138/163																																						
PCB 141	0.0997		0.0965		0.131		0.0781		0	U	0.0735		0.0614		0.0291		0.1036		0.0772		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.06	
PCB 146	0.372		0.3347		0.5241		0.5742		0.8017		0.3146		0.3596		0.4132		0.531		0	U	0.2027		0		0.4394		0	U	0	U	0.5186		0	U	0	U
PCB 149	0.3469		0.3092		0.4836		0.273		0.293		0.2796		0.2242		0.1793		0.3523		0.2412		0.1695		0.2463		0.3434		0.2561		0.4547		0.4213		0.2721		0.2814	
PCB 149/123																																						
PCB 151	0.127		0.128		0.18		0.1017		0.1111		0.0945		0.0748		0.0661		0.1346		0.1821		0.0628		0.0881		0.1242		0.0943		0.131		0.1278		0.0986		0.1707	
PCB 153/184																																						
PCB 156/171																																						
PCB 156/171/202	0.1362		0.1041		0.1495		0.1182		0.1093		0.0831		0.0684		0.0566		0.1172		0	U	0.0601		0.0818		0.1102		0	U	0	U	0.1474		0	U	0	U
PCB 157/200	0.0155		0.0128		0.0276		0.0297		0.0205		0	U	0.0013		0	U	0.0277		0	U	0	U	0.0372		0.0128		0.0412		0.0453		0	U	0	U	0	U
PCB 157																																						
PCB 158																																						
PCB 167	0.0183		0.0303		0.0494		0.0244		0.0358		0.0333		0.0273		0.0162		0.0364		0	U	0.0218		0.0246		0.041		0.1345		0.039		0.0372		0.0238		0	U
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																						
PCB 172																																						
PCB 170/190	0.3193		0.3258		0.4348		0.454		1.364		0.1381		0.1785		0.1279		0.6032		0	U	0.188		0		0.3131		0	U	0	U	0.3649		0	U	0	U
PCB 172/197	0.0278		0.0255		0.0487		0.0305		0.1538		0.015		0.017		0.0208		0.0668		0	U	0.0081		0.0379		0.0324		0.0401		0.0417		0.0496		0.0289		0	U
PCB 173	0.003		0.0013		0.003		0.0016		0.0022		0	U	0.0022		0	U	0.0022		0	U	0	U	0	U	0	U	0	U	0	U	0.0027		0.0012		0	U
PCB 174	0.1291		0.0989		0.1676		0.1169		0.1105		0.0998		0.0741		0.0732		0.1498		0.0663		0.0571		0.0876		0.1132		0.0928		0.1104		0.1503		0.0906		0.044	

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	89GG26S30		89GG26S50		89GG26S70		89GG31D81		89GG31S01		89GG31S21		89GG31S41		89GG31S81		89GG32S01		89GG41R9E		89GG41S01		89GG41S21		89GG41S41		89GG41S61		89GG41S81		89GG42S01		89GG56D61		89GG56R9E	
Sample Date	5/5/89		5/5/89		5/6/89		6/8/89		6/7/89		6/8/89		6/7/89		6/8/89		6/8/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		9/20/89		9/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175	0.003		0	U	0	U	0.005		0	U	0	U	0.0054		0	U	0.0061		0	U	0	U	0	U	0	U	0	U	0	U	0.0049		0	U	0	U
PCB 176																																				
PCB 177	0.0525		0.0436		0.0655		0.0853		0.0827		0.0786		0.0492		0.049		0.1		0	U	0.0499		0.0639		0.0909		0.0661		0.0858		0.1287		0.0621		0	U
PCB 178/126																																				
PCB 180	0.2718		0.236		0.3502		0.2871		0.2772		0.229		0.2124		0.1577		0.3196		0.1821		0.1506		0.2143		0.305		0.2285		0.3178		0.3454		0.2276		0.1854	
PCB 182/187	0.1715		0.1623		0.2506		0.1781		0.1868		0.1515		0.1213		0.1064		0.2076		0.0965		0.0952		0.1151		0.1871		0.1274		0.1952		0.223		0.1308		0.096	
PCB 183	0.098		0.088		0.1256		0.0939		0.0932		0.0804		0.0649		0.0742		0.1046		0	U	0.0571		0.0796		0.1112		0.0869		0.1217		0.1175		0.0741		0.08	
PCB 185	0.1236		0.0161		0.0315		0.0237		0.0212		0.021		0.0223		0.0116		0.0273		0	U	0.0105		0.012		0.0209		0.0772		0.0172		0.0217		0.0184		0	U
PCB 189	0.0063		0.0068		0.0133		0.0061		0.0055		0.0045		0.0076		0.0036		0.0115		0	U	0.0037		0.007		0.0073		0.0042		0.008		0.0066		0.0052		0	U
PCB 190																																				
PCB 191	0	U	0	U	0.0099		0	U	0.0045		0	U	0.0075		0	U	0.0055		0	U	0	U	0	U	0.0066		0	U	0	U	0	U	0	U	0	U
PCB 193	0.0237		0.0223		0.0182		0.0171		0.0189		0.0078		0.0108		0.0088		0.0179		0	U	0.0066		0.0116		0.0184		0.012		0.0191		0.0208		0.0112		0	U
PCB 194	0.064		0.0601		0.0857		0.1007		0.0704		0.0574		0.0436		0.0392		0.0938		0	U	0.0703		0.0817		0.1024		0.0586		0.061		0.0859		0.063		0	U
PCB 195																																				
PCB 195/208	0.159		0.1071		0.1812		0.195		0.1367		0.1278		0.0945		0.0908		0.153		0	U	0.0811		0.1013		0.1429		0.0921		0.1476		0.167		0.0894		0	U
PCB 196/203	0.17		0.1385		0.22		0.2741		0.1719		0.1472		0.1117		0.111		0.2196		0	U	0.0988		0.1504		0.211		0.1492		0.2147		0.2116		0.1321		0	U
PCB 197																																				
PCB 198	0.0037		0.0258		0.0363		0.0717		0	U	0.0028		0	U	0	U	0.0476		0.2002		0.0035		0	U	0.011		0	U	0	U	0.0064		0	U	0	U
PCB 199	0.0136		0.0137		0.0192		0.016		0.0117		0.0167		0.0108		0.008		0.016		0	U	0.0082		0.0125		0.0187		0.0134		0.0191		0.0241		0.0099		0	U
PCB 201	0.1392		0.1245		0.1995		0.2689		0.199		0.1396		0.1015		0.0977		0.2082		0	U	0.0826		0.1278		0.1793		0.117		0.1758		0.1945		0.129		0	U
PCB 202																																				
PCB 203/196																																				
PCB 205	0.0399		0.0289		0.0298		0.038		0.0699		0.0286		0.0192		0.0135		0.029		0	U	0.1142		0.1043		0.1213		0.0877		0.0326		0.0209		0.051		0	U
PCB 206	0.0896		0.0802		0.1375		0.2391		0.1087		0.1119		0.0734		0.0728		0.1675		0	U	0.0572		0.0896		0.1217		0.0596		0.1354		0.1185		0.0705		0	U
PCB 207	0.0134		0.0086		0.0159		0.0217		0.0172		0.0184		0.0087		0.009		0.0253		0	U	0.0041		0.0159		0.013		0.002		0.0126		0.0157		0.0065		0	U
PCB 208																																				
PCB 209	0.0722		0.0232		0.0963		0.0919		0	U	0.0985		0.0592		0.0488		0.0485		0	U	0.0329		0.0647		0.0738		0.0594		0.0514		0	U	0.0401		0	U
Total Suspended PCBs (by congener sum) =	**86.67**		**82.14**		**103.81**		**55.27**		**55.01**		**47.79**		**37.15**		**30.95**		**56.60**		**25.26**		**29.21**		**46.39**		**78.02**		**41.08**		**70.53**		**77.75**		**36.16**		**11.63**	
Total Congeners Analyzed (Susp) =	**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**	
Total Congeners Detected (Susp) =	**90**		**89**		**88**		**87**		**83**		**84**		**87**		**83**		**89**		**41**		**80**		**80**		**84**		**78**		**78**		**84**		**77**		**41**	
Reported TPCBs (Susp) =																																				

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	89GG56S01		89GG56S21		89GG56S41		89GG56S61		89GG56S81		89GG57S01		90GG01D61		90GG01S01		90GG01S21		90GG01S41		90GG01S61		90GG01S81		90GG02S01		90GG26S10		90GG26S50		90GG26S70		90GG26S90		90GG27S10	
Sample Date	9/20/89		9/20/89		9/20/89		9/20/89		9/20/89		9/20/89		10/18/89		10/17/89		10/17/89		10/18/89		10/18/89		10/18/89		10/18/89		4/30/90		5/1/90		5/1/90		5/1/90		5/1/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0	U	0.4139		0.0126		0.03		0	U	0.0376		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 003	0	U	0	U	0	U	0.0707		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.2786		0	U	0	U	0.0431		0	U
PCB 004																																				
PCB 004/010	0.0515		0.0863		0.0545		0.0451		0.0833		0.0918		0.1059		0.0674		0.1089		0.0993		0.1441		0.1134		0.1337		0.0857		0.1693		0.0819		0.0888		0.0894	
PCB 005																																				
PCB 005/008	1.8402		2.2623		1.6068		0.9317		1.8622		2.018		3.4201		1.8819		3.8698		3.0506		3.7275		3.4264		4.3291		2.3282		4.2535		1.3924		1.7901		1.9585	
PCB 006	0.3847		0.3648		0.2061		0.1468		0.2656		0.204		0.7873		0.3347		0.6313		0.5632		0.7823		0.6665		0.8365		0.4346		0.9481		0.2543		0.417		0.3784	
PCB 007	0.0269		0.0401		0.0286		0.0218		0.0274		0.0234		0.0513		0.0272		0.0576		0.0469		0.06		0.0544		0.069		0.036		0.0668		0.0238		0.0368		0.0483	
PCB 008																																				
PCB 012/013	0.0044		0.0131		0.002		0	U	0	U	0.0361		0.0192		0	U	0	U	0	U	0	U	0	U	0.0507		0.0193		0.0477		0	U	0.0122		0.016	
PCB 016/032	1.2525		1.8713		1.2294		0.9133		1.3293		1.1906		2.6395		1.5826		2.8592		2.4836		3.5493		2.7809		3.4025		1.8084		3.6496		1.5448		1.7679		1.9315	
PCB 017	0.739		1.4144		0.8495		0.6581		0.8843		0.79		1.6239		0.9535		1.5595		1.4802		2.1448		1.6423		2.0039		1.083		2.3217		1.0358		1.203		1.2507	
PCB 018	1.178		1.8456		1.2709		1.0235		1.3453		1.2727		2.582		1.5685		2.67		2.422		3.549		2.7724		3.296		1.5614		3.2657		1.4528		1.7287		1.7833	
PCB 019	0.0525		0.1237		0.0712		0.0529		0.0775		0.0656		0.1421		0.0925		0.157		0.1273		0.1932		0.1501		0.1695		0.1053		0.1801		0.0855		0.2511		0.0999	
PCB 021	0	U	0.0094		0.007		0.0191		0.0627		0.0605		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0345		0.0128		0	U	0	U	0.0277	
PCB 022	1.5139		1.8571		1.2773		0.9203		1.5322		1.2615		2.5194		1.5294		3.1192		2.4864		3.1341		2.6997		3.572		1.8694		3.7607		1.4718		1.7542		2.0889	
PCB 024																																				
PCB 024/027	0.1342		0.1752		0.109		0.0813		0.1539		0.1477		0.2689		0.1614		0.2946		0.2474		0.3585		0.2851		0.3503		0.1686		0.412		0.1676		0.1876		0.2	
PCB 025	0.5859		0.7957		0.8911		0.4936		0.9119		0.7893		1.3561		0.7049		1.332		1.1765		1.7256		1.3742		1.7836		1.0222		1.8652		0.7506		0.982		0.9586	
PCB 026	0.7935		1.1246		0.9718		0.6377		1.0853		0.9624		2.0134		1.1054		2.0621		1.8616		2.6378		2.1102		2.6947		1.4482		2.913		1.1226		1.3045		1.3852	
PCB 027																																				
PCB 028																																				
PCB 028/031	5.9006		8.836		5.8867		4.6033		6.6222		5.8623		11.1231		6.7884		13.2766		10.9771		14.3727		11.7696		15.5055		7.9206		15.3969		6.2905		7.6971		8.3485	
PCB 029	0.0129		0.014		0.0408		0.0051		0.0323		0.0108		0.1039		0.0488		0.0582		0.0719		0.0706		0.0769		0.1142		0.0427		0.0636		0.0237		0.0818		0.0228	
PCB 031																																				
PCB 033	1.55		2.1639		1.3804		0.9561		1.5875		1.4762		2.7789		1.7183		3.5103		2.7674		3.4776		3.0179		3.9109		1.9598		3.6426		1.3836		1.6903		1.9412	
PCB 037/042	0.9275		1.3693		0.9355		0.7504		1.1299		0.923		1.7817		1.0429		1.9658		1.9224		2.8296		1.8708		2.3898		0.8822		2.3867		1.0918		1.2464		1.0274	
PCB 040	0.4344		0.6487		0.3836		0.2887		0.4603		0.3742		0.9737		0.5402		0.9328		0.8328		1.1856		0.8898		1.1113		0.4996		1.1863		0.5243		0.7199		0.652	
PCB 041/064/071	0	U	2.2757		1.6715		1.3416		1.8838		1.672		3.6348		2.0134		4.0799		3.5934		4.5899		3.5587		4.8304		0	U	0	U	2.1388		1.5477		2.824	
PCB 043	0.1818		0.1834		0.1379		0.1436		0.2314		0.1996		0.4754		0.2403		0.8231		0.7444		0.4648		0.4138		0.811		0.1446		0.4707		0.1813		0.2091		0.2167	
PCB 044	1.6266		2.4461		2.0044		1.4322		1.9861		1.7226		3.2895		2.0008		3.6574		3.376		4.567		3.4741		4.3184		1.9065		4.532		1.9839		2.4519		6.5108	
PCB 045	0.2522		0.3713		0.2877		0.2291		0.3716		0.3541		0.6533		0.44		0.5965		0.6319		0.9033		0.6675		0.8343		0.3968		0.8815		0.357		0.449		0.491	
PCB 046	0.1738		0.227		0.1663		0.1384		0.151		0.1784		0.3232		0.2108		0.3582		0.3159		0.44		0.3411		0.414		0.1982		0.4842		0.2479		0.2418		0.394	
PCB 047																																				
PCB 048																																				
PCB 047/048	1.0816		1.4987		1.0679		0.9617		1.3521		1.0857		2.3552		1.3683		2.7528		2.312		2.9526		2.4129		3.0586		1.2256		2.9671		1.2892		1.4871		1.8874	
PCB 049	1.2836		1.9761		1.4194		1.2208		1.6877		1.3864		2.8998		1.7512		3.1928		2.7141		3.8355		2.953		3.6577		1.5865		3.5577		1.5799		1.8083		2.0956	
PCB 051	0.0808		0.117		0.0793		0.0611		0.1212		0.092		0.1506		0.0809		0.1544		0.1434		0.2126		0.1534		0.1922		0.0827		0.2359		0.1037		0.1078		0.1591	
PCB 052	1.2696		1.7981		1.5759		1.441		1.7412		1.5078		2.7231		1.4304		2.8742		2.4564		3.5979		2.6669		3.4191		1.3591		3.3312		1.6407		1.7157		2.0074	
PCB 053	0.3203		0.3773		0.3102		0.2601		0.3754		0.3119		0.504		0.294		0.5223		0.4824		0.7019		0.4986		0.6341		0.364		0.6564		0.312		0.3359		0.3893	
PCB 056																																				
PCB 059																																				
PCB 060/092																																				
PCB 056/060	1.3153		1.7157		1.1721		0.9129		1.356		1.2394		2.4609		1.6242		3.3141		2.3385		3.2433		2.59		3.496		1.7365		3.2689		1.3174		1.6533		2.0172	
PCB 063	0.1077		0.2253		0.1781		0.139		0.1857		0.0891		0.291		0.2161		0.342		0.2936		0.4122		0.3045		0.4067		0.1933		0.4322		0.1823		0.1992		0.2087	
PCB 064/041																																				
PCB 066/095	3.0164		3.7696		2.4678		0	U	3.0684		2.6188		3.9369		2.4789		4.9423		3.4578		5.0776		4.1525		5.1226		3.8592		6.2151		2.7039		1.4238		3.2068	
PCB 070																																				
PCB 070/076	2.3704		2.5149		1.4593		1.1674		2.0644		1.5892		4.2408		2.8905		5.0735		4.0759		5.6649		4.3035		5.4214		0	U	3.1793		1.4156		2.6076		1.8051	
PCB 071																																				
PCB 074	0.7613		1.0037		0.7156		0.5491		0.7997		0.67		1.4403		1.0149		1.8204		1.5491		1.7805		1.4585		1.9638		0.8529		1.8127		0.7573		0.82		1.1742	
PCB 076																																				
PCB 077/110	0.7889		1.0531		0.8154		0.6916		0.7748		0.7243		1.526		0.9637		1.7101		1.5673		2.0011		1.6284		2.1594		1.0779		2.085		0.8674		0.924		1.3836	
PCB 081	0.0373		0.0298		0.0099		0.0124		0.0166		0.013		0.0476		0	U	0	U	0.0379		0	U	0	U	0.0575		0.0175		0.0431		0.0244		0	U	0.0301	

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	89GG56S01		89GG56S21		89GG56S41		89GG56S61		89GG56S81		89GG57S01		90GG01D61		90GG01S01		90GG01S21		90GG01S41		90GG01S61		90GG01S81		90GG02S01		90GG26S10		90GG26S50		90GG26S70		90GG26S90		90GG27S10	
Sample Date	9/20/89		9/20/89		9/20/89		9/20/89		9/20/89		9/20/89		10/18/89		10/17/89		10/17/89		10/18/89		10/18/89		10/18/89		10/18/89		4/30/90		5/1/90		5/1/90		5/1/90		5/1/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 082	0.0768		0.1924		0.1276		0.0872		0.2004		0.1662		0.2038		0.1537		0.2126		0.1581		0.2313		0.2123		0.2565		0.1821		0.1931		0.1583		0.1745		0.1509	
PCB 083	0.083		0.0843		0.051		0.0384		0.0519		0.0448		0.1153		0.0627		0.1037		0.0961		0.1393		0.1055		0.1395		0.0453		0.1245		0.0892		0.0894		0.1842	
PCB 084																																						
PCB 084/092	0.4267		0.6779		0.4112		0.3975		0.4685		0.4408		0.9425		0.5667		1.0302		0.9007		1.2913		0.9535		1.222		0.5213		1.3442		0.6019		0.6345		0.8388	
PCB 085	0.1648		0.2055		0.1481		0.1297		0.2158		0.1579		0.3058		0.1998		0.3491		0.306		0.424		0.3202		0.4227		0.1939		0.4169		0.1909		0.2068		0.3151	
PCB 087	0.2601		0.3162		0.2112		0.2177		0.2455		0.2258		0.4549		0.316		0.5505		0.4354		0.6655		0.4994		0.6073		0.3		0.6264		0.2981		0.3342		0.4913	
PCB 087/081																																						
PCB 089	0.0165		0.0278		0.0292		0.0196		0.0306		0.0287		0.0503		0	U	0	U	0.0458		0.0574		0.0454		0.0579		0.0219		0.0404		0.0132		0.0198		0.0177	
PCB 091	0.0886		0.2567		0.1455		0.1227		0.1371		0.1127		0.4103		0.2588		0.4286		0.4414		0.6073		0.2853		0.3568		0.1843		0.3759		0.1723		0.2671		0.2076	
PCB 097	0.2205		0.2654		0.1968		0.1834		0.2422		0.2001		0.4128		0.2842		0.4879		0.4166		0.5749		0.4306		0.561		0.2593		0.5421		0.2541		0.2734		0.4013	
PCB 099	0.2842		0.347		0.2522		0.2267		0.2817		0.2541		0.5136		0.3363		0.5789		0.4888		0.666		0.5097		0.6583		0.2828		0.6607		0.3039		0.3306		0.4589	
PCB 100	0.0881		0.087		0.0457		0.0382		0.1107		0.0673		0.2005		0.1589		0.1632		0.1611		0.1589		0.1736		0.1855		0.0644		0.1731		0.0703		0.1374		0.0988	
PCB 101	0.4581		0.5942		0.4347		0.4018		0.4844		0.4208		0.8848		0.6035		1.0273		0.8828		1.2094		0.9068		1.1551		0.5539		1.082		0.537		0.5163		0.8069	
PCB 101/090																																						
PCB 105																																						
PCB 105/132/153	0.5932		1.0706		0.778		0.6335		0.8251		0.6611		1.1321		0.8639		1.2921		0.9452		1.2729		1.1827		1.4126		1.1042		1.0813		0.859		0.6321		1.0176	
PCB 107	0.0423		0.1301		0.0868		0.0519		0.1182		0.0781		0.1288		0.1176		0.1493		0.1053		0.1442		0.1339		0.1556		0.1265		0.118		0.0826		0.1285		0.0949	
PCB 114																																						
PCB 114/134	0	U	0	U	0	U	0	U	0.0854		0	U	0.2029		0.2269		0.108		0.2032		0.3112		0.2628		0.1205		0.1281		0	U	0	U	0	U	0	U		
PCB 118	0.3727		0.6859		0.4711		0.3706		0.571		0.4247		0.7261		0.5839		0.8155		0.5657		0.7996		0.7399		0.9195		0.7733		0.7261		0.5474		0.5551		0.8233	
PCB 119	0.0561		0.0326		0.0239		0.061		0.084		0.0732		0.1154		0.0829		0.1356		0.1174		0.1611		0.1214		0.1517		0.0376		0.1334		0.0814		0.0894		0.113	
PCB 124/135/144/147	0.0465		0.1054		0.0722		0.0555		0.0928		0.0721		0.1184		0.1009		0.0792		0.0562		0.0795		0.1051		0.1226		0.1022		0.1133		0.095		0.0917		0.0815	
PCB 128	0.0766		0.1361		0.0853		0.0803		0.0939		0.0846		0.1258		0.1043		0.1254		0.0955		0.1373		0.126		0.153		0.1249		0.141		0.12		0.1358		0.171	
PCB 129/178	0.0352		0.0328		0.0329		0.0255		0.0511		0.0293		0.0493		0.0402		0.0534		0.0366		0.0489		0.0469		0.0572		0.0372		0.0528		0.0489		0	U	0.0422	
PCB 130	0.035		0.0839		0.0707		0.0597		0.1144		0.0495		0.1019		0.0811		0.0681		0.0469		0.0673		0.0611		0.0734		0.0656		0.099		0.076		0.0713		0.098	
PCB 131	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0084		0	U	0	U	0	U	0.0101		0.0105		0	U	0	U	0	U	0	U		
PCB 132/168																																						
PCB 135/144																																						
PCB 136	0.0364		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.1486		0	U	0	U	0.1583		0	U		
PCB 137																																						
PCB 137/176	0.0061		0.0207		0.0137		0.0158		0	U	0.0089		0.0247		0.0191		0	U	0	U	0	U	0	U	0	U	0.009		0.026		0.0235		0.0195		0.0199	
PCB 138/158/163	0.3662		0.5737		0.4196		0.3955		0.4673		0.3677		0	U	0.8927		0.9108		0.6346		0.8868		0.8092		0.9601		0.6783		0.6511		0.55		0.4599		0.7422	
PCB 138/163																																						
PCB 141	0	U	0.0769		0.069		0.0601		0.0755		0.0561		0	U	0.0653		0.077		0	U	0.0877		0	U	0	U	0.0826		0.1007		0.0733		0.0895		0.0878	
PCB 146	0.2375		0.4362		0	U	0.2151		0.304		0.2867		0.5839		0.5629		0.4603		0.5501		0.6645		0.6249		0.4475		0.4454		0.6493		0.3732		0.6703		0	U
PCB 149	0.1923		0.379		0.2398		0.2094		0.3132		0.2449		0.3845		0.3221		0.4229		0.2998		0.4223		0.4008		0.4646		0.3425		0.3163		0.2669		0.2911		0.3734	
PCB 149/123																																						
PCB 151	0.0674		0.1321		0.0822		0.0661		0.1252		0.1052		0.1337		0.1054		0.1383		0.0959		0.1341		0.127		0.1496		0.1139		0.1085		0.0958		0.1004		0.094	
PCB 153/184																																						
PCB 156/171																																						
PCB 156/171/202	0	U	0.0908		0.0636		0.058		0.0739		0.0662		0.1535		0.0888		0.1601		0.1101		0.1117		0.1445		0.1272		0.1026		0.1181		0.0769		0.1295		0	U
PCB 157/200	0.0102		0.0211		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0318		0	U	0	U	0	U	0	U
PCB 157																																						
PCB 158																																						
PCB 167	0.0153		0.0382		0.0143		0.0133		0.0254		0.0209		0.0333		0.0224		0.028		0.0199		0.0304		0.0264		0.0353		0.038		0.0581		0.0251		0.0634		0.0585	
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																						
PCB 172																																						
PCB 170/190	0.1303		0.1548		0	U	0.1841		0.1793		0.1794		0	U	0.121		0.1715		0.1062		0.1618		0.1562		0.1927		0.2076		0	U	0.1625		0	U	0	U
PCB 172/197	0.0173		0.0292		0.0304		0.0172		0.0296		0.0235		0.039		0.0325		0.0388		0.0306		0.037		0.0344		0.0439		0.0385		0.0391		0.0252		0.0309		0.0248	
PCB 173	0	U	0	U	0.0014		0.0013		0	U	0.002		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0816		0.1039		0.0745		0.0669		0.0968		0.0795		0.1578		0.1193		0.1587		0.1098		0.1546		0.1433		0.1697		0.1544		0.1217		0.0799		0.1378		0.0896	

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	89GG56S01		89GG56S21		89GG56S41		89GG56S61		89GG56S81		89GG57S01		90GG01D61		90GG01S01		90GG01S21		90GG01S41		90GG01S61		90GG01S81		90GG02S01		90GG26S10		90GG26S50		90GG26S70		90GG26S90		90GG27S10	
Sample Date	9/20/89		9/20/89		9/20/89		9/20/89		9/20/89		9/20/89		10/18/89		10/17/89		10/17/89		10/18/89		10/18/89		10/18/89		10/18/89		4/30/90		5/1/90		5/1/90		5/1/90		5/1/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175	0	U	0.0052		0.001		0.0011		0.0085		0	U	0	U	0	U	0.0001		0	U	0	U	0	U	0	U	0.0161		0.0094		0.0284		0	U	0.0092	
PCB 176																																						
PCB 177	0.0645		0.0714		0.0587		0.0502		0.0865		0.0734		0.1076		0.0589		0.1301		0.0883		0.0825		0.1172		0.1394		0.0914		0.0911		0.0629		0.1406		0.0763	
PCB 178/126																																						
PCB 180	0.1613		0.2553		0.1775		0.1528		0.2058		0.1693		0.2681		0.2253		0.3072		0.2085		0.2926		0.2782		0.3421		0.2932		0.3104		0.2259		0.2191		0.26	
PCB 182/187	0.099		0.1683		0.1257		0.0916		0.1365		0.1165		0.178		0.151		0.1999		0.1386		0.194		0.1811		0.2227		0.1849		0.1943		0.1162		0.158		0.1477	
PCB 183	0.061		0.0961		0.061		0.0512		0.0711		0.0556		0.1011		0.0836		0.1024		0.0731		0.1035		0.0951		0.1161		0.0834		0.1183		0.0747		0.1035		0.095	
PCB 185	0.0085		0.0127		0.0093		0.009		0.0304		0.0089		0.0047		0	U	0	U	0.0078		0	U	0	U	0.0084		0.0095		0.025		0.0132		0.045		0.0136	
PCB 189	0	U	0.0065		0.0028		0.0025		0.0086		0.0078		0.0077		0	U	0	U	0	U	0	U	0	U	0	U	0.0069		0.0139		0.0115		0.0052		0.0172	
PCB 190																																						
PCB 191	0	U	0	U	0.0016		0.0017		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0091		0.0181		0.0092		0.0074		0.0115		0.0099		0.015		0.0117		0	U	0.0115		0.0142		0.0151		0.0192		0.0194		0.0168		0.0166		0.0126		0.0159	
PCB 194	0.0317		0.0545		0.0361		0.03		0.0392		0.0324		0.0623		0.0557		0.0763		0.0492		0.0675		0.0656		0.0825		0.0858		0.0959		0.0646		0.0797		0.067	
PCB 195																																						
PCB 195/208	0.0664		0.111		0.0737		0.061		0.0811		0.0741		0.1277		0.1084		0.1462		0.0953		0.128		0.1301		0.1542		0.1684		0.1732		0.109		0.1547		0.1213	
PCB 196/203	0.1053		0.1503		0.097		0.0809		0.1143		0.0962		0.1575		0.136		0.1933		0.1247		0.1707		0.1681		0.2045		0.1907		0.2297		0.128		0.1379		0.1519	
PCB 197																																						
PCB 198	0.003		0.0043		0	U	0	U	0.0045		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0094		0	U	0.0031		0	U	0	U
PCB 199	0.0103		0.0146		0.0069		0.0096		0.0157		0.0081		0.0259		0.0155		0.0248		0.0213		0.025		0.0249		0.0293		0.0281		0.0116		0.0066		0.0184		0.0087	
PCB 201	0.0919		0.1304		0	U	0.0773		0.1061		0.0861		0.1393		0.1828		0.1707		0.1116		0.1531		0.1499		0.1818		0.1578		0.1971		0.1184		0.1342		0	U
PCB 202																																						
PCB 203/196																																						
PCB 205	0.0648		0	U	0	U	0	U	0.0059		0	U	0	U	0.0328		0	U	0.0325		0.0427		0.038		0.0417		0.0594		0.036		0	U	0.0336		0.0319	
PCB 206	0	U	0.0798		0.0479		0.0364		0.059		0.0416		0.1011		0.0958		0.1248		0.0827		0.1092		0.1146		0.1313		0.1458		0.149		0.0799		0.1015		0.089	
PCB 207	0	U	0.0077		0.0013		0.0022		0.002		0.0027		0.0073		0	U	0	U	0	U	0	U	0	U	0	U	0.0054		0.007		0.0067		0.0247		0.011	
PCB 208																																						
PCB 209	0	U	0.0744		0.0139		0.0179		0.027		0.0273		0.0738		0.071		0.0975		0.0758		0.0816		0.0788		0.0966		0.084		0.0954		0.07		0.0789		0	U
Total Suspended PCBs (by congener sum) =	**37.41**		**55.66**		**38.16**		**28.54**		**44.83**		**38.89**		**75.33**		**47.89**		**86.59**		**72.29**		**97.59**		**78.42**		**99.68**		**47.71**		**92.73**		**43.29**		**49.27**		**60.03**	
Total Congeners Analyzed (Susp) =	**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**	
Total Congeners Detected (Susp) =	**77**		**85**		**82**		**84**		**83**		**83**		**78**		**76**		**75**		**77**		**76**		**75**		**79**		**86**		**82**		**81**		**80**		**78**	
Reported TPCBs (Susp) =																																						

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data, however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	SW060001		SW090001		SW090002		SW090003		SW090004		SW090005		SW090006		SW090007		SW090007			SW090008		SW090009		SW090010		SW090011		SW090012		SW090013		SW090014	
Sample Date	7/26/00		7/27/00		9/28/00		11/30/00		1/17/01		3/27/01		4/8/01		4/13/01		4/13/01			4/17/01		4/30/01		5/1/01		5/11/01		5/22/01		5/24/01		5/31/01	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended			Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0	U	0	U	0	U	0.048	LOQ, V	0	U	0	U	0	U	0	U	0.38	R	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 003																																
PCB 004	0.025	LOQ	0.062		0.032		0	U	0	U	0	U	0.05	Q	0	U	0.17	R	R3	0.036	Q	0.031	Q	0.026	Q	0.36		0	U	0	U	0.32	
PCB 004/010																																
PCB 005	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.1	R	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 005/008																																
PCB 006	0.26		0.16		0.079		0.011	LOQ	0.01	T	0.023		0.046		0.66		0.08	R	R3	0	U	0.18		0.23		0.72		0.57		0.29		0.31	
PCB 007	0.069	B	0.034	B	0.03		0	U	0	U	0	U	0.013	Q	0	U	0.11	R	R3	0	U	0.062		0.081		0	U	0	U	0	U	0	U
PCB 008	0.6		0.32		0.14		0.035		0	U	0.052		0.087		0.29		0.11	R	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 012/013																																
PCB 016/032	0.38		0.24		0.088		0.023	LOQ	0.017	T	0.04		0.078		0.26		0.11	R	R3	0.079		0.23		0.31		0.72		0.56		0.47		0.41	
PCB 017	0.38		0.29		0.11		0.019	LOQ	0.015	T	0.039		0.079		0.25		0.42	J	R3	0	U	0.24		0.31		0.8		0.75		0.61		0.49	
PCB 018	0.68		0.49		0.25	V	0.036		0	U	0	U	0	U	0	U	0.32	QJ	R3	0.1		0	U	0	U	3	BD	1.2	B	0.98	B	1	
PCB 019	0	U	0.038	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0.27	UJ	R3	0	U	0	U	0	U	0	U	0.31		0.13		0	U
PCB 021																																
PCB 022	0.34		0.19		0.071		0.018		0	U	0.035		0.053		0.42	B	0.056	UJ	R3	0.25		0.52		0.63		0	U	0	U	0	U	0	U
PCB 024	0	U	0	U	0.12	V	0.014	LOQ	0.05		0.14		0.54		6.1		0.39	J	R3	4.8		1.9	J	2.6	J	4.7	D	1.4	J	1.1		0.69	
PCB 024/027																																
PCB 025	0.24		0	U	0.075		0	U	0	U	0	U	0	U	0.2		0.37	QJ	R3	0.17		0.19		0.28		1		0	U	0.42		0.29	
PCB 026	0.3		0.21		0.082		0	U	0	U	0.031		0.055		0.24		0.5	J	R3	0.17		0.2		0.27		0.6		0.49		0.4		0.38	
PCB 027	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.11	UJ	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 028	0	U	0	U	0.23		0.059	LOQ	0.049	T	0.13		0.22		0.91		1.7	J	R3	0.64		0.85		1.1		2.5	D	2	J	1.7	E	1.4	J
PCB 028/031																																
PCB 029	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.092	UJ	R3	0	U	0.012	Q	0.011	Q	0.075		0.031		0	U	0.023	Q
PCB 031	1.2		1.1		0.24		0.061	LOQ	0.043	T	0.1		0.2		0.75		1.1	J	R3	0.52		0.79		1		3.2	D	2.7	J	1.8	E	1.3	J
PCB 033	0	U	0	U	0.16		0.039		0.027	T	0.072		0.12		0.44		0.67	J	R3	0.2		0.61		0.71		1.5	D	1		0.99		0.89	
PCB 037/042	0.42		0.29		0.09		0.053		0.05		0.042		0.09		0.092		0.18	QJ	R3	0.076		0.28		0.34		0.83		0.67		0.57		0.49	
PCB 040	0.09		0.073		0.025		0.0075	LOQ	0	U	0.0054		0.026		0	U	0.051	UJ	R3	0	U	0.041		0.057		0.22		0.12		0.11		0.13	
PCB 041/064/071																																
PCB 043																																
PCB 044	0.37		0.31		0.093	V	0.03		0.051		0.057		0.099		0.24		0.36	J	R3	0.13		0.23		0.31		0.64		0.55		0.52		0.44	
PCB 045	0	U	0.11		0.028		0.031		0.019	T	0.032		0.049		0.01	Q	0.089	UJ	R3	0	U	0.1		0.12		0.37		0.52		0.23		0.17	
PCB 046	0.045		0.044	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0.18	UJ	R3	0	U	0.26		0.4		0.59		0.11		0.033	Q	0.11	
PCB 047	0.18		0.18		0.05		0.018	LOQ	0	U	0	U	0.093		0.019	Q	0.76	J	R3	0.041		0.13		0.17		0.43		0.33		0.32		0.36	
PCB 048	0.15		0.69		0.043	V	0	U	0	U	0	U	0.085		0.85		0.15	UJ	R3	0.5		0	U	0	U	0	U	0	U	0	U	0	U
PCB 047/048																																
PCB 049	0.4		0.35		0.099		0.03	LOQ	0.022	T	0.057		0.11		0.25		1.2	J	R3	0.29		0.27		0.37		0.83		0.62		0.58		0.5	
PCB 051																																
PCB 052	0.39		0.37		0.12		0.02	LOQ	0.027	T	0	U	0.14		0.062		1.4	J	R3	0.24		0.31	J	0.4	J	1.8	D	0.78		0.64		0.6	
PCB 053	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.12	UJ	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 056	0	U	0	U	0.086		0.038	LOQ	0	U	0.048		0.074	Q	0	U	0.28	UJ	R3	0	U	0.32		0.4		1		0.68		0.65		0.48	
PCB 059	0	U	0.044		0.0098		0	U	0	U	0	U	0.014	Q	0	U	0.066	UJ	R3	0	U	0.03		0.034		0.21		0.059		0.05		0.052	
PCB 060/092	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.16		0.15	UJ	R3	0.025	Q	0	U	0	U	0	U	0	U	0	U	0	U
PCB 056/060																																
PCB 063	0.027		0.023	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0.079	UJ	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 064/041	0	U	0.17		0.051		0.019	LOQ	0.016	T	0	U	0.061		0.044		0.12	UJ	R3	0	U	0.15		0.2		0.41		0	U	0	U	0.28	
PCB 066/095	0	U	0	U	0.12		0.042		0.031		0.066		0.12		0.4		0.97	J	R3	0.31		0.41		0.51		1.2		1		0.85		0.7	
PCB 070	0.47		0.31		0.097		0.033		0.018		0	U	0.093		0.29		0.76	J	R3	0.23		0.33		0.39		1.1		0.67		0.59		0.51	
PCB 070/076																																
PCB 071	0.18		0.14		0.041		0.012	LOQ	0.0086	T	0.023		0.052		0.063		0.28	J	R3	0.09		0.11		0.15		0.29		0.26		0.24		0.21	
PCB 074	0	U	0.18		0.066		0.023		0.011	T	0.033		0.064		0.13		0.37	J	R3	0.051		0.13		0.15		0.42		0.3		0.28		0.29	
PCB 076	0.015		0.013		0.0052		0	U	0	U	0	U	0.0055	Q	0	U	0.036	UJ	R3	0	U	0	U	0	U	0.22		0.13		0.063		0.081	
PCB 077/110	0.24		0.2		0.058		0.022	LOQ	0.02	T	0.036		0.06	Q	0.14		0.23	QJ	R3	0.06	Q	0.2		0.25		0.51		0.38		0.37		0.29	
PCB 081																																

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	SW060001		SW090001		SW090002		SW090003		SW090004		SW090005		SW090006		SW090007		SW090007			SW090008		SW090009		SW090010		SW090011		SW090012		SW090013		SW090014	
Sample Date	7/26/00		7/27/00		9/28/00		11/30/00		1/17/01		3/27/01		4/8/01		4/13/01		4/13/01			4/17/01		4/30/01		5/1/01		5/11/01		5/22/01		5/24/01		5/31/01	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended			Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 082	0	U	0.039		0	U	0	U	0	U	0	U	0	U	0	U	0.11	UJ	R3	0	U	0.027	Q	0.036		0.092		0.061		0.06		0.062	
PCB 083																																		
PCB 084	0.095		0.11		0.016		0.015	LOQ	0	U	0.0086		0.014	Q	0.022		0.28	UJ	R3	0	U	0	U	0	U	0.11		0	U	0	U	0	U
PCB 084/092																																		
PCB 085	0.037		0.038		0.007		0	U	0	U	0.0044		0.008	Q	0.02		0.076	QJ	R3	0.023		0.034		0.039		0.11		0.057		0.056		0.048	
PCB 087																																		
PCB 087/081	0.074		0.075		0.024		0	U	0	U	0.028		0.022	Q	0.042	Q	0.15	QJ	R3	0.043	Q	0.054		0.047		0.16		0.076		0.1		0.087	
PCB 089																																		
PCB 091	0.041		0.042		0.0087		0	U	0	U	0	U	0.011	Q	0.013	Q	0.1	QJ	R3	0.021	Q	0	U	0	U	0	U	0	U	0	U	0.15	
PCB 097	0.051		0.049		0.012		0.005	LOQ, V	0	U	0.013		0.016		0.043		0.1	J	R3	0.034		0.039		0.052		0	U	0	U	0	U	0.063	
PCB 099	0.077	B	0.075	B	0.02		0.011	LOQ	0	U	0.016		0.018	Q	0.023	Q	0.3	J	R3	0.067		0.06		0.077		0.17		0.12		0.11		0.094	
PCB 100																																		
PCB 101																																		
PCB 101/090	0	U	0	U	0.032		0.019	LOQ	0.0097	T	0.028		0.035		0.088		0.56	J	R3	0.11		0.093		0.068		0.25		0.17		0.17		0.15	
PCB 105	0	U	0.046		0.013		0	U	0	U	0	U	0	U	0	U	0.076	UJ	R3	0.0099	Q	0	U	0	U	0	U	0.12		0.07		0.079	
PCB 105/132/153																																		
PCB 107	0.019	LOQ	0.017	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0.11	UJ	R3	0.012	Q	0	U	0.014	Q	0.04		0.024	Q	0.022	Q	0.019	Q
PCB 114	0.0065	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.061	UJ	R3	0	U	0.0089	Q	0.043		0	U	0.026		0.03		0.012	Q
PCB 114/134																																		
PCB 118	0.12		0.094		0.026		0.0092	LOQ, V	0.011	T	0.019		0.03		0.08		0.17	QJ	R3	0.067		0.083		0.11		0.22		0.18		0.17		0.14	
PCB 119	0.0081	LOQ	0.012	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0.051	UJ	R3	0.0065	Q	0	U	0.0064	Q	0.021		0.011	Q	0.023		0.013	Q
PCB 124/135/144/147																																		
PCB 128	0	U	0.019	LOQ	0	U	0	U	0	U	0	U	0	U	0.016	Q	0.16	UJ	R3	0	U	0	U	0.028	Q	0.028	Q	0.021	Q	0.027	Q	0.019	Q
PCB 129/178																																		
PCB 130																																		
PCB 131																																		
PCB 132/168	0.022	LOQ	0.038	LOQ	0	U	0.12		0.023	T	0	U	0	U	0	U	0.14	UJ	R3	0.021	Q	0	U	0	U	0	U	0	U	0.029	Q	0	U
PCB 135/144	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.22	UJ	R3	0	U	0	U	0	U	0.052	Q	0.029	Q	0.028	Q	0	U
PCB 136	0.0095	LOQ	0.013	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0.08	UJ	R3	0.0099	Q	0.0096	Q	0.0099	Q	0.044		0.013	Q	0.018	Q	0.013	Q
PCB 137	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.1	UJ	R3	0	U	0	U	0	U	0.032		0	U	0	U	0	U
PCB 137/176																																		
PCB 138/158/163																																		
PCB 138/163	0.07		0.083		0.028		0	U	0	U	0	U	0.023	Q	0.054		0.19	QJ	R3	0.061		0.066		0.088		0.3		0.097		0.1		0.092	
PCB 141	0.01	LOQ	0.011	LOQ	0	U	0	U	0	U	0	U	0	U	0.01	Q	0.086	UJ	R3	0.011	Q	0.0096	Q	0	U	0.032		0.019	Q	0.017	Q	0.015	Q
PCB 146	0.018	LOQ	0.018	LOQ	0	U	0	U	0	U	0.013		0	U	0.012	Q	0.09	QJ	R3	0.016	Q	0.012	Q	0.026		0.078		0.029		0.027		0.021	Q
PCB 149																																		
PCB 149/123	0.055	B	0.055	B	0.016		0	U	0	U	0.017		0.02	Q	0.039		0.24	Q	R3	0.054		0.04		0.055		0.11		0.083		0.078		0.072	
PCB 151	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0.017	Q	0	U	0	U	0	U	0	U	0	U	0	U
PCB 153/184	0	U	0	U	0.02		0.017	LOQ	0	U	0.038		0.021	Q	0.049		0.29	Q	R3	0.069		0.07		0.1		0.18		0.098		0.098		0.084	
PCB 156/171	0.027	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0.037	Q	0	U	0.028	Q	0	U	0.034	Q	0	U
PCB 156/171/202																																		
PCB 157/200																																		
PCB 157	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0.021	Q	0	U	0	U	0	U
PCB 158	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0.016	Q	0.081		0.014	Q	0.012	Q	0.014	Q
PCB 167	0	U	0	U	0	U	0	U	0	U	0.061		0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170	0.013	LOQ	0.016	LOQ	0	U	0	U	0	U	0	U	0	U	0.015	Q	0	U	R3	0.016	Q	0.015	Q	0.017	Q	0.051		0.029	Q	0.024	Q	0.021	Q
PCB 172	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170/190																																		
PCB 172/197																																		
PCB 173																																		
PCB 174	0.017	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0.015	Q	0	U	R3	0.019	Q	0.018	Q	0.027	Q	0.036	Q	0.033	Q	0.03	Q	0.022	Q

Table H-9. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended)

Sample Name	SW060001		SW090001		SW090002		SW090003		SW090004		SW090005		SW090006		SW090007		SW090007			SW090008		SW090009		SW090010		SW090011		SW090012		SW090013		SW090014	
Sample Date	7/26/00		7/27/00		9/28/00		11/30/00		1/17/01		3/27/01		4/8/01		4/13/01		4/13/01			4/17/01		4/30/01		5/1/01		5/11/01		5/22/01		5/24/01		5/31/01	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended			Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175																																
PCB 176	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0.025	Q	0.023	Q	0	U
PCB 178/126	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 180	0.03	LOQ	0.036	LOQ	0	U	0	U	0	U	0	U	0	U	0.027	Q	0	U	R3	0.037	Q	0.022	QJ	0.039	QJ	0.082		0.057		0.053	Q	0.042	Q
PCB 182/187	0.026	LOQ	0.035	LOQ	0	U	0	U	0	U	0	U	0	U	0.022	Q	0	U	R3	0.03	Q	0.024	Q	0.026	Q	0.054	Q	0.049	Q	0.037	Q	0.028	Q
PCB 183	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0.011	Q	0.011	Q	0	U
PCB 185	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 189	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 190	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0.034		0	U	0	U	0	U
PCB 191																																
PCB 193																																
PCB 194	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0.02	Q	0.021	Q	0	U
PCB 195	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 195/208																																
PCB 196/203																																
PCB 197	0	U	0	U	0	U	0	U	0.033	T	0.042		0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 198																																
PCB 199	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 201	0.017	LOQ	0.016	LOQ	0	U	0	U	0	U	0	U	0	U	0.013	Q	0	U	R3	0.018	Q	0.017	Q	0.02	Q	0.07		0.058		0.046		0.039	Q
PCB 202	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0.034	Q	0	U	0	U	0	U
PCB 203/196	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0.044	Q	0.037	Q	0.044	Q	0.034	Q
PCB 205																																
PCB 206	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0.028	Q	0.017	Q	0.027	Q	0.023	Q
PCB 207																																
PCB 208	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	R3	0	U	0	U	0	U	0.045	Q	0.025	Q	0.026	Q	0.025	Q
Total Suspended PCBs (by congener sum) =	**8.29**		**7.57**		**3.01**		**0.94**		**0.56**		**1.35**		**2.99**		**13.87**		**18.63**			**9.78**		**9.86**		**12.75**		**32.88**		**19.80**		**16.61**		**14.68**	
Total Congeners Analyzed (Susp) =	**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**			**91**		**91**		**91**		**91**		**91**		**91**		**91**	
Total Congeners Detected (Susp) =	**46**		**50**		**43**		**32**		**22**		**32**		**40**		**44**		**63**			**45**		**49**		**51**		**60**		**57**		**59**		**57**	
Reported TPCBs (Susp) =	**7.57**		**8.29**		**3.00**																											

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#10F	#11F	#12F	#12F	#13F	#14F	#15F	#16F	#17F	#18F	#19F	#1F	#20F	#21F	#22F	#23F	#24F	#25F	#26F	#27F
Sample Date	6/1/89	6/6/89	6/13/89	6/13/89	6/21/89	6/28/89	7/5/89	7/12/89	7/20/89	7/25/89	7/31/89	1/19/89	8/9/89	8/14/89	8/23/89	8/29/89	9/6/89	9/13/89	9/20/89	9/27/89
Fraction	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved
Congener (ng/l)	Result Q	Result Q	Result Q	Result Q Rep	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q
PCB 001																				
PCB 003																				
PCB 004																				
PCB 004/010																				
PCB 005																				
PCB 005/008																				
PCB 006																				
PCB 007																				
PCB 008																				
PCB 012/013																				
PCB 016/032																				
PCB 017																				
PCB 018																				
PCB 019																				
PCB 021																				
PCB 022																				
PCB 024																				
PCB 024/027																				
PCB 025																				
PCB 026																				
PCB 027																				
PCB 028																				
PCB 028/031	1.3778	1.5787	2.3442		2.8029	3.4294	2.4345	2.5919	2.6156	2.5551	3.1698	0.6647	2.6719	2.9818	2.9839	2.7234	2.1818	2.4477	2.1855	1.7597
PCB 029																				
PCB 031																				
PCB 033																				
PCB 037/042																				
PCB 040																				
PCB 041/064/071																				
PCB 043																				
PCB 044																				
PCB 045																				
PCB 046																				
PCB 047																				
PCB 048																				
PCB 047/048																				
PCB 049																				
PCB 051																				
PCB 052																				
PCB 053																				
PCB 056																				
PCB 059																				
PCB 060/092																				
PCB 056/060	0.1612	0.1768	0.2114		0.2997	0.3663	0.2631	0.298	0.3191	0.2815	0.3618	0.0938	0.3099	0.2849	0.3103	0.3032	0.2601	0.2638	0.275	0.1793
PCB 063																				
PCB 064/041																				
PCB 066/095																				
PCB 070																				
PCB 070/076																				
PCB 071																				
PCB 074																				
PCB 076																				

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#10F	#11F	#12F	#12F			#13F	#14F	#15F	#16F	#17F	#18F	#19F	#1F	#20F	#21F	#22F	#23F	#24F	#25F	#26F	#27F
Sample Date	6/1/89	6/6/89	6/13/89	6/13/89			6/21/89	6/28/89	7/5/89	7/12/89	7/20/89	7/25/89	7/31/89	1/19/89	8/9/89	8/14/89	8/23/89	8/29/89	9/6/89	9/13/89	9/20/89	9/27/89
Fraction	Dissolved	Dissolved	Dissolved	Dissolved			Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved
Congener (ng/l)	Result Q	Result Q	Result Q	Result Q	Rep		Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q	Result Q
PCB 077/110	0.1165	0.1226	0.1247				0.1399	0.1847	0.1362	0.1604	0.1991	0.1396	0.1931	0.0754	0.1797	0.1631	0.1722	0.1737	0.1627	0.1554	0.1775	0.1186
PCB 081																						
PCB 082																						
PCB 083																						
PCB 084																						
PCB 084/092																						
PCB 085																						
PCB 087																						
PCB 087/081																						
PCB 089																						
PCB 091																						
PCB 097																						
PCB 099																						
PCB 100																						
PCB 101	0.0758	0.081	0.0881	0.0947	R1			0.1367	0.0903	0.1052	0.1052	0.0941	0.1191	0.0568	0.1141	0.1031	0.117	0.1007	0.0932	0.096	0.1071	0.0757
PCB 101/090																						
PCB 105																						
PCB 105/132/153																						
PCB 107																						
PCB 114																						
PCB 114/134																						
PCB 118	0.0362	0.0411	0.0452	0.049	R1			0.0583	0.0408	0.0612	0.0536	0.0501	0.0522	0.1232	0.0548	0.0514	0.0596	0.0506	0.0587	0.0503	0.0528	0.0372
PCB 119																						
PCB 124/135/144/147																						
PCB 128																						
PCB 129/178																						
PCB 130																						
PCB 131																						
PCB 132/168																						
PCB 135/144																						
PCB 136																						
PCB 137																						
PCB 137/176																						
PCB 138/158/163	0.0691	0.0554	0.2641					0.0691		0.0744	0.0546	0.0758	0.0528		0.0579	0.045	0.0623	0.0601	0.0742	0.0512	0.0891	0.0434
PCB 138/163																						
PCB 141																						
PCB 146																						
PCB 149	0.0487	0.0377	0.032	0.0589	R1			0.0459	0.0311	0.0482	0.0361	0.0426	0.0422	0.0828	0.0453	0.0349	0.063	0.0346	0.041	0.0346	0.0407	0.0318
PCB 149/123																						
PCB 151																						
PCB 153/184																						
PCB 156/171																						
PCB 156/171/202																						
PCB 157/200																						
PCB 157																						
PCB 158																						
PCB 167																						
PCB 169																						
PCB 170																						
PCB 172																						
PCB 170/190																						
PCB 172/197																						
PCB 173																						
PCB 174																						

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#10F		#11F		#12F		#12F			#13F		#14F		#15F		#16F		#17F		#18F		#19F		#1F		#20F		#21F		#22F		#23F		#24F		#25F		#26F		#27F	
Sample Date	6/1/89		6/6/89		6/13/89		6/13/89			6/21/89		6/28/89		7/5/89		7/12/89		7/20/89		7/25/89		7/31/89		1/19/89		8/9/89		8/14/89		8/23/89		8/29/89		9/6/89		9/13/89		9/20/89		9/27/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved			Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Rep	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175																																								
PCB 176																																								
PCB 177																																								
PCB 178/126																																								
PCB 180	0.0225		0.0305		0.0134		0.0273		R1			0.0248		0.0132		0.0252		0.0223		0.0205		0.021		0.057		0.021		0.0129		0.024		0.0149		0.019		0.0137		0.02		0.0125	
PCB 182/187																																								
PCB 183																																								
PCB 185																																								
PCB 189																																								
PCB 190																																								
PCB 191																																								
PCB 193																																								
PCB 194																																								
PCB 195																																								
PCB 195/208																																								
PCB 196/203																																								
PCB 197																																								
PCB 198																																								
PCB 199																																								
PCB 201																																								
PCB 202																																								
PCB 203/196																																								
PCB 205																																								
PCB 206																																								
PCB 207																																								
PCB 208																																								
PCB 209																																								
Total Dissolved PCBs (by congener sum) =	1.91		2.12		3.12		0.23			3.24		4.32		3.01		3.36		3.41		3.26		4.01		1.15		3.45		3.68		3.79		3.46		2.89		3.11		2.95		2.26	
Total Congeners Analyzed (Diss) =	8		8		8		4			3		8		7		8		8		8		8		7		8		8		8		8		8		8		8		8	
Total Congeners Detected (Diss) =	8		8		8		4			3		8		7		8		8		8		8		7		8		8		8		8		8		8		8		8	
Reported TPCBs (Diss) =	9.11		9.99		14.95		14.95			17.2		21.74		14.55		17.19		17.01		16.42		19.66		25.91		17.18		18.22		17.88		16.78		14.83		15.23		13.93		10.97	

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#28F		#29F		#2F		#30F		#32F		#33F		#34F		#35F		#36F		#37F		#38F		#39F		#3F		#40F		#41F		#42F		#43F		#44F		#45F		#46F	
Sample Date	10/4/89		10/12/89		4/13/89		10/18/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		12/13/89		1/11/90		1/25/90		4/19/89		2/6/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001																																								
PCB 003																																								
PCB 004																																								
PCB 004/010																																								
PCB 005																																								
PCB 005/008																																								
PCB 006																																								
PCB 007																																								
PCB 008																																								
PCB 012/013																																								
PCB 016/032																																								
PCB 017																																								
PCB 018																																								
PCB 019																																								
PCB 021																																								
PCB 022																																								
PCB 024																																								
PCB 024/027																																								
PCB 025																																								
PCB 026																																								
PCB 027																																								
PCB 028																																								
PCB 028/031	2.0358		1.8571		0.5252		1.9323		1.9644		1.0987		0.5864		0.362		0.3152		0.8936		0.3539		0.5198		0.1059		0.4444		0.5214		0.53		0.6779		0.2873		0.5387		0.6893	
PCB 029																																								
PCB 031																																								
PCB 033																																								
PCB 037/042																																								
PCB 040																																								
PCB 041/064/071																																								
PCB 043																																								
PCB 044																																								
PCB 045																																								
PCB 046																																								
PCB 047																																								
PCB 048																																								
PCB 047/048																																								
PCB 049																																								
PCB 051																																								
PCB 052																																								
PCB 053																																								
PCB 056																																								
PCB 059																																								
PCB 060/092																																								
PCB 056/060	0.2201		0.2133		0.0503		0.2188		0.237		0.1022		0.0612		0.0343		0.0388		0.1175		0.0338		0.0325		0.0213		0.037		0.0432		0.0544		0.0736		0.0312		0.0542		0.074	
PCB 063																																								
PCB 064/041																																								
PCB 066/095																																								
PCB 070																																								
PCB 070/076																																								
PCB 071																																								
PCB 074																																								
PCB 076																																								

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#28F		#29F		#2F		#30F		#32F		#33F		#34F		#35F		#36F		#37F		#38F		#39F		#3F		#40F		#41F		#42F		#43F		#44F		#45F		#46F	
Sample Date	10/4/89		10/12/89		4/13/89		10/18/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		12/13/89		1/11/90		1/25/90		4/19/89		2/6/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 077/110	0.134		0.1364		0.0428		0.1302		0.1511		0.0731		0.0564		0.0333		0.0463		0.0817		0.0441		0.0469		0.0236		0.0414		0.0443		0.0549		0.0601		0.0343		0.0459		0.0544	
PCB 081																																								
PCB 082																																								
PCB 083																																								
PCB 084																																								
PCB 084/092																																								
PCB 085																																								
PCB 087																																								
PCB 087/081																																								
PCB 089																																								
PCB 091																																								
PCB 097																																								
PCB 099																																								
PCB 100																																								
PCB 101	0.0877		0.0848		0.036		0.0855		0.0897		0.0493		0.0316		0.0213		0.0265		0.0382		0.0251		0.0256		0.0214		0.0208		0.0265		0.0367		0.0443		0.0236		0.0285		0.0344	
PCB 101/090																																								
PCB 105																																								
PCB 105/132/153																																								
PCB 107																																								
PCB 114																																								
PCB 114/134																																								
PCB 118	0.0425		0.0433		0.0145		0.0411		0.0598		0.0261		0.0182		0.0087		0.0113		0.0283		0.0124		0.0135		0.007		0.0105		0.0119		0.0157		0.0178		0.0094		0.0143		0.0155	
PCB 119																																								
PCB 124/135/144/147																																								
PCB 128																																								
PCB 129/178																																								
PCB 130																																								
PCB 131																																								
PCB 132/168																																								
PCB 135/144																																								
PCB 136																																								
PCB 137																																								
PCB 137/176																																								
PCB 138/158/163	0.05		0.0484				0.0574		0.0571		0.0396		0.0324		0.0626		0.0282		0.0314		0.0249		0.0416		0.0233		0.0228		0.0311		0.0323		0.0308		0.0271		0.0214		0.0247	
PCB 138/163																																								
PCB 141																																								
PCB 146																																								
PCB 149	0.0404		0.0319		0.0285		0.0352		0.0383		0.0287		0.0164		0.0118		0.0157		0.0249		0.0183		0.0166		0.0134		0.0116		0.0176		0.0158		0.0197		0.0176		0.014		0.014	
PCB 149/123																																								
PCB 151																																								
PCB 153/184																																								
PCB 156/171																																								
PCB 156/171/202																																								
PCB 157/200																																								
PCB 157																																								
PCB 158																																								
PCB 167																																								
PCB 169																																								
PCB 170																																								
PCB 172																																								
PCB 170/190																																								
PCB 172/197																																								
PCB 173																																								
PCB 174																																								

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#28F		#29F		#2F		#30F		#32F		#33F		#34F		#35F		#36F		#37F		#38F		#39F		#3F		#40F		#41F		#42F		#43F		#44F		#45F		#46F	
Sample Date	10/4/89		10/12/89		4/13/89		10/18/89		10/31/89		11/7/89		11/14/89		11/30/89		11/30/89		12/13/89		1/11/90		1/25/90		4/19/89		2/6/90		2/21/90		3/6/90		3/21/90		3/28/90		4/4/90		4/11/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175																																									
PCB 176																																									
PCB 177																																									
PCB 178/126																																									
PCB 180	0.0157		0.013		0.0166		0.0124		0.0153		0.0182		0.0063		0.0078		0.0078				0.0064		0.0058		0.0062		0.006		0.0089		0.0092		0.0128		0.0067		0.0045		0.0054	
PCB 182/187																																									
PCB 183																																									
PCB 185																																									
PCB 189																																									
PCB 190																																									
PCB 191																																									
PCB 193																																									
PCB 194																																									
PCB 195																																									
PCB 195/208																																									
PCB 196/203																																									
PCB 197																																									
PCB 198																																									
PCB 199																																									
PCB 201																																									
PCB 202																																									
PCB 203/196																																									
PCB 205																																									
PCB 206																																									
PCB 207																																									
PCB 208																																									
PCB 209																																									
Total Dissolved PCBs (by congener sum) =	**2.63**		**2.43**		**0.71**		**2.51**		**2.61**		**1.44**		**0.81**		**0.54**		**0.49**		**1.22**		**0.52**		**0.70**		**0.22**		**0.59**		**0.70**		**0.75**		**0.94**		**0.44**		**0.72**		**0.91**	
Total Congeners Analyzed (Diss) =	**8**		**8**		**7**		**8**		**8**		**8**		**8**		**8**		**8**		**7**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**	
Total Congeners Detected (Diss) =	**8**		**8**		**7**		**8**		**8**		**8**		**8**		**8**		**8**		**7**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**	
Reported TPCBs (Diss) =	**12.92**		**11.88**		**4.24**		**12.13**		**12.32**		**6.81**		**4**		**2.63**		**2.68**		**5.92**		**2.46**		**3.36**		**1.33**		**2.71**		**3.26**		**3.46**		**5.27**								

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data, however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#47F		#48F		#49F		#4F		#50F		#5F		#6F		#7F		#8F		#9F		89GG25R96		89GG25S70		89GG25S90		89GG26D10		89GG26S10		89GG26S30		89GG26S50		89GG26S70	
Sample Date	4/17/90		4/24/90		4/24/90		4/19/89		5/1/90		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		5/5/89		5/4/89		5/5/89		5/5/89		5/5/89		5/5/89		5/5/89		5/6/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001																					0.1845		0.0783		0.0542		0.136		0.1184		0.5881		0.1583		0.1527	
PCB 003																					0.128		0.1743		0.0342		0.8094		0	U	0.1932		0	U	0.4547	
PCB 004																																				
PCB 004/010																					0.0742		0.2326		0.3272		0.1825		0.2403		0.3305		0.267		0.2722	
PCB 005																																				
PCB 005/008																					0.2305		1.5919		2.2855		2.0711		1.7985		2.3099		2.1155		2.2433	
PCB 006																					0.0389		0.3368		0.4908		0.5151		0.4324		0.4743		0.5425		0.578	
PCB 007																					0.0176		0.0318		0.0522		0.0568		0.0489		0.0555		0.0419		0.0543	
PCB 008																																				
PCB 012/013																					0.0072		0.0174		0.0243		0.0074		0.0148		0.0253		0.0201		0.0604	
PCB 016/032																					0.0641		1.5873		2.2067		1.7177		1.807		1.8952		1.9658		1.8462	
PCB 017																					0.0543		0.9666		1.5607		1.1621		1.1751		1.1299		1.3267		1.3208	
PCB 018																					0.0815		1.6134		3.1079		1.9233		1.9532		2.0035		2.209		2.3354	
PCB 019																					0.0091		0.1392		0.2113		0.1505		0.16		0.1652		0.1654		0.1798	
PCB 021																					0	U	0	U	0.0003		0	U	0.001		0	U	0	U	0.0072	
PCB 022																					0.0487		0.7078		0.8176		0.7513		0.7847		0.8268		0.8761		0.7979	
PCB 024																																				
PCB 024/027																					0.0081		0.1617		0.2556		0.1779		0.1968		0.1855		0.1795		0.2019	
PCB 025																					0.0235		0.3078		0.419		0.3975		0.3803		0.4418		0.4391		0.4463	
PCB 026																					0.0146		0.5792		1.0677		0.82		0.7553		0.7719		0.9575		0.9221	
PCB 027																																				
PCB 028																																				
PCB 028/031	1.0419		1.6433		1.6585		2.8032		2.374		1.9515		2.611		2.4351		3.001		2.3613		0.1416		3.1683		4.1716		3.9688		3.6647		3.9012		4.251		3.9898	
PCB 029																					0	U	0.0321		0.0051		0	U	0.0352		0.005		0.0049		0	U
PCB 031																																				
PCB 033																					0.0438		0.7465		0.8645		0.8279		0.7729		0.7984		0.8586		0.8105	
PCB 037/042																					0.0156		0.3919		0.515		0.5211		0.4736		0.4515		0.5038		0.4246	
PCB 040																					0.0166		0.2011		0.2675		0.2419		0.2466		0.2514		0.2626		0.2197	
PCB 041/064/071																					0	U	0.6533		0.9446		0.9238		0.8313		0.9442		0.938		0.798	
PCB 043																					0.0033		0.0713		0.1048		0.0913		0.0929		0.0847		0.0912		0.0684	
PCB 044																					0.0469		0.7948		1.1101		1.0109		0.9907		0.9944		1.0441		0.9448	
PCB 045																					0.0058		0.1917		0.2647		0.2165		0.2324		0.2329		0.2432		0.2155	
PCB 046																					0.0014		0.1056		0.1626		0.1358		0.1272		0.1253		0.137		0.1171	
PCB 047																																				
PCB 048																																				
PCB 047/048																					0.0231		0.4836		0.6375		0	U	0.5642		0.3717		0.6082		0.5313	
PCB 049																					0.0082		0.3054		0.5377		1.2784		0 391		0.4557		0.4533		0.37	
PCB 051																					0.0207		0.0485		0.0735		0.0563		0.0608		0.0613		0.0623		0.0546	
PCB 052																					0.0401		0.7116		1.059		0.9499		0.9146		1.0317		1.0414		0.9489	
PCB 053																					0.0167		0.1943		0.2955		0.2407		0.2491		0.2586		0.2465		0.2573	
PCB 056																																				
PCB 059																																				
PCB 060/092																																				
PCB 056/060	0.1211		0.2359		0.2485		0.8738		0.2838		0.2294		0.3044		0.2271		0.3596		0.2574		0.0284		0.3395		0.3945		0.4777		0.3862		0.3988		0.3962		0.3435	
PCB 063																					0.0171		0.0455		0.0618		0.0534		0.0505		0.0551		0.0562		0.0456	
PCB 064/041																																				
PCB 066/095																					0	U	0.6674		0.8072		0	U	0.8392		0.8958		0.8543		0.7048	
PCB 070																																				
PCB 070/076																					0.0347		0.567		0.6604		0.5666		0.6491		0.6463		0.7029		0.5815	
PCB 071																																				
PCB 074																					0.0265		0.2292		0.2635		0.2691		0.2431		0.2501		0.2712		0.2199	
PCB 076																																				

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#47F		#48F		#49F		#4F		#50F		#5F		#6F		#7F		#8F		#9F		89GG25R96		89GG25S70		89GG25S90		89GG26D10		89GG26S10		89GG26S30		89GG26S50		89GG26S70	
Sample Date	4/17/90		4/24/90		4/24/90		4/19/89		5/1/90		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		5/5/89		5/4/89		5/5/89		5/5/89		5/5/89		5/5/89		5/5/89		5/6/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 077/110	0.0916		0.1558		0.158		0.3224		0.1618		0.119		0.168		0.1149		0.1764		0.1313		0.025		0.1747		0.2305		0.2433		0.2047		0.2228		0.2205		0.1894	
PCB 081																					0.0049		0.0045		0	U	0	U	0.0046		0.0051		0.0073		0	U
PCB 082																					0	U	0.0242		0.0414		0.0775		0.0245		0.048		0.025		0.0299	
PCB 083																					0	U	0.0096		0.0124		0.0139		0.0109		0.0087		0.0134		0.0114	
PCB 084																																				
PCB 084/092																					0.0236		0.1347		0.1398		0.1918		0.1726		0.188		0.1799		0.1653	
PCB 085																					0.0031		0.0313		0.046		0.0319		0.0378		0.0431		0.0409		0.0362	
PCB 087																					0.0124		0.0538		0.0792		0.0737		0.0659		0.0843		0.0679		0.0687	
PCB 087/081																																				
PCB 089																					0.0049		0.0059		0.0115		0.0138		0.008		0.006		0.0078		0.0085	
PCB 091																					0.0047		0.0432		0.0571		0.0558		0.058		0.0762		0.0543		0.0353	
PCB 097																					0.0035		0.0494		0.062		0.0659		0.0581		0.065		0.0623		0.0553	
PCB 099																					0.0058		0.0579		0.0728		0.082		0.0667		0.0688		0.0727		0.0631	
PCB 100																					0	U	0.025		0.0293		0.0253		0.0265		0.0268		0.0305		0.0311	
PCB 101	0.0581		0.0954		0.0901		0.2042		0.093		0.077		0.1111		0.0858		0.1069		0.0861		0.0229		0.1106		0.1363		0.1214		0.1276		0.1382		0.1365		0.1126	
PCB 101/090																																				
PCB 105																																				
PCB 105/132/153																					0.0399		0.0893		0.1142		0.1419		0.1055		0.1452		0.113		0.1432	
PCB 107																					0.0007		0.009		0.0122		0.0228		0.0107		0.0152		0.0122		0.014	
PCB 114																																				
PCB 114/134																					0	U	0.0273		0.0173		0.0241		0.0136		0.0302		0.0195		0.0342	
PCB 118	0.0259		0.048		0.0461		0.1939		0.0428		0.0424		0.0756		0.0443		0.0419		0.0485		0.006		0.055		0.0662		0.0759		0.0629		0.0684		0.073		0.0353	
PCB 119																					0	U	0.0165		0.0174		0.0142		0.0117		0.019		0.019		0.0128	
PCB 124/135/144/147																					0.0112		0.0112		0.0135		0.0306		0.0132		0.0269		0.0142		0.0206	
PCB 128																					0	U	0.0092		0.0063		0		0.0141		0.0043		0.0117		0.0016	
PCB 129/178																					0.0016		0.0041		0.0043		0.0044		0.0043		0.0066		0.0048		0.0092	
PCB 130																					0	U	0.0046		0.0071		0.0126		0.0049		0.0038		0.0061		0.0089	
PCB 131																					0.0217		0.0137		0.0083		0.011		0.0085		0.0184		0.0206		0.0121	
PCB 132/168																																				
PCB 135/144																																				
PCB 136																					0.0043		0.0076		0.0083		0	U	0	U	0.0153		0	U	0.0096	
PCB 137																																				
PCB 137/176																					0.0006		0.002		0.0023		0.005		0.0019		0.0033		0.0023		0.0064	
PCB 138/158/163	0.0326				0.053		0.3601		0.0586		0.0701		0.1712		0.142		0.0473		0.0618		0.0333		0.0632		0.075		0.106		0.0621		0.1389		0.0696		0.1157	
PCB 138/163																																				
PCB 141																					0.0007		0.0084		0.0082		0.0108		0.007		0.0156		0.0097		0.0091	
PCB 146																					0	U	0.0359		0.0361		0.0434		0.034		0.0362		0.0258		0.0347	
PCB 149	0.0218		0.032		0.0277		0.3126		0.0393		0.0385		0.0541		0.0384		0.0299		0.0399		0.0175		0.0401		0.0464		0.057		0.046		0.0761		0.0515		0.0393	
PCB 149/123																																				
PCB 151																					0.0129		0.0183		0.0216		0.0341		0.0185		0.0403		0 0204		0.0339	
PCB 153/184																																				
PCB 156/171																																				
PCB 156/171/202																					0.0021		0.006		0.004		0.0214		0.0081		0.0097		0.0097		0.0063	
PCB 157/200																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.004	
PCB 157																																				
PCB 158																																				
PCB 167																					0	U	0.0013		0.0025		0.0074		0.0026		0.0028		0.0021		0.0006	
PCB 169																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																				
PCB 172																																				
PCB 170/190																					0	U	0.0199		0	U	0.0267		0.0143		0.0072		0.0176		0.0297	
PCB 172/197																					0.002		0.0026		0.0025		0.0016		0.0025		0.0035		0.0019		0.0064	
PCB 173																					0.0002		0.0014		0	U	0.0002		0	U	0	U	0	U	0.0003	
PCB 174																					0.0147		0.0076		0.0101		0.0137		0.0096		0.0164		0.0114		0.0219	

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	#47F		#48F		#49F		#4F		#50F		#5F		#6F		#7F		#8F		#9F		89GG25R96		89GG25S70		89GG25S90		89GG26D10		89GG26S10		89GG26S30		89GG26S50		89GG26S70	
Sample Date	4/17/90		4/24/90		4/24/90		4/19/89		5/1/90		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		5/5/89		5/4/89		5/5/89		5/5/89		5/5/89		5/5/89		5/5/89		5/6/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175																					0	U	0.0047												
PCB 176																																			
PCB 177																					0.0032		0.0015		0.0032		0.0102		0.0036		0.0051		0.0026		0.0056	
PCB 178/126																																			
PCB 180	0.0076		0.012		0.0112		0.6863		0.0138		0.0134		0.0245		0.0172		0.0176		0.0181		0.0082		0.0127		0.0175		0.0226		0.0191		0.0398		0.022		0.0481	
PCB 182/187																					0.0082		0.015		0.0173		0.0256		0.0181		0.0289		0.0174		0.0348	
PCB 183																					0.0025		0.0054		0.0081		0.0163		0.0089		0.0166		0.0095		0.0192	
PCB 185																					0	U	0.0005		0.0095		0.0194		0.0039		0.0007		0.0016		0	U
PCB 189																					0	U	0	U	0.0001		0	U	0.0009		0	U	0	U	0	U
PCB 190																																			
PCB 191																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0006	
PCB 193																					0	U	0.0019		0.001		0		0.0009		0.0011		0.0009		0.0022	
PCB 194																					0	U	0.0023		0.003		0.0091		0.0023		0.0038		0.0028		0.0045	
PCB 195																																			
PCB 195/208																					0.0016		0.0034		0.0062		0.0071		0.0049		0.0062		0.0052		0.0141	
PCB 196/203																					0.0024		0.007		0.0074		0.0093		0.0077		0.0117		0.0091		0.0278	
PCB 197																																			
PCB 198																					0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0011	
PCB 199																					0.0031		0.001		0.0013		0.001		0.0016		0.003		0.0016		0.0073	
PCB 201																					0	U	0.0056		0.0057		0		0.007		0.0094		0.0079		0.0155	
PCB 202																																			
PCB 203/196																																			
PCB 205																					0	U	0.0023		0.0025		0	U	0.0018		0.0016		0.0018		0	U
PCB 206																					0.0009		0.0024		0.0049		0.0081		0.0028		0.0046		0.0055		0.0106	
PCB 207																					0	U	0.0003		0	U	0	U	0.0002		0.0006		0.0003		0.0005	
PCB 208																																			
PCB 209																					0.0013		0.0005		0.0006		0.0011		0.0001		0.0211		0.001		0.0006	
Total Dissolved PCBs (by congener sum) =	**1.40**		**2.22**		**2.29**		**5.76**		**3.07**		**2.54**		**3.52**		**3.10**		**3.78**		**3.00**		**1.79**		**19.72**		**27.61**		**24.50**		**23.09**		**25.45**		**25.82**		**25.13**	
Total Congeners Analyzed (Diss) =	**8**		**7**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**	
Total Congeners Detected (Diss) =	**8**		**7**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**8**		**67**		**87**		**84**		**76**		**85**		**85**		**83**		**86**	
Reported TPCBs (Diss) =					**11.1**		**27.6**		**15.03**		**12.86**		**18.3**		**15.66**		**18.72**		**15.46**																	

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	89GG31D81		89GG31S01		89GG31S21		89GG31S41		89GG31S81		89GG32S01		89GG41R96		89GG41S01		89GG41S21		89GG41S41		89GG41S61		89GG41S81		89GG42S01		89GG56D61		89GG56R96		89GG56S01		89GG56S21	
Sample Date	6/8/89		6/7/89		6/8/89		6/7/89		6/8/89		6/8/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		9/20/89		9/20/89		9/20/89		9/20/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0.1126		0.1472		0.1027		0.1608		0.078		0.2306		0	U	0.0542		0.1329		0.0802		0.061		0.1191		0.1252		0.0429		0	U	0.0532		0	U
PCB 003	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0417		0	U	0	U	0	U	0	U	0.0219		0	U	0.0306		0.032	
PCB 004																																		
PCB 004/010	0.1629		0.0723		0.1116		0.1521		0.1552		0.1779		0.2657		0.1985		0.2977		0.3453		0.2786		0.3902		0.2343		0.1935		0.388		0.1909		0.2564	
PCB 005																																		
PCB 005/008	1.2136		0.6301		1.0019		1.2391		1.2418		1.2486		3.1482		1.3366		1.7629		2.2851		1.4821		2.0228		1.5967		1.1839		5.2398		1.4519		1.7506	
PCB 006	0.2723		0.114		0.1909		0.327		0.2832		0.3341		0.437		0.2747		0.4216		0.8089		0.5026		0.7164		0.512		0.2999		0	U	0.2678		0.4463	
PCB 007	0.0252		0.021		0.0186		0.0231		0.0254		0.0268		0.0579		0.0251		0.0398		0.0493		0.0357		0.0394		0.033		0.0279		0.2198		0.0295		0.0389	
PCB 008																																		
PCB 012/013	0.0084		0.0145		0.0081		0.0033		0.008		0.0257		0	U	0.0123		0.0114		0.0542		0.0246		0	U	0.0133		0	U	0	U	0.0136		0.0114	
PCB 016/032	1.2046		0.6425		0.9589		1.2093		1.2352		1.1739		0.9848		1.6632		2.0865		2.5547		1.9		2.6201		1.8934		1.1706		1.4613		1.2887		1.6734	
PCB 017	0.6976		0.4116		0.5434		0.6908		0.6856		0.6409		0.403		1.2113		1.4201		2.2389		1.3537		1.4512		1.3862		0.889		0.7712		1.0034		1.417	
PCB 018	1.278		0.6639		0.9805		1.2545		1.3314		1.2835		1.0288		2.0428		2.6489		2.6126		2.6996		2.5005		2.5628		1.6466		1.5342		1.5526		2.3249	
PCB 019	0.1125		0.0591		0.0837		0.1114		0.1139		0.112		0.1511		0.1635		0.2006		0.2625		0.2324		0.2375		0.1984		0.1782		0.2093		0.1663		0.2211	
PCB 021	0	U	0.003		0	U	0.8426		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022	0.5831		0.3847		0.5224		0.6004		0.5877		0.5443		0.6523		0.7731		0.936		1.0777		0.8093		1.0292		0.919		0.6081		1.4684		0.6924		0.8344	
PCB 024																																		
PCB 024/027	0.1167		0.0751		0.098		0.111		0.1139		0.1192		0	U	0.228		0.2606		0.3566		0.2748		0.3658		0.2438		0.1737		0.1093		0.168		0.2147	
PCB 025	0.3048		0.1645		0.2071		0.3086		0.3118		0.2677		0.0894		0.3537		0.5243		0.5555		0.7155		0.518		0.4464		0.3406		0.2187		0.288		0.4017	
PCB 026	0.5119		0.2666		0.3663		0.5114		0.5474		0.4797		0.1801		0.5716		0.839		0.8837		1.0143		0.8339		1.1142		0.7429		0.234		0.5677		0.6204	
PCB 027																																		
PCB 028																																		
PCB 028/031	2.541		1.5713		2.179		2.5992		2.6048		2.4565		2.1194		3.1283		4.092		5.1066		3.7784		5.1201		4.1819		2.9578		4.1089		3.0476		3.8414	
PCB 029	0.0076		0.0049		0.026		0.0055		0.0097		0.009		0.3148		0	U	0.0445		0.0631		0.0461		0.0769		0.0595		0	U	0	U	0	U	0.002	
PCB 031																																		
PCB 033	0.9636		0.6779		0.8796		1.009		0.9661		0.8512		0.5742		0.7987		0.9395		0.9637		0.6834		0.9578		0.817		0.5106		1.3696		0.6936		0.7906	
PCB 037/042	0.3103		0.2372		0.2849		0.3411		0.3389		0.279		0.4861		0.4133		0.4953		0.5762		0.4361		0.5398		0.4847		0.3395		0.2304		0.3469		0.4341	
PCB 040	0.1895		0.1319		0.1725		0.202		0.1928		0.1668		0.097		0.2257		0.2634		0.317		0.2391		0.2991		0.2669		0.1717		0.1752		0.1689		0.2174	
PCB 041/064/071	0.6195		0.4362		0.5456		0.6514		0.6295		0.573		0.4345		0.734		0.8726		1.0388		0.8026		0.6155		0.8795		0.5768		0.5384		0.6189		0.7595	
PCB 043	0.1017		0.0515		0.0592		0.0739		0.0892		0.0626		0		0.064		0.0823		0.115		0.0506		0.1126		0.0919		0.0654		0	U	0.0637		0.085	
PCB 044	0.7271		0.5127		0.6374		0.7507		0.7321		0.6726		0.5478		0.8861		1.0984		1.3284		1.0021		1.2435		1.0781		0.7579		0.7336		0.7398		0.9334	
PCB 045	0.1888		0.0839		0.1532		0.1699		0.1844		0.1783		0.0592		0.2259		0.2987		0.2982		0.2592		0.3212		0.2832		0.1938		0.1822		0.1949		0.2418	
PCB 046	0.0943		0.0556		0.0744		0.0947		0.095		0.0955		0	U	0.1292		0.1545		0.1751		0.1421		0.1784		0.1556		0.0966		0	U	0.1005		0.1322	
PCB 047																																		
PCB 048																																		
PCB 047/048	0.4062		0.2622		0.336		0.4175		0.4091		0.338		0.0957		0.4355		0.5232		0.6142		0.4018		0.588		0.5012		0.3666		0.301		0.4046		0.4851	
PCB 049	0.5258		0.3573		0.4524		0.5434		0.5397		0.4715		0.204		0.5617		0.7176		0.8727		0.5937		0.8016		0.6902		0.5059		0.3515		0.5245		0.6594	
PCB 051	0.0474		0.0344		0.043		0.0511		0.0497		0.0411		0	U	0.0466		0.0581		0.0707		0.0517		0.0652		0.0508		0.0417		0.0799		0.0422		0.0546	
PCB 052	0.6661		0.4793		0.5887		0.6679		0.679		0.6229		1.1825		0.735		0.9225		1.1214		0.9764		1.2703		0.9024		0.8263		0.8476		0.6664		0.8338	
PCB 053	0.1047		0.0671		0.0945		0.1109		0.1071		0.1021		0	U	0.2045		0.2925		0.3096		0.2567		0.2787		0.2463		0.1984		0.3068		0.1754		0.2329	
PCB 056																																		
PCB 059																																		
PCB 060/092																																		
PCB 056/060	0.2661		0.2208		0.2583		0.2781		0.2663		0.2513		0.1637		0.3422		0.382		0.4571		0.3492		0.4325		0.4087		0.266		0.549		0.322		0.37	
PCB 063	0.0335		0.0389		0.0485		0.0443		0.0452		0.0399		0	U	0.0373		0.0487		0.0606		0.0488		0.0664		0.0486		0.0289		0	U	0.0313		0.0533	
PCB 064/041																																		
PCB 066/095	0.5415		0.5053		0.5614		0.6159		0.562		0.5246		1.0238		0.6908		0.7747		0.9203		0.6891		0.8325		0.7554		0.5966		0	U	0.6821		0.7853	
PCB 070																																		
PCB 070/076	0.4283		0.3872		0.4401		0.4768		0.444		0.416		0.4168		0.5587		0.644		0.737		0.5351		0.669		0.6102		0.4318		0.6854		0.527		0.6105	
PCB 071																																		
PCB 074	0.1643		0.1539		0.1872		0.188		0.1804		0.1638		0.1788		0.1964		0.2476		0.2721		0.209		0.2493		0.2361		0.1647		0.2598		0.1954		0.2408	
PCB 076																																		

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	89GG31D81		89GG31S01		89GG31S21		89GG31S41		89GG31S81		89GG32S01		89GG41R96		89GG41S01		89GG41S21		89GG41S41		89GG41S61		89GG41S81		89GG42S01		89GG56D61		89GG56R96		89GG56S01		89GG56S21	
Sample Date	6/8/89		6/7/89		6/8/89		6/7/89		6/8/89		6/8/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		9/20/89		9/20/89		9/20/89		9/20/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 077/110	0.1439		0.1458		0.1488		0.1474		0.1466		0.1369		0.7291		0.1906		0.1924		0.2605		0.2027		0.2166		0.1968		0.154		0.6454		0.163		0.1923	
PCB 081	0.0041		0.0043		0.0066		0.0036		0.0044		0.0066		0.1889		0.0089		0.0055		0.005		0.0095		0.0023		0.0087		0.0047		0	U	0.0022		0.0053	
PCB 082	0.023		0.0142		0.0152		0.0182		0.0267		0.0224		0.2638		0.0227		0.0222		0.0232		0.0167		0	U	0.0209		0.0206		0.0984		0.0187		0.0228	
PCB 083	0.0094		0.0063		0.0063		0.0084		0.0075		0.0103		0	U	0	U	0	U	0.0013		0	U	0	U	0	U	0.003		0	U	0.0041		0.0053	
PCB 084																																		
PCB 084/092	0.138		0.1129		0.1318		0.1426		0.1389		0.1331		0.4899		0.1448		0.1605		0.2135		0.1717		0.2048		0.173		0.1489		0.3891		0.1343		0.167	
PCB 085	0.0314		0.0268		0.0268		0.027		0.0271		0.0248		0.1058		0.0322		0.0335		0.0462		0.0367		0.0259		0.0363		0.0261		0.1164		0.0278		0.0354	
PCB 087	0.059		0.0515		0.0543		0.0517		0.0526		0.049		0.2594		0.0651		0.0639		0.0731		0.0681		0.0537		0.0625		0.053		0.4385		0.0496		0.0603	
PCB 087/081																																		
PCB 089	0.0042		0.0038		0.0063		0.0055		0.0059		0.0067		0	U	0.0192		0.0128		0.0186		0.0151		0.0152		0.0145		0.014		0.0482		0.0119		0.0137	
PCB 091	0.0524		0.0186		0.0449		0.0443		0.043		0.0217		0.0378		0.0266		0.0466		0.051		0.035		0.0492		0.0472		0.0349		0.0729		0.0347		0.0339	
PCB 097	0.0516		0.0483		0.0501		0.048		0.0527		0.0544		0.0944		0.0532		0.0575		0.0691		0.0552		0.0623		0.0546		0.0424		0.1458		0.0451		0.0543	
PCB 099	0.0525		0.0481		0.0515		0.0513		0.0491		0.0451		0.0995		0.061		0.0576		0.0697		0.0549		0.0738		0.0536		0.0465		0.1787		0.0523		0.0596	
PCB 100	0.032		0.0175		0.0234		0.0205		0.0197		0.0204		0	U	0.0442		0.0272		0.0272		0.03		0.1927		0.0292		0.0185		0	U	0.0218		0.0285	
PCB 101	0.0946		0.0959		0.1005		0.0998		0.096		0.0891		0.5768		0.117		0.1242		0.15		0.116		0.1361		0.1136		0.099		0.7371		0.1075		0.121	
PCB 101/090																																		
PCB 105																																		
PCB 105/132/153	0.0965		0.096		0.0944		0.0924		0.0934		0.08		0.6094		0.0741		0.0849		0.103		0.099		0.175		0.0716		0.0876		1.1195		0.0997		0.1053	
PCB 107	0.0108		0.0109		0.0115		0.0122		0.0162		0.0094		0	U	0.005		0.0122		0.0092		0.0095		0.0096		0.0099		0.0073		0	U	0.0097		0.0143	
PCB 114																																		
PCB 114/134	0.0264		0.0417		0.0246		0.0392		0.0258		0.0136		0	U	0.011		0.0121		0.0133		0.0117		0.008		0.0099		0.0138		0	U	0.016		0.017	
PCB 118	0.0522		0.0438		0.051		0.0524		0.0508		0.0431		0.1217		0.0513		0.0597		0.0665		0.0504		0.0556		0.0512		0.0537		0.286		0.0642		0.0718	
PCB 119	0.0143		0.0076		0.0081		0.0086		0.0049		0.0087		0	U	0.0056		0.0096		0.0079		0.0097		0.0089		0.0096		0.0076		0	U	0.0091		0.01	
PCB 124/135/144/147	0.0142		0.013		0.0134		0.0129		0.0133		0.0112		0.0784		0.0075		0.009		0.0088		0.0069		0.0073		0.0059		0.0118		0.1775		0.0124		0.0137	
PCB 128	0.0046		0.0044		0.0047		0.0043		0.0046		0.0039		0	U	0.0074		0.0053		0.0067		0.0051		0.0069		0.0045		0.0082		0.0548		0.0101		0.0094	
PCB 129/178	0.0041		0.0048		0.0044		0.0046		0.0045		0.0035		0	U	0.0204		0.0046		0.006		0.0027		0.1298		0.0032		0.0029		0.072		0.0036		0.0039	
PCB 130	0.0082		0.0065		0.0077		0.0074		0.0067		0.0068		0	U	0.0091		0.0092		0.0105		0.007		0.0158		0.0073		0.0085		0	U	0.0089		0.0118	
PCB 131	0.0067		0.0093		0.006		0.0087		0.0063		0.0042		0.0171		0.0007		0.0019		0.0023		0.0009		0.0007		0.0008		0.0014		0.0142		0	U	0.002	
PCB 132/168																																		
PCB 135/144																																		
PCB 136	0	U	0	U	0	U	0.1851		0	U	0	U	0.2733		0.0324		0.0318		0.0404		0	U	0.0292		0	U	0	U	0	U	0	U	0	U	0	U
PCB 137																																		
PCB 137/176	0.0033		0.0032		0.0026		0.0022		0.003		0.0033		0	U	0.0026		0.0027		0.003		0.0027		0	U	0.0023		0.0023		0.0355		0.0015		0.002	
PCB 138/158/163	0.0676		0.0629		0.0657		0.0593		0.0646		0.0795		0	U	0.0676		0.0819		0.0719		0.0596		0.0825		0.0583		0.0615		0	U	0.0654		0.0715	
PCB 138/163																																		
PCB 141	0.0095		0.0108		0	U	0.0084		0.0095		0.0078		0.1353		0.0061		0.0074		0.0096		0.0076		0.009		0.0065		0.008		0.216		0.01		0.0086	
PCB 146	0.034		0.0375		0.0277		0.0401		0.0272		0.021		0.0455		0.027		0.0302		0.0312		0.0186		0.0203		0.0174		0.0187		0.1034		0.0334		0.035	
PCB 149	0.0508		0.0475		0.0473		0.0473		0.0469		0.0414		0.5309		0.0338		0.0459		0.0426		0.0366		0.0382		0.0329		0.041		0.9258		0.0436		0.0497	
PCB 149/123																																		
PCB 151	0.0204		0.0202		0.0198		0.0196		0.0221		0.0176		0.3456		0.0149		0.0186		0.0182		0.0142		0.0222		0.0137		0.0192		0.4766		0.0175		0.0174	
PCB 153/184																																		
PCB 156/171																																		
PCB 156/171/202	0.0081		0.007		0.002		0.0073		0.0065		0.0071		0	U	0.0057		0.0069		0.0093		0.0051		0.0059		0.0052		0.0051		0.0761		0.0059		0.0046	
PCB 157/200	0	U	0	U	0	U	0	U	0	U	0.002		0	U	0	U	0.0017		0	U	0	U	0	U	0	U	0	U	0	U	0.0041		0	U	0	U
PCB 157																																		
PCB 158																																		
PCB 167	0.0011		0.0019		0.0009		0.0015		0.0014		0.0003		0	U	0.0012		0.0012		0.002		0.0016		0.0242		0.0017		0	U	0	U	0	U	0.0015	
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																		
PCB 172																																		
PCB 170/190	0.0107		0	U	0.0103		0.0106		0	U	0	U	0	U	0.0284		0.0438		0.023		0.0451		0.0649		0.0205		0.0336		0	U	0.0212		0.02	
PCB 172/197	0.0017		0.0017		0.002		0.0018		0.002		0.0013		0	U	0.0009		0.0014		0.0024		0.0016		0.0522		0.0011		0.0012		0	U	0.0017		0.0021	
PCB 173	0	U	0	U	0	U	0.0003		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0108		0.0102		0.0098		0.0097		0.0099		0.0086		0.1114		0.0115		0.0112		0.0135		0.0096		0.0097		0.0086		0.0097		0.1916		0.0105		0.0127	

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	89GG31D81		89GG31S01		89GG31S21		89GG31S41		89GG31S81		89GG32S01		89GG41R96		89GG41S01		89GG41S21		89GG41S41		89GG41S61		89GG41S81		89GG42S01		89GG56D61		89GG56R96		89GG56S01		89GG56S21	
Sample Date	6/6/89		6/7/89		6/8/89		6/7/89		6/8/89		6/8/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		7/27/89		9/20/89		9/20/89		9/20/89		9/20/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175	0	U	0.002		0	U	0.2232		0.0034		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 176																																		
PCB 177	0.0057		0.0061		0.0042		0.0062		0.006		0.0059		0.0648		0.0124		0.0067		0.0085		0.0051		0	U	0.0046		0.0048		0.0892		0.0064		0.0069	
PCB 178/126																																		
PCB 180	0.0204		0.0183		0.0191		0.0175		0.0178		0.0154		0.158		0.0215		0.0196		0.0244		0.0173		0.0212		0.0153		0.0191		0.2424		0.0208		0.0222	
PCB 182/187	0.0184		0.0152		0.0147		0.0164		0.0177		0.0147		0.1285		0.0117		0.0115		0.0136		0.0087		0.0115		0.0085		0.0124		0.3062		0.0143		0.0174	
PCB 183	0.0095		0.0087		0.008		0.0076		0.0077		0.0068		0.0614		0.0061		0.0061		0.0082		0.0054		0.0059		0.0045		0.006		0.145		0.0067		0.0079	
PCB 185	0.0025		0.0046		0.0014		0.003		0.0029		0.0028		0	U	0	U	0	U	0.001		0	U	0	U	0	U	0.0034		0.0446		0.0012		0.0017	
PCB 189	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0049		0	U	0	U	0.0001		0	U	0	U	0	U	0	U	0	U	0	U
PCB 190																																		
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0006		0.0006		0.0008		0.0007		0.0016		0.0006		0	U	0.0011		0.0011		0.0009		0.0009		0.0015		0.0006		0.0007		0	U	0.0009		0.001	
PCB 194	0.0025		0.0024		0.0022		0.0022		0.0024		0.0018		0	U	0	U	0.0023		0.0008		0	U	0	U	0.0015		0	U	0	U	0.0011		0.0013	
PCB 195																																		
PCB 195/208	0.0041		0.0041		0.0048		0.0045		0.0048		0.0058		0	U	0.0055		0.0035		0.0052		0.0026		0.0089		0.0026		0.0033		0.0416		0.0043		0.0049	
PCB 196/203	0.0084		0.0078		0.0075		0.0073		0.0071		0.0064		0	U	0.0026		0.0061		0.0063		0.0026		0	U	0.0041		0.005		0.0385		0.0064		0.0073	
PCB 197																																		
PCB 198	0.0004		0	U	0	U	0	U	0	U	0	U	0	U	0.0004		0	U	0.0018		0	U	0	U	0.0003		0	U	0	U	0	U	0	U
PCB 199	0.0026		0.0017		0.0018		0.0011		0.0014		0.0003		0	U	0	U	0.0014		0.0012		0.0021		0	U	0.0012		0	U	0	U	0.0004		0.0015	
PCB 201	0.008		0.0076		0.0075		0.0071		0.0069		0.006		0.0455		0.0074		0.0051		0.0072		0.0048		0.0043		0.0038		0.0052		0	U	0.0067		0.0075	
PCB 202																																		
PCB 203/196																																		
PCB 205	0	U	0	U	0.0014		0.0008		0.0018		0	U	0.0489		0	U	0.0008		0.0018		0.0013		0.0087		0.0013		0	U	0	U	0	U	0	U
PCB 206	0.0054		0.0025		0.0027		0.0033		0.0057		0.0048		0	U	0	U	0.0024		0.0037		0.0047		0	U	0	U	0.0013		0	U	0.0019		0.0021	
PCB 207	0.0005		0	U	0	U	0	U	0.0002		0	U	0	U	0	U	0	U	0.0005		0	U	0.0891		0	U	0	U	0	U	0.0003		0.0009	
PCB 208																																		
PCB 209	0.0024		0.007		0.0011		0.0007		0.0005		0.0032		0.0023		0	U	0.003		0.0014		0.0575		0	U	0	U	0.0008		0	U	0.0007		0.0006	
Total Dissolved PCBs (by congener sum) =	16.78		11.06		14.37		18.44		17.02		16.05		20.92		20.61		25.94		31.18		24.27		29.52		25.23		17.75		30.10		18.50		23.37	
Total Congeners Analyzed (Diss) =	93		93		93		93		93		93		93		93		93		93		93		93		93		93		93		93		93	
Total Congeners Detected (Diss) =	83		82		81		86		83		81		53		77		83		85		80		73		79		77		57		80		82	
Reported TPCBs (Diss) =																																		

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE. WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	89GG56S41		89GG56S61		89GG56S81		89GG57S01		90GG01D61		90GG01S01		90GG01S21		90GG01S41		90GG01S61		90GG01S81		90GG02S01		90GG26S10		90GG26S50		90GG26S70		90GG26S90		90GG27S10	
Sample Date	9/20/89		9/20/89		9/20/89		9/20/89		10/18/89		10/17/89		10/17/89		10/18/89		10/18/89		10/18/89		10/18/89		4/30/90		5/1/90		5/1/90		5/1/90		5/1/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0.1514		0.0265		0.1182		0.0413		0.1736		0.159		0.1006		0.07		0.1943		0.2275		0.1639		0.0969		0	U	0	U	0	U	0.2982	
PCB 003	0.1279		0	U	0.1022		0.0438		0.0208		0	U	0.2962		0	U	0	U	0.0797		0	U	0.3104		0	U	0	U	0	U	0	U
PCB 004																																
PCB 004/010	0.3049		0.224		0.2657		0.2434		0.361		0.1703		0.1553		0.2574		0.2945		0.3092		0.34		0.1737		0.5133		0	U	0.4182		0.2867	
PCB 005																																
PCB 005/008	2.3272		1.2024		1.9733		1.8496		2.6735		1.4458		1.363		1.884		2.346		2.3517		2.7147		1.3346		2.3602		1.6019		1.7859		1.314	
PCB 006	0.7043		0.3293		0.6313		0.4595		0.7328		0.3053		0.2915		0.4732		0.6297		0.6276		0.8132		0.2447		0	U	0.3317		0.5563		0.3493	
PCB 007	0.0487		0.0264		0.0433		0.0412		0.0533		0.0276		0.0274		0.0381		0.0452		0.0466		0.0505		0.0266		0.047		0.0327		0.0336		0.0361	
PCB 008																																
PCB 012/013	0.021		0	U	0.0213		0	U	0.0151		0.0122		0.0117		0.0136		0	U	0.0209		0.021		0.0142		0.0208		0.0199		0.021		0.0243	
PCB 016/032	2.02		1.2014		1.8067		1.4663		2.0731		1.0705		1.1307		1.5231		1.7689		1.8402		1.9611		1.4542		2.6585		1.7131		2.3709		1.4871	
PCB 017	1.3081		0.8726		1.2318		1.0342		1.2905		0.6854		0.688		0.9774		1.0588		1.1373		1.1919		0.92		0	U	1.2666		1.2718		1.0893	
PCB 018	1.7198		1.6967		2.0671		2.0046		2.6838		1.253		1.2967		1.9129		2.2071		2.2654		2.4828		1.7234		0	U	2.6406		2.3656		2.1214	
PCB 019	0.2862		0.1455		0.2565		0.1651		0.2339		0.1236		0.1209		0.1782		0.1848		0.1992		0.2117		0.1947		0	U	0.2338		0.4168		0.2027	
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022	0.986		0.5619		0.9203		0.7475		0.8578		0.5231		0.5596		0.6751		0.7951		0.7832		0.826		0.5511		0.8128		0.5769		0.7377		0.5605	
PCB 024																																
PCB 024/027	0.2813		0.1549		0.2743		0.1702		0.2281		0.1303		0.1338		0.1702		0.2043		0.2108		0.2194		0.1828		0.2951		0.2199		0.2791		0.1866	
PCB 025	0.5202		0.3651		0.5048		0.3994		0.5882		0.2585		0.3216		0.4368		0.5271		0.5202		0.5603		0	U	0	U	0.3364		0.4204		0.3036	
PCB 026	0.7927		0.596		0.7593		0.7172		0.9394		0.4403		0.5089		0.7014		0.8461		0.8275		0.8879		0	U	0	U	0.5758		0.7172		0.5292	
PCB 027																																
PCB 028																																
PCB 028/031	4.7138		2.727		4.4393		3.3062		4.0599		2.5186		2.598		3.3545		3.8771		3.7183		3.8915		2.6098		4.6453		3.1265		4.2781		2.9382	
PCB 029	0.0661		0.0053		0.0636		0.0074		0.0535		0.0053		0.0154		0.0468		0.0079		0.0503		0.0185		0.0115		0.0146		0.0141		0.0155		0.0171	
PCB 031																																
PCB 033	0.884		0.4822		0.8331		0.7292		0.8249		0.5064		0.5486		0.6802		0.7801		0.7654		0.8072		0.6281		0.8217		0.5522		0.7093		0.5337	
PCB 037/042	0.5022		0.3108		0.4831		0.3775		0.3839		0.298		0.2727		0.3434		0.3907		0.3628		0.3704		0.3388		0.4774		0.3358		0.4036		0.3501	
PCB 040	0.2568		0.1788		0.2484		0.2116		0.2148		0.14		0.1503		0.1793		0.2121		0.2059		0.2106		0.1764		0.2705		0.1855		0.239		0.1813	
PCB 041/064/071	0.8624		0.6033		0.8448		0.7407		0.7721		0.5286		0.5478		0.6803		1.1024		0.8721		0.7559		0.634		0.8998		0.6353		0.8132		0.6162	
PCB 043	0.0985		0.069		0.082		0.0867		0.0875		0.0817		0.0842		0.0813		0.0899		0.0895		0.082		0.075		0.1428		0.0732		0.113		0.0686	
PCB 044	1.0961		0.7513		1.0716		0.8828		0.9441		0.6316		0.6433		0.7905		0.9544		0.8846		0.9184		0.7952		1.1735		0.8289		1.0267		0.7832	
PCB 045	0.2878		0.2022		0.2773		0.2266		0.2642		0.158		0.1606		0.2019		0.2359		0.2395		0.2503		0.205		0.2867		0.226		0.2936		0.2129	
PCB 046	0.1491		0.0978		0.1452		0.1191		0.1335		0.0843		0.0835		0.1022		0.123		0.1247		0.1289		0.1101		0.1555		0.1191		0.142		0.0868	
PCB 047																																
PCB 048																																
PCB 047/048	0.5425		0.3736		0.5204		0.4658		0.4567		0.3229		0.3838		0.3954		0.4606		0.437		0.4437		0.4283		0.5945		0.4084		0.5202		0.4096	
PCB 049	0.7533		0.5114		0.7241		0.61		0.6677		0.4725		0.5112		0.5791		0.6742		0.6355		0.6489		0.5871		0.8752		0.5872		0.7703		0.5616	
PCB 051	0.0644		0.0443		0.0559		0.0493		0.0572		0.0356		0.0383		0.0466		0.0487		0.0551		0.0522		0.05		0.0692		0.0474		0.0536		0.0472	
PCB 052	0.99		0.7546		0.974		0.7628		0.8766		0.6007		0.6023		0.7322		0.871		0.8133		0.8661		0.7837		1.2358		1.001		1.1106		0.8003	
PCB 053	0.2992		0.2041		0.2692		0.184		0.2663		0.1551		0.1573		0.2228		0.2348		0.233		0.217		0.1915		0.3549		0.2333		0.252		0.1782	
PCB 056																																
PCB 059																																
PCB 060/092																																
PCB 056/060	0.4052		0.2398		0.3914		0.3417		0.3137		0.2545		0.2642		0.2825		0.3559		0.3045		0.3183		0.2774		0.3584		0.2573		0.3228		0.2667	
PCB 063	0.0579		0.0286		0.0558		0.038		0.047		0.0488		0.0418		0.0448		0.0332		0.0442		0.0458		0.0319		0.049		0.0316		0.035		0.0299	
PCB 064/041																																
PCB 066/095	0.8893		0.554		0.8296		0.6981		0.7025		0.5661		0.5626		0.6098		0.7568		0.6359		0.6588		0.6186		0.7914		0.5827		0.7146		0.5642	
PCB 070																																
PCB 070/076	0.668		0.4123		0.6406		0.5436		0.5546		0.4667		0.4678		0.4981		0.5919		0.5312		0.5454		0.441		0.5336		0.3682		0.4691		0.3598	
PCB 071																																
PCB 074	0.2628		0.1461		0.2484		0.1981		0.2171		0.2123		0.196		0.2026		0.2573		0.2323		0.2158		0.1609		0.2172		0.1566		0.1866		0.1471	
PCB 076																																

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	89GG56S41		89GG56S61		89GG56S81		89GG57S01		90GG01D61		90GG01S01		90GG01S21		90GG01S41		90GG01S61		90GG01S81		90GG02S01		90GG26S10		90GG26S50		90GG26S70		90GG26S90		90GG27S10	
Sample Date	9/20/89		9/20/89		9/20/89		9/20/89		10/18/89		10/17/89		10/17/89		10/18/89		10/18/89		10/18/89		10/18/89		4/30/90		5/1/90		5/1/90		5/1/90		5/1/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 077/110	0.2031		0.1446		0.2026		0.1628		0.1703		0.15		0.1437		0.1474		0.1799		0.1505		0.1547		0.1527		0.1967		0.1551		0.1768		0.1471	
PCB 081	0.0019		0.0084		0.0055		0.0088		0.0057		0.0062		0.0064		0.0084		0.0054		0.0051		0.0049		0.0023		0.0026		0.0046		0.0039		0.0028	
PCB 082	0.0273		0.0135		0.0288		0.0195		0.0168		0.011		0.0133		0.0141		0.0305		0.029		0.015		0.0246		0.0384		0.0227		0.0277		0.0237	
PCB 083	0.0055		0.005		0.0056		0.0129		0.0091		0.0136		0.0121		0.008		0.009		0.012		0.0075		0	U	0.0007		0	U	0	U	0	U
PCB 084																																
PCB 084/092	0.1903		0.1417		0.189		0.1577		0.1485		0.1085		0.1148		0.1299		0.1604		0.1406		0.1415		0.1424		0.1965		0.1421		0.1694		0.1318	
PCB 085	0.0352		0.0258		0.0371		0.0328		0.036		0.0305		0.0273		0.0274		0.0323		0.0279		0.0314		0.0279		0.0352		0.028		0.0325		0.0266	
PCB 087	0.0658		0.0529		0.0634		0.0597		0.0624		0.0507		0.0501		0.0543		0.0654		0.0542		0.0572		0.0491		0.0602		0.0507		0.0544		0.0444	
PCB 087/081																																
PCB 089	0.0159		0.0024		0.0175		0.0046		0.0121		0.0129		0.0054		0.0054		0.0092		0.0071		0.0071		0.0095		0.0119		0.0079		0.0124		0.0151	
PCB 091	0.0742		0.0395		0.0378		0.0481		0.0478		0.0362		0.0226		0.0231		0.0531		0.0455		0.0463		0.0317		0.0435		0.0265		0.0357		0.0253	
PCB 097	0.0584		0.0379		0.056		0.0549		0.0503		0.0494		0.0499		0.0445		0.0535		0.046		0.0468		0.0443		0.0572		0.0454		0.0486		0.0396	
PCB 099	0.0635		0.0454		0.0601		0.0521		0.055		0.0494		0.0485		0.0482		0.0613		0.0509		0.0515		0.0545		0.0568		0.044		0.0539		0.041	
PCB 100	0.0362		0.0208		0.0344		0.027		0.0227		0.0174		0.019		0.0189		0.0273		0.0203		0.0225		0.0131		0.0153		0.0121		0.0164		0.012	
PCB 101	0.1315		0.0905		0.1228		0.0984		0.118		0.0958		0.0905		0.0934		0.1217		0.0971		0.1014		0.0969		0.1153		0.0973		0.1158		0.0963	
PCB 101/090																																
PCB 105																																
PCB 105/132/153	0.1145		0.0794		0.0994		0.0789		0.1022		0.0681		0.07		0.0729		0.0896		0.0674		0.0717		0.0813		0.0929		0.0798		0.0861		0.0655	
PCB 107	0.0143		0.0029		0.0131		0.0045		0.0086		0.0104		0.0096		0.0054		0.0052		0.0098		0.0047		0.0094		0.0104		0.0077		0.0093		0.0076	
PCB 114																																
PCB 114/134	0.0184		0.0076		0.0176		0.0186		0.0091		0.0085		0.0077		0.0041		0.0066		0.007		0.0055		0.0087		0.0143		0.0085		0.0114		0	U
PCB 118	0.0764		0.0429		0.0695		0.0526		0.0544		0.0459		0.0493		0.0482		0.0507		0.0466		0.0472		0.051		0.0624		0.049		0.0552		0.0438	
PCB 119	0.0102		0.0068		0.0098		0.0089		0.0064		0.0152		0.0168		0.0084		0.008		0.0085		0.0055		0.0083		0.013		0.0065		0.0073		0.0064	
PCB 124/135/144/147	0.0158		0.0057		0.0135		0.006		0.015		0.0084		0.0086		0.0084		0.0086		0.0085		0.0077		0.009		0.0112		0.0087		0.0098		0.0081	
PCB 128	0.0095		0.0067		0.0101		0.0023		0.0034		0.003		0.0036		0.0031		0.0045		0.0039		0.0028		0.0071		0.0082		0.0078		0.0078		0.0053	
PCB 129/178	0.0045		0.0057		0.0038		0.0096		0.0064		0.0036		0.003		0.003		0.005		0.0028		0.0031		0.003		0.0035		0.0031		0.0037		0.0022	
PCB 130	0.011		0.0037		0.0113		0.0053		0.0099		0.0083		0.0133		0.0084		0	U	0.0087		0.0078		0.0043		0.0058		0.0045		0.005		0.0034	
PCB 131	0	U	0.0009		0.0021		0.0018		0.0017		0.002		0.0026		0.0023		0.0019		0.0028		0.002		0.0008		0.0017		0.0007		0.0011		0	U
PCB 132/168																																
PCB 135/144																																
PCB 136	0	U	0.0065		0	U	0.0064		0	U	0.0074		0.0053		0	U	0.0072		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137																																
PCB 137/176	0.0026		0.0015		0.0025		0	U	0.0032		0.0013		0	U	0.0014		0.0011		0.0014		0.0015		0.0016		0.0019		0.0029		0.0036		0.0015	
PCB 138/158/163	0.071		0.0483		0.0685		0.1471		0.0789		0.0559		0.0608		0.0764		0.5727		0.081		0.0797		0.0518		0.0524		0.0794		0.0553		0.0385	
PCB 138/163																																
PCB 141	0.0102		0	U	0.0099		0	U	0.0155		0.0072		0.0062		0.0077		0	U	0.0072		0.0084		0.0059		0.007		0.0061		0.0075		0.0053	
PCB 146	0.0332		0.0153		0.0286		0.0186		0.0219		0.0277		0.0235		0.0236		0.0226		0.0209		0.0191		0.0207		0.0211		0.0142		0.0164		0.0196	
PCB 149	0.0559		0.0349		0.0483		0.0347		0.0643		0.0344		0.0324		0.0334		0.0469		0.0325		0.0366		0.0322		0.0377		0.0343		0.0354		0.0264	
PCB 149/123																																
PCB 151	0.0215		0.0133		0.0177		0.0137		0.0288		0.0125		0.0116		0.0129		0.0212		0.0136		0.0149		0.0122		0.014		0.014		0.0154		0.0107	
PCB 153/184																																
PCB 156/171																																
PCB 156/171/202	0.005		0.0017		0.0066		0.0057		0.0033		0.0043		0.0066		0.006		0.0029		0.0059		0.0021		0.0056		0.0058		0.0063		0.0062		0.0046	
PCB 157/200	0	U	0	U	0.003		0	U	0	U	0	U	0	U	0	U	0	U	0.0022		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 157																																
PCB 158																																
PCB 167	0.002		0.0008		0	U	0	U	0	U	0.0006		0.0014		0	U	0	U	0.0024		0	U	0.0022		0.0024		0.0008		0.0015		0.0013	
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170																																
PCB 172																																
PCB 170/190	0.0191		0.0062		0.0182		0	U	0.0078		0	U	0	U	0	U	0	U	0	U	0	U	0.0154		0.0238		0.2036		0.0156		0.0109	
PCB 172/197	0.0022		0.0008		0.0026		0.0013		0.0018		0.0033		0.0021		0.0016		0	U	0.0016		0	U	0.0013		0.0016		0.0013		0.0016		0	U
PCB 173	0	U	0	U	0	U	0	U	0.0045		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0128		0.0088		0.0109		0.0094		0.0139		0.0091		0.0072		0.0084		0.0118		0.0074		0.0085		0.0074		0.0096		0.009		0.0101		0.0071	

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	89GG56S41		89GG56S61		89GG56S81		89GG57S01		90GG01D61		90GG01S01		90GG01S21		90GG01S41		90GG01S61		90GG01S81		90GG02S01		90GG26S10		90GG26S50		90GG26S70		90GG26S90		90GG27S10	
Sample Date	9/20/89		9/20/89		9/20/89		9/20/89		10/18/89		10/17/89		10/17/89		10/18/89		10/18/89		10/18/89		10/18/89		4/30/90		5/1/90		5/1/90		5/1/90		5/1/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 176																																
PCB 177	0.0072		0.0024		0.0061		0.0032		0.0066		0.0053		0.005		0.005		0.0041		0.0047		0.0049		0.0048		0.0049		0.0048		0.0051		0.0035	
PCB 178/126																																
PCB 180	0.023		0.0159		0.0234		0.0161		0.0255		0.024		0.018		0.0192		0.0271		0.0179		0.0187		0.0133		0.0212		0.0192		0.02		0.0155	
PCB 182/187	0.0183		0.0086		0.0167		0.0101		0.0209		0.012		0.0096		0.0132		0.016		0.0121		0.0131		0.0113		0.0119		0.0108		0.013		0.0082	
PCB 183	0.0092		0.0057		0.0077		0.0074		0.011		0.0066		0.0057		0.0052		0.007		0.0051		0.0087		0.0058		0.0064		0.0072		0.0082		0.0047	
PCB 185	0.002		0.0008		0.0015		0	U	0.0064		0.0021		0.0015		0.0023		0	U	0.0037		0.0074		0	U	0.0006		0	U	0	U	0	U
PCB 189	0	U	0	U	0	U	0	U	0.0005		0	U	0	U	0	U	0.0127		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 190																																
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.001		0	U	0.001		0.0003		0.0016		0.0011		0.0008		0	U	0	U	0.0005		0.0005		0.0007		0.0008		0	U	0	U	0	U
PCB 194	0	U	0.0012		0	U	0.0008		0.0026		0.0026		0.0023		0.0027		0.0013		0.0018		0.0023		0.0013		0.0015		0.0004		0.0007		0	U
PCB 195																																
PCB 195/208	0.005		0	U	0.0047		0.0033		0.0036		0.0049		0.004		0.004		0.0233		0.0036		0.0044		0.0028		0.0033		0.0034		0.0034		0.0015	
PCB 196/203	0.0071		0.005		0.0069		0.0052		0.0083		0.0062		0.0065		0.0058		0.0651		0.0057		0.0072		0.005		0.0052		0.005		0.0056		0.003	
PCB 197																																
PCB 198	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 199	0.0014		0.0006		0.0013		0.0007		0.0027		0.0016		0.0012		0.0006		0	U	0.0014		0	U	0.0009		0	U	0.0019		0.0008		0	U
PCB 201	0.007		0.0039		0.0066		0.0049		0.0059		0.0066		0.0047		0.0037		0.0289		0.0051		0.0058		0.0047		0.0052		0.0052		0.0058		0.0025	
PCB 202																																
PCB 203/196																																
PCB 205	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 206	0.0017		0.0012		0.0021		0.0013		0.002		0.0085		0.0027		0.002		0	U	0.0013		0.0014		0.0021		0.002		0.002		0.0024		0.0026	
PCB 207	0	U	0	U	0.0009		0	U	0	U	0.0003		0	U	0	U	0	U	0.0002		0	U	0.0007		0.0001		0	U	0	U	0	U
PCB 208																																
PCB 209	0.0002		0.0047		0.0005		0	U	0.0011		0.0019		0.002		0.0026		0	U	0.0031		0.0013		0.0006		0.0006		0.0006		0.0008		0.0005	
Total Dissolved PCBs (by congener sum) =	**26.95**		**17.08**		**25.58**		**21.18**		**26.14**		**15.75**		**16.34**		**20.41**		**25.02**		**23.78**		**24.98**		**17.42**		**21.97**		**20.56**		**25.04**		**18.86**	
Total Congeners Analyzed (Diss) =	**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**		**93**	
Total Congeners Detected (Diss) =	**80**		**78**		**82**		**76**		**83**		**82**		**81**		**78**		**72**		**83**		**77**		**79**		**74**		**76**		**77**		**73**	
Reported TPCBs (Diss) =																																

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	SW060001		SW090001		SW0900 02		SW090003		SW09000 4		SW0900 05		SW090006		SW090007		SW090008		SW09000 9		SW09001 0		SW0900 11		SW0900 12		SW0900 13		SW0900 14	
Sample Date	7/26/00		7/27/00		9/28/00		11/30/00		1/17/01		3/27/01		4/8/01		4/13/01		4/17/01		4/30/01		5/1/01		5/11/01		5/22/01		5/24/01		5/31/01	
Fraction	Dissolved		Dissolved		Dissolve		Dissolved		Dissolved		Dissolve		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolve		Dissolve		Dissolve		Dissolve	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 001	0		0		0		22		26		0		0		0		0.038		11		13		23		19		26		32	
PCB 003																														
PCB 004	0.2		0.89		1.2		0		0		0		0.022		0		0.017		0.14		0.094		1.2		0.82		0.85		0.36	
PCB 004/010																														
PCB 005	0.14		0.3		0.51		0.33		0.87		0.19		0		0		0.01		0.19		0.27		0		0.48		0.56		0.27	
PCB 005/008																														
PCB 006	0.35		0.77		0.98		0.13		0		0.03		0.2		0.11		0.02		0.13		0.17		0		0		0		0	
PCB 007	0.13		0.16		0.22		0.065		0		0.051		0.02		0		0.01		0.38		0.34		0.78		0.89		0.9		0.75	
PCB 008	0.37		0.87		0		0.19		0		0		0.29		0.12		0.011		0		0		0		0		0		0	
PCB 012/013																														
PCB 016/032	0.54		0.97		1.4		0.2		0		0.094		0.31		0.14		0.014		0.24		0.22		0.64		0.8		0.92		0.82	
PCB 017	0.62		1.2		1.2		0.19		0.11		0.063		0.44		0.2		0.079		0.25		0.31		1.4		1.6		1.7		1.5	
PCB 018	1		2.3		2.8		0.27		0		0		0.77		0		0.047		0		0		1.7		1.9		2.5		2.1	
PCB 019	0.054		0.44		0		0.27		0		0		0		0		0.027		0		0		1.1		0		0.76		0	
PCB 021																														
PCB 022	0		0		0.62		0.12		0.057		0.022		0.075		0		0.0064		0.066		0.077		0.26		0		0.28		0.21	
PCB 024	0		0		3.4		0		0.087		0		1.4		0		0.32		0		0		0		0		0		0	
PCB 024/027																														
PCB 025	0		0		0.9		1.3		0		0		0.17		0.072		0.019		0		0		0		0.3		0.38		0.28	
PCB 026	0.25		0		1.1		0.11		0.015		0.022		0.27		0.11		0.063		0.14		0.13		0.38		0.48		0.6		0.46	
PCB 027	0		0		0		0.77		0		0		0		0		0.011		0		0		0		0		0		0.34	
PCB 028	0.76		0		2.2		0.26		0.085		0.07		0.62		0.22		0.15		0.31		0.35		1.1		1		1.3		0.92	
PCB 028/031																														
PCB 029	0		0		0.085		0		0		0		0		0		0.0092		0		0		0		0		0		0	
PCB 031	1.5		2.1		2.7		0.39		0.093		0.16		0.61		0.33		0.16		0.46		0		1.4		1.4		1.6		1.2	
PCB 033	0		0		1.2		0.31		0.096		0.063		0.28		0.13		0.012		0.21		0.26		0.59		0.7		0.89		0.6	
PCB 037/042	0.16		0.2		0.53		0.17		0		0.029		0.11		0.059		0.013		0.078		0.065		0.35		0.25		0.33		0.24	
PCB 040	0.045		0.12		0.23		0.041		0		0		0.0058		0		0.0051		0.039		0.024		0.15		0.14		0.19		0.12	
PCB 041/064/071																														
PCB 043																														
PCB 044	0.48		0.65		0.99		0.19		0.078		0		0.25		0.12		0.033		0		0		0.62		0.61		0.78		0.62	
PCB 045	0.23		0		0.36		0.17		0.19		0.091		0.091		0.034		0.0089		0.11		0.13		0.22		0.23		0.36		0.27	
PCB 046	0.057		0.14		0.1		0.17		0		0		0		0		0.018		0		0		0		0.12		0		0	
PCB 047	0.17		0.26		0.53		0.13		0.061		0		0.18		0.044		0.051		0.13		0.14		0.42		0.33		0.6		0.32	
PCB 048	0.44		0.63		0.22		0.16		0		0		0		0		0.038		0		0		0		0		0		0	
PCB 047/048																														
PCB 049	0.45		0.58		1.1		0.22		0.05		0		0.33		0		0.12		0		0		0		0.52		0.66		0	
PCB 051																														
PCB 052	0.45		0.68		1.1		0.18		0.092		0		0.43		0.18		0.18		0.26		0.28		1.1		1.1		1.2		0.98	
PCB 053	0		0		0		0		0		0		0		0		0.047		0		0		0		0		0		0	
PCB 056	0		0		0.84		0		0		0		0.11		0.028		0.028		0		0		0.43		0.22		0.32		0.17	
PCB 059	0.048		0.07		0.12		0.031		0.012		0		0.019		0.011		0.0066		0		0		0		0		0		0	
PCB 060/092	0		0		0		0		0		0		0.016		0.041		0.016		0		0		0		0		0		0	
PCB 056/060																														
PCB 063	0.0084		0.015		0		0		0		0		0.0079		0.0079		0.0079		0		0		0		0		0		0	
PCB 064/041	0.16		0		0.46		0.066		0		0		0.093		0.047		0.012		0.15		0.15		0		0		0		0	
PCB 066/095	0.55		0		0.91		0		0		0		0.23		0.096		0.054		0.13		0.16		0		0		0		0	
PCB 070	0.26		0		0.66		0.12		0.015		0		0.17		0.08		0.04		0.098		0.1		0		0		0		0	
PCB 070/076																														
PCB 071	0.16		0.22		0.42		0.058		0.017		0.019		0.12		0.053		0.033		0.061		0.058		0.22		0.24		0.25		0.19	
PCB 074	0.23		0.21		0.28		0.033		0		0.029		0.05		0.051		0.027		0.058		0.065		0		0		0		0	
PCB 076	0		0		0.051		0.038		0.035		0		0.0036		0.0036		0.0049		0.0079		0.0079		0		0		0		0	

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	SW060001		SW090001		SW0900 02		SW090003		SW09000 4		SW0900 05		SW090006		SW090007		SW090008		SW09000 9		SW09001 0		SW0900 11		SW0900 12		SW0900 13		SW0900 14	
Sample Date	7/26/00		7/27/00		9/28/00		11/30/00		1/17/01		3/27/01		4/8/01		4/13/01		4/17/01		4/30/01		5/1/01		5/11/01		5/22/01		5/24/01		5/31/01	
Fraction	Dissolved		Dissolved		Dissolve		Dissolved		Dissolved		Dissolve		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolve		Dissolve		Dissolve		Dissolve	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 077/110	0	U	0	U	0.33		0.035	LOQ	0.026	T	0.024		0.093	J	0.048	QJ	0.019	UJ	0.065		0.062		0.16		0.13		0.17		0.096	
PCB 081																														
PCB 082	0.017		0		0.12		0		0		0		0.011		0.011		0.011		0		0		0.013		0		0.022		0.019	
PCB 083																														
PCB 084	0.057		0.055		0.12		0.06		0		0		0.025		0.012		0.0064		0		0		0.12		0		0.14		0	
PCB 084/092																														
PCB 085	0.026		0.015		0.057		0.014		0		0		0.017		0.0076		0.0044		0.044		0.039		0.087		0		0.081		0	
PCB 087																														
PCB 087/081	0.042		0.03		0.12		0		0		0		0.039		0.02		0.014		0		0		0.064		0.028		0.044		0	
PCB 089																														
PCB 091	0.034		0		0.045		0		0		0		0.02		0.009		0.0078		0		0		0		0		0		0.064	
PCB 097	0.025		0.02		0.089		0.017		0.025		0.011		0.032		0.014		0.0091		0.017		0.018		0.047		0		0		0.046	
PCB 099	3.1		2.8		2.7		2.9		16		0		0.041		0.022		0.016		1.2		1.3		0		0		0		0	
PCB 100																														
PCB 101																														
PCB 101/090	0.11		0		0.26		0.082		0		0		0.079		0.036		0.032		0.012		0.027		0.16		0.1		0.15		0.12	
PCB 105	0.022		0.015		0.057		0		0		0		0.02		0.033		0.034		0		0		0		0		0		0	
PCB 105/132/153																														
PCB 107	0		0		0.039		0		0		0		0.011		0.011		0.011		0		0		0.015		0.016		0.013		0	
PCB 114	0.0066	LOQ	0	U	0.011		0.026	V	0	U	0	U	0.0061	UJ	0.0061	UJ	0.0061	UJ	0	U	0.013	Q	0	U	0	U	0	U	0	U
PCB 114/134																														
PCB 118	0.066		0.034		0.21		0.051	V	0.025		0	U	0.044	J	0.023	J	0.0075	QJ	0.019	Q	0.019	Q	0.044		0.058		0.044		0.043	
PCB 119	0	U	0	U	0.016		0	U	0.0063	T	0	U	0.0051	UJ	0.0051	UJ	0.0051	UJ	0	U	0	U	0	U	0	U	0	U	0	U
PCB 124/135/144/147																														
PCB 128	0	U	0	U	0.024		0	U	0.019		0	U	0.016	UJ	0.016	UJ	0.016	UJ	0	U	0	U	0	U	0	U	0	U	0	U
PCB 129/178																														
PCB 130																														
PCB 131																														
PCB 132/168	0.02	LOQ	0.026	LOQ	0.024		0	U	0	U	0	U	0.014	UJ	0.014	UJ	0.014	UJ	0.044	Q	0.081		0	U	0.055		0.033	Q	0.028	Q
PCB 135/144	0.032	LOQ	0.034	LOQ	0.03		0	U	0	U	0	U	0.022	UJ	0.022	UJ	0.022	UJ	0.032	Q	0.066	Q	0	U	0	U	0	U	0	U
PCB 136	0.016	LOQ	0	U	0.027		0	U	0	U	0	U	0.0095	QJ	0.006	UJ	0.006	UJ	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137	0	U	0	U	0	U	0	U	0	U	0	U	0.01	UJ	0.01	UJ	0.01	UJ	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137/176																														
PCB 138/158/163																														
PCB 138/163	0.068		0.045	LOQ	0.11		0.027	LOQ	0.1		0	U	0.033	QJ	0.02	QJ	0.017	UJ	0.025	Q	0.027	Q	0	U	0	U	0	U	0	U
PCB 141	0	U	0	U	0.013		0	U	0	U	0	U	0.0086	UJ	0.0086	UJ	0.0086	UJ	0	U	0	U	0	U	0	U	0	U	0	U
PCB 146	0	U	0	U	0.016		0.21	V	0	U	0	U	0.013	UJ	0.0073	UJ	0.0073	UJ	0	U	0	U	0	U	0	U	0	U	0	U
PCB 149																														
PCB 149/123	0	U	0	U	0.18		0	U	0.13		0	U	0.017	Q	0.015	Q	0	U	0.03	Q	0.02	Q	0.046		0.07		0.059		0.069	
PCB 151	0	U	0	U	0	U	0	U	0	U	0	U	0.018	Q	0	U	0	U	0	U	0	U	0.082		0	U	0	U	0	U
PCB 153/184	0.042	LOQ	0	U	0.26		0.14		0.15	B	0	U	0.034	Q	0.017	Q	0.015	Q	0.12		0.11		0	U	0	U	0	U	0	U
PCB 156/171	0	U	0	U	0.041		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 156/171/202																														
PCB 157/200																														
PCB 157	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 158	0	U	0	U	0.016		0.013	LOQ	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.013	Q	0	U	0	U	0	U
PCB 167	0.058		0	U	0	U	0	U	0	U	0.028		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 169	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 170	0	U	0	U	0.012		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.011	Q	0	U
PCB 172	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.025	Q	0	U	0	U
PCB 170/190																														
PCB 172/197																														
PCB 173																														
PCB 174	0	U	0	U	0.036		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U

Table H-10. Lower Fox River Historic Water Column Congener Data for OU4 (Dissolved)

Sample Name	SW060001		SW090001		SW0900 02		SW090003		SW09000 4		SW0900 05		SW090006		SW090007		SW090008		SW09000 9		SW09001 0		SW0900 11		SW0900 12		SW0900 13		SW0900 14	
Sample Date	7/26/00		7/27/00		9/28/00		11/30/00		1/17/01		3/27/01		4/8/01		4/13/01		4/17/01		4/30/01		5/1/01		5/11/01		5/22/01		5/24/01		5/31/01	
Fraction	Dissolved		Dissolved		Dissolve		Dissolved		Dissolved		Dissolve		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolve		Dissolve		Dissolve		Dissolve	
Congener (ng/l)	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 175																														
PCB 176	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.029	Q	0	U	0	U	0	U	0	U
PCB 178/126	0	U	0	U	0.043		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 180	0.019	LOQ	0	U	0.056		0	U	0.021	T	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 182/187	0.019	LOQ	0	U	0.04		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.027	Q	0	U	0	U	0	U	0	U
PCB 183	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 185	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 189	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 190	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.017	Q	0	U	0	U	0	U	0	U	0	U
PCB 191																														
PCB 193																														
PCB 194	0	U	0	U	0.022		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 195	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 195/208																														
PCB 196/203																														
PCB 197	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.032	Q	0.036	Q
PCB 198																														
PCB 199	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 201	0	U	0	U	0.035		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.022	Q	0.024	Q	0.032	Q	0.021	Q
PCB 202	0	U	0	U	0.015		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 203/196	0	U	0	U	0.032		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 205																														
PCB 206	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 207																														
PCB 208	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
Total Dissolved PCBs (by congener sum) =	**13.59**		**16.85**		**34.62**		**32.26**		**44.47**		**1.00**		**8.33**		**2.68**		**2.07**		**16.26**		**18.24**		**37.93**		**33.64**		**44.76**		**45.26**	
Total Congeners Analyzed (Diss) =	**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**		**91**	
Total Congeners Detected (Diss) =	**47**		**32**		**66**		**43**		**28**		**17**		**56**		**48**		**62**		**35**		**36**		**33**		**31**		**36**		**32**	
Reported TPCBs (Diss) =	**13.59**		**16.85**		**35.00**																									

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

NOTE WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database

All PCB and congener data reported in this database were obtained from the 1989-90 Fox River Mass Balance Study, 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook, and 2000-01 FRG Fox River Surface Water Survey.

Table H-11. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended and Dissolved, HRGC/MS Method)
Lower Fox River Baseline Monitoring Plan

Sample Name	SW060001		SW090001		SW090002		SW090003		SW090009		SW090010		SW090011		SW090012		SW090013		SW090014		SW060001			SW090002	
Sample Date	7/26/00		7/27/00		9/28/00		11/30/00		4/30/01		5/1/01		5/11/01		5/22/01		5/24/01		5/31/01		7/26/00			9/28/00	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Dissolved			Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Remark	Result	Remark
PCB 001	0	U	0.13105		0.1437		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0			0.25	
PCB 004	0.63838		0.95771		0.5748		0	U	0	U	0	U	0	U	0.64343		1.23609		0.50918		1.1			2.1	
PCB 005	3.04459		6.55275		3.73617		0.46654		6.38638		3.15339		12.2732		3.80697		6.92213		3.37478		0.92			1.8	
PCB 006	1.47319		2.6211		1.58069		0	U	2.07557		1.12239		4.21558		1.34048		2.5958		1.24334		0.57			1.5	
PCB 007	0	U	0.16634		0	U	0	U	0	U	0	U	0.27215		0	U	0	U	0	U	0			0	
PCB 008	3.04459		6.55275		2.39498		0.46654		6.38638		3.15339		12.2732		3.80697		6.92213		3.37478		0.92			1.2	
PCB 016/032	1.81693		2.46988		1.38909		0	U	1.41565		0.72688		2.2412		1.44772		2.57108		1.16045		0.98			1.1	
PCB 017	2.01336		2.46988		1.91598		0	U	1.38371		0.74826		2.02775		1.60858		2.84302		1.24334		1			1.6	
PCB 018	3.68297		4.3853		3.16137		0.313		1.64981		1.0155		2.77481		1.87668		3.46106		1.48017		2.2			3.2	
PCB 019	0.28973		0.25203		0.1916		0	U	0	U	0	U	0.27215		0	U	0	U	0	U	0.32			0.44	
PCB 022	1.86604		3.22597		1.91598		0.24804		2.02235		0.90861		3.09498		1.6622		2.96663		1.24334		0.33			0.37	
PCB 024	0.7857		1.00812		0.67059		0	U	0.51091		0.30465		0.80043		0.64343		1.08776		0.44997		0.41			0.53	
PCB 025	1.42408		1.56258		1.19749		0	U	0.90474		0.53447		1.49413		0.96515		1.85414		0.82889		0.27			0.47	
PCB 026	2.25889		3.02435		2.25128		0.25394		1.49015		0.90861		2.508		1.82306		3.33745		1.42096		0.57			1	
PCB 027	0.31428		0.39821		0.30177		0	U	0.2661		0	U	0.39488		0.23056		0	U	0	U	0.21			0.25	
PCB 028	8.83913		13.1055		9.10092		1.00396		5.85418		3.31374		9.60512		6.43432		10.8776		4.67732		1.4			2.1	
PCB 029	2.25889		3.02435		2.25128		0.25394		1.49015		0.90861		2.508		1.82306		3.33745		1.42096		0.57			1	
PCB 031	6.38381		9.07304		6.70594		0.76773		5.85418		3.09995		9.0715		5.36193		9.64153		4.38129		1.3			2.1	
PCB 033	2.11157		3.98206		2.20338		0.3189		2.82065		1.22929		4.0555		2.25201		3.9555		1.83541		0.37			0.34	
PCB 037/042	3.04459		4.78855		3.59247		0.37205		3.08675		1.54463		4.26894		3.21716		5.43881		2.42747		0			0.3	
PCB 040	2.25889		2.11704		1.72439		0	U	1.11762		0.74826		1.97439		1.55496		3.09023		1.24334		0.44			0.46	
PCB 044	3.68297		3.32678		2.87398		0.313		1.27728		0.85516		2.18783		1.82306		3.46106		1.42096		0.71			0.74	
PCB 045	0.7857		0.55446		0.5269		0	U	0.35125		0.24051		0.58698		0.51475		0.98888		0.39668		0.25			0.25	
PCB 046	0.26026		0.22179		0.19639		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0			0	
PCB 047	3.68297		3.32678		2.63448		0.313		1.27728		0.85516		2.18783		1.82306		3.46106		1.42096		0.71			0.74	
PCB 048	0.54017		0.55446		0.41194		0	U	0.29271		0	U	0.53362		0.3807		0.71693		0.29011		0			0	
PCB 049	2.89727		2.82272		2.34708		0.24213		1.54337		1.0155		2.77481		1.98391		3.83189		1.59858		0.47			0.6	
PCB 052	4.17403		3.73003		3.16137		0.34253		1.33049		0.85516		2.40128		1.87668		3.70828		1.48017		0.82			0.98	
PCB 053	0.73659		0.50406		0.47421		0	U	0.27674		0	U	0.46958		0.40751		0.82818		0.32564		0.2			0.23	
PCB 056	1.27676		1.61298		1.34119		0	U	1.01118		0.53447		1.60085		1.01877		1.85414		0.8881		0			0.12	
PCB 059	0.39776		0.39316		0.3353		0	U	0	U	0	U	0.35219		0.27882		0.5068		0	U	0			0	
PCB 060/092	0.67276		0.90226		0.67538		0	U	0.4364		0.22982		0.99787		0.39142		0.71693		0.30195		0			0	
PCB 063	0.20134		0.22179		0.20118		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0			0	
PCB 064/041	3.58476		3.478		2.77818		0	U	1.81591		1.22929		3.25507		2.46649		4.82077		1.95382		0.7			0.67	
PCB 066/095	3.53565		4.3853		3.20927		0.3189		2.22991		1.13308		3.57524		2.25201		4.05439		1.87685		0.24			0.3	
PCB 070	4.41956		6.04869		4.21517		0.47836		3.72539		1.97755		5.8698		3.37802		6.18047		2.78271		0.46			0.41	
PCB 071	2.25889		2.11704		1.72439		0	U	1.11762		0.74826		1.97439		1.55496		3.09023		1.24334		0.44			0.46	
PCB 074	4.41956		6.04869		4.21517		0.47836		3.72539		1.97755		5.8698		3.37802		6.18047		2.78271		0.46			0.41	
PCB 076	4.41956		6.04869		4.21517		0.47836		3.72539		1.97755		5.8698		3.37802		6.18047		2.78271		0.46			0.41	
PCB 077/110	1.71872		1.96582		1.67649		0.07087		1.33582		0.74292		2.02775		1.36729		2.39802		1.0894		0	U	U	0.1	
PCB 082	0.16696		0.17642		0.12454		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0			0	
PCB 084	0.34374		0.30243		0.2874		0	U	0	U	0	U	0.28262		0	U	0	U	0	U	0			0	
PCB 085	1.32587		1.36096		1.10169		0	U	0.90474		0.53447		1.38741		0.96515		1.73053		0.76969		0			0.1	
PCB 087/081	0.63838		0.65527		0.61389		0	U	0.42044		0.25655		0.64034		0.46113		0.81582		0.36708		0			0	
PCB 091	0.28973		0.25203		0.21076		0	U	0	U	0	U	0.23479		0	U	0	U	0	U	0			0	
PCB 097	0.63838		0.65527		0	U, ND	0	U	0.42044		0.25655		0.64034		0.46113		0.81582		0.36708		0			0	
PCB 099	0.63838		0.65527		0.5269		0	U	0.46833		0.28862		0.74707		0.64343		1.17429		0.52694		0			0	
PCB 101/090	1.76783		1.91542		1.34119		0	U	0.83023		0.52378		1.28068		0.80429		1.53276		0.71048		0			0	
PCB 105	0.33883		0.43853		0.27782		0.05256		0.20756		0.11758		0.31483		0.19839		0.33375		0.15986		0			0	

Table H-11. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended and Dissolved, HRGC/MS Method)
Lower Fox River Baseline Monitoring Plan

Sample Name	SW060001		SW090001		SW090002		SW090003		SW090009		SW090010		SW090011		SW090012		SW090013		SW090014		SW060001			SW090002	
Sample Date	7/26/00		7/27/00		9/28/00		11/30/00		4/30/01		5/1/01		5/11/01		5/22/01		5/24/01		5/31/01		7/26/00			9/28/00	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Dissolved			Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Remark	Result	Remark
PCB 107	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0			0	
PCB 114	0	U	0	U	0.01676		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 118	0.73659		0.95771		0.62269		0.11221		0.46833		0.26189		0.6937		0.43968		0.80346		0.34932		0.061			0	U, ND
PCB 119	0.63838		0.65527		0	U, ND	0	U	0.42044		0.25655		0.64034		0.46113		0.81582		0.36708		0	U	U	0	U, ND
PCB 128	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 132/168	0.3683		0.58471		0.39757		0	U	0	U	0	U	0.27748		0	U	0	U	0	U	0	U	U	0	U, ND
PCB 135/144	0.18169		0	U	0.12454		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 136	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 137	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 138/163	0.79552		0.88714		0.5748		0	U	0.4364		0	U	0.60832		0	U	0	U	0	U	0	U	U	0	U, ND
PCB 141	0.3683		0.41837		0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 146	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 149/123	0.33883		0.36796		0.25866		0	U	0.25013		0	U	0.35219		0.25737		0	U	0	U	0	U	U	0	U, ND
PCB 151	0.18169		0	U	0.12454		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 153/184	0.3683		0.41837		0.25387		0	U	0	U	0	U	0.27748		0	U	0	U	0	U	0	U	U	0	U, ND
PCB 156/171	0	U	0.09073		0.04167		0	U	0.03566		0	U	0.04749		0.02735		0.06057		0.02724		0	U	U	0	U, ND
PCB 157	0	U	0.09073		0.04167		0	U	0.03566		0	U	0.04749		0.02735		0.06057		0.02724		0	U	U	0	U, ND
PCB 158	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 167	0	U	0	U	0.01245		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 169	0.04763		0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 170	0	U	0.1361		0.08143		0	U	0.06386		0.04222		0.09072		0.05898		0.11372		0.04737		0	U	U	0	U, ND
PCB 172	0	U	0		0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 174	0	U	0	U	0.10538		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 176	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 177	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		0	U, ND
PCB 178/126	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 180	0.20134		0.29235		0.22992		0.04016		0.17563		0.10689		0.26681		0.16622		0.30902		0.13618		0	U	U	0	U, ND
PCB 182/187	0	U	0.18146		0.10538		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 183	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 185	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 189	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 190	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 194	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 195	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 197	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 199	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 201	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 202	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 203/196	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 206	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 208	0	U	0	U	0	U, ND	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
PCB 209	0	U	0	U	0	U, ND	0	U	0	U	0.21379	UJ	0	U	0	U	0	U	0	U	0	U	U	0	U, ND
Total Suspended PCBs (by congener sum) =	101.59		131.62		91.09		7.71		75.43		40.65		127.49		73.74		133.68		58.81						
Total Congeners Analyzed (Susp) =	91		91		91		91		91		91		91		91		91		91						
Total Congeners Detected (Susp) =	58		61		62		22		47		41		54		48		46		45						
Reported TPCBs (Susp) =	131.62		101.59		91.09																				
Total Dissolved PCBs (by congener sum) =																					19.86			28.63	
Total Congeners Analyzed (Diss) =																					91			91	
Total Congeners Detected (Diss) =																					31			35	
Reported TPCBs (Diss) =																					19.86			28.63	

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data, however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 2000-01 FRG Fox River Surface Water Survey.

Table H-11. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended and Dissolved, HRGC/MS Method)
Lower Fox River Baseline Monitoring Plan

Sample Name	SW090009		SW090010			SW090012		SW090013		SW090014	
Sample Date	4/30/01		5/1/01			5/22/01		5/24/01		5/31/01	
Fraction	Dissolved		Dissolved			Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0		0.22			0		0		0.23	
PCB 004	0.6		2.4			0		1.3		2.2	
PCB 005	0.73		1.4			2.7		1.6		2	
PCB 006	0.44		0.92			1.8		1		1.3	
PCB 007	0		0			0		0		0	
PCB 008	0.73		1.4			2.7		1.6		2	
PCB 016/032	0.34		0.29			1.35		0.99		1.31	
PCB 017	0.57		0.58			1.5		1.4		1.9	
PCB 018	0.69		0.66			2.1		1.7		2.3	
PCB 019	0		0.28			0.42		0.28		0.45	
PCB 022	0		0			0.4		0.29		0.35	
PCB 024	0		0			0.46		0.36		0.46	
PCB 025	0		0			0.4		0.38		0.47	
PCB 026	0.33		0.31			0.85		0.81		0.99	
PCB 027	0		0			0.26		0.21		0.24	
PCB 028	0.61		0.62			1.5		1.4		1.6	
PCB 029	0.33		0.31			0.85		0.81		0.99	
PCB 031	0.86		0.83			2		1.7		2.1	
PCB 033	0		0			0.36		0.29		0.36	
PCB 037/042	0		0			0.27		0.31		0.36	
PCB 040	0.25		0.21			0.59		0.58		0.71	
PCB 044	0.38		0.32			0.71		0.72		0.88	
PCB 045	0		0			0.34		0.32		0.41	
PCB 046	0		0			0		0		0	
PCB 047	0.38		0.32			0.71		0.72		0.88	
PCB 048	0		0			0		0		0	
PCB 049	0.37		0.27			0.8		0.79		0.92	
PCB 052	0.47		0.39			0.86		0.94		1.1	
PCB 053	0		0			0.29		0.28		0.36	
PCB 056	0		0			0		0		0	
PCB 059	0		0			0		0		0	
PCB 060/092	0		0			0		0		0	
PCB 063	0		0			0		0		0	
PCB 064/041	0.25		0.21			0.91		0.88		1.03	
PCB 066/095	0		0			0.21		0		0.44	
PCB 070	0.26		0.21			0.55		0.5		0.6	
PCB 071	0.25		0.21			0.59		0.58		0.71	
PCB 074	0.26		0.21			0.55		0.5		0.6	
PCB 076	0.26		0.21			0.55		0.5		0.6	
PCB 077/110	0	U	0	U	U	0.02		0	U	0	U
PCB 082	0		0			0		0		0	
PCB 084	0		0			0		0		0	
PCB 085	0		0			0		0		0	
PCB 087/081	0		0			0		0		0	
PCB 091	0		0			0		0		0	
PCB 097	0		0			0		0		0	
PCB 099	0		0			0		0		0	
PCB 101/090	0		0			0		0		0	
PCB 105	0		0			0		0		0	

Table H-11. Lower Fox River Historic Water Column Congener Data for OU4 (Suspended and Dissolved, HRGC/MS Method)
Lower Fox River Baseline Monitoring Plan

Sample Name	SW090009		SW090010			SW090012		SW090013		SW090014	
Sample Date	4/30/01		5/1/01			5/22/01		5/24/01		5/31/01	
Fraction	Dissolved		Dissolved			Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 107	0		0			0		0		0	
PCB 114	0	U	0	U	U	0	U	0	U	0	U
PCB 118	0	U	0.024			0.047		0.041		0.05	
PCB 119	0	U	0	U	U	0	U	0	U	0	U
PCB 128	0	U	0	U	U	0	U	0	U	0	U
PCB 132/168	0	U	0	U	U	0	U	0	U	0	U
PCB 135/144	0	U	0	U	U	0	U	0	U	0	U
PCB 136	0	U	0	U	U	0	U	0	U	0	U
PCB 137	0	U	0	U	U	0	U	0	U	0	U
PCB 138/163	0	U	0	U	U	0	U	0	U	0	U
PCB 141	0	U	0	U	U	0	U	0	U	0	U
PCB 146	0	U	0	U	U	0	U	0	U	0	U
PCB 149/123	0	U	0	U	U	0	U	0	U	0	U
PCB 151	0	U	0	U	U	0	U	0	U	0	U
PCB 153/184	0	U	0	U	U	0	U	0	U	0	U
PCB 156/171	0	U	0	U	U	0	U	0	U	0	U
PCB 157	0	U	0	U	U	0	U	0	U	0	U
PCB 158	0	U	0	U	U	0	U	0	U	0	U
PCB 167	0	U	0	U	U	0	U	0	U	0	U
PCB 169	0	U	0	U	U	0	U	0	U	0	U
PCB 170	0	U	0	U	U	0	U	0	U	0	U
PCB 172	0	U	0	U	U	0	U	0	U	0	U
PCB 174	0	U	0	U	U	0	U	0	U	0	U
PCB 176	0	U	0	U	U	0	U	0	U	0	U
PCB 177	0	U	0	U	U	0	U	0	U	0	U
PCB 178/126	0	U	0	U	U	0	U	0	U	0	U
PCB 180	0	U	0	U	U	0	U	0	U	0	U
PCB 182/187	0	U	0	U	U	0	U	0	U	0	U
PCB 183	0	U	0	U	U	0	U	0	U	0	U
PCB 185	0	U	0	U	U	0	U	0	U	0	U
PCB 189	0	U	0	U	U	0	U	0	U	0	U
PCB 190	0	U	0	U	U	0	U	0	U	0	U
PCB 194	0	U	0	U	U	0	U	0	U	0	U
PCB 195	0	U	0	U	U	0	U	0	U	0	U
PCB 197	0	U	0	U	U	0	U	0	U	0	U
PCB 199	0	U	0	U	U	0	U	0	U	0	U
PCB 201	0	U	0	U	U	0	U	0	U	0	U
PCB 202	0	U	0	U	U	0	U	0	U	0	U
PCB 203/196	0	U	0	U	U	0	U	0	U	0	U
PCB 206	0	U	0	U	U	0	U	0	U	0	U
PCB 208	0	U	0	U	U	0	U	0	U	0	U
PCB 209	0	U	0	U	U	0	U	0	U	0	U
Total Suspended PCBs (by congener sum) =											
Total Congeners Analyzed (Susp) =											
Total Congeners Detected (Susp) =											
Reported TPCBs (Susp) =											
Total Dissolved PCBs (by congener sum) =	9.36		12.80			27.65		23.78		30.90	
Total Congeners Analyzed (Diss) =	91		91			91		91		91	
Total Congeners Detected (Diss) =	21		24			32		31		33	
Reported TPCBs (Diss) =											

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
NOTE: WDNR May 1995 Report indicates that 60 congeners were analyzed for these data; however, only a subset of the congener results are reported in the WDNR website database
All PCB and congener data reported in this database were obtained from the 2000-01 FRG Fox River Surface Water Survey.

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI01		89GH5FI02		89GH5FI04		89GH5FI05		89GH5FI06		89GH5FI07		89GH5FI08		89GH5FI09		89GH5FI10		89GH5FI11		89GH5FI12			89GH5FI14	
Sample Date	1/19/89		4/14/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/6/89		6/13/89			6/28/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended			Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Remark	Result	Remark
PCB 001	0.1032				5.3331		0	U	0	U	4.5656		0.0479		0.0071		0	U	0	U	0	U	U	0	U
PCB 003	0.2384				0.0659		0.0365		0	U	0	U	0	U	0.0119		0	U	0	U	0	U	U	0	U
PCB 004/010	0.0584				0.0736		0.1465		0.1784		0.0733		0.0751		0.0725		0.0569		0.0641		0.0679			0.1129	
PCB 005/008	0.4421				1.9221		3.5125		2.4846		1.294		1.5244		1.8832		2.1507		1.8935		1.8297			3.5712	
PCB 006	0.0456				0.3104		0.6264		0.4559		0.2184		0.2886		0.3276		0.3514		0.2781		0.296			0.5236	
PCB 007	0.0445				0.038		0.0554		0.049		0.0372		0.0228		0.031		0.0303		0.0283		0.0348			0.0562	
PCB 012/013	0	U			0.0073		0	U	0	U	0.0072		0.0222		0.0156		0	U	0	U	0	U	U	0	U
PCB 016/032	0.3265				1.9195		3.7964		2.8306		1.9182		1.7318		1.1116		1.4885		1.4737		1.6749			2.6805	
PCB 017	0.1911				1.2659		2.2451		1.8067		1.4745		1.1298		0.7891		0.982		0.9743		0.9495			1.6499	
PCB 018	0.2048				2.0063		3.3733		4.1258		2.168		2.236		1.2545		1.4341		1.4963		1.5719			2.7945	
PCB 019	0.048				0.1091		0.1739		0.1606		0.1075		0.1033		0.0572		0.0593		0.07		0.0885			0.1719	
PCB 021	0.0323				0.0074		0.0055		0	U	0.0057		0	U	0	U	0.0062		0.0141		0.0327			0.073	
PCB 022	0.1723				1.8506		3.0167		2.5579		1.924		1.5624		1.4512		1.9028		1.924		1.544			3.1881	
PCB 024/027	0.0355				0.2082		0.2353		0.2266		0.2125		0.1634		0.1146		0.1668		0.1609		0.1545			0.3158	
PCB 025	0.0951				0.9162		1.4783		1.1851		0.998		0.8273		0.5561		0.7124		0.6308		0.8037			1.3362	
PCB 026	0.48				1.5065		1.9606		1.6443		1.6058		1.1462		0.8299		1.1233		1.0178		1.1572			2.0636	
PCB 028/031	8.8274				9.1171		13.0053		11.4346		9.7069		9.6069		6.8465		7.9993		7.5884		7.5492			14.2471	
PCB 029	0.0655				0.0333		0.0494		0.0582		0.0396		0.0298		0.0347		0.0695		0.0435		0.0514			0.0778	
PCB 033	0.4483				1.6264		3.8794		3.5841		1.2573		2.4584		1.4496		2.008		1.8772		1.7187			3.0007	
PCB 037/042	0.1715				1.7518		3.2088		2.181		1.668		1.3039		0.8474		1.2087		1.1648		1.2519			2.2052	
PCB 040	0.0471				0.6705		1.0541		0.8458		0.723		0.5906		0.377		0.6039		0.568		0.5112			0.9399	
PCB 041/064/071	0.2326				7.3339		0	U	0	U	9.2344		2.5131		1.6452		2.0955		2.2289		2.0738			3.9575	
PCB 043	0.0102				0.211		0.7034		0.4488		0.2278		0.3321		0.1983		0.1678		0.3721		0.2289		U	0.3369	
PCB 044	0.2484				3.1182		2.839		4.1904		3.0129		2.6755		1.5629		2.0871		2.2233		2.1782			4.0234	
PCB 045	0.0733				0.4946		0.8325		0.6452		0.5511		0.4341		0.2745		0.4033		0.3581		0.4203			0.694	
PCB 046	0.0132				0.279		0.5347		0.3757		0.2942		0.25		0.1558		0.1745		0.1767		0.2431			0.39	
PCB 047/048	0.134				2.0091		2.8392		3.0637		2.2767		2.0019		1.168		1.2832		1.6685		1.4674			2.5724	
PCB 049	0.1791				1.2124		3.2977		2.8367		1.3193		1.9722		1.4726		1.5573		1.7561		1.7496			3.1193	
PCB 051	0.0113				0.1243		0.2212		0.1749		0.1498		0.1244		0.0743		0.068		0.0762		0.107			0.1994	
PCB 052	0.2638				2.4434		3.6198		3.1387		2.6881		2.1344		1.5051		1.4179		1.7059		1.8816			3.2907	
PCB 053	0	U			0.4288		0.5216		0.4293		0.478		0.2527		0.2903		0.2697		0.252		0.392			0.7014	
PCB 056/060	0.1566				2.1306		3.066		2.5449		2.2569		1.5789		1.2448		2.108		1.8968		1.7082			3.4513	
PCB 063	0.0237				0.231		0.3193		0.3631		0.2817		0.3259		0.2382		0.1888		0.2009		0.2031			0.3731	
PCB 066/095	0.4205				4.0881		5.8542		5.3393		4.2508		3.3757		2.4082		3.8195		4.2728		3.8135			6.6228	
PCB 070/076	0.418				3.061		4.3357		3.9837		3.1645		2.2415		1.781		4.0111		5.283		2.7975			5.2147	
PCB 074	0.1084				1.0933		2.4833		1.5093		1.2264		0.926		0.6985		0.9823		1.0342		0.9689			1.794	
PCB 077/110	0.1237				1.2488		1.6901		1.3387		1.2346		0.9712		0.7249		1.0136		1.2046		1.2182			1.9037	
PCB 081	0.0048				0.0012		0.0407		0.0322		0.0221		0.0238		0.0165		0.0173		0.0364		0.0293			0.0446	
PCB 082	0.0255				0.2404		0.2695		0.2413		0.1902		0.1838		0.1207		0.119		0.1357		0.1573			0.2381	
PCB 083	0.0048				0.099		0	U	0.128		0.1009		0.0811		0.0544		0.0719		0.0932		0.0703			0.1185	
PCB 084/092	0.0725				0.8404		1.1461		1.1631		0.837		0.7179		0.4887		0.7173		0.6517		0.7255			1.1402	
PCB 085	0.0234				0.2864		0.4035		0.3265		0.2285		0.2205		0.1403		0.2028		0.219		0.2337			0.4432	
PCB 087	0.0379				0.4275		0.5876		0.4876		0.406		0.3206		0.2225		0.303		0.3297		0.389			0.6479	
PCB 089	0.0059				0.0762		0.0595		0.0471		0.0403		0.0325		0.0172		0.059		0.0353		0.0313			0.0434	
PCB 091	0.0078				0.3192		0.5114		0.396		0.3261		0.2443		0.1775		0.2007		0.1799		0.1996			0.3591	
PCB 097	0.0378				0.326		0.5993		0.4363		0.3411		0.2832		0.2065		0.2732		0.3222		0.3212			0.5345	
PCB 099	0.0469				0.4573		0.7009		0.5437		0.4729		0.3509		0.2594		0.343		0.4073		0.3887			0.6617	
PCB 100	0.0122				0.1405		0.2567		0.1743		0.1374		0.1231		0.0956		0.1082		0.1183		0.0784			0.2372	
PCB 101	0.0854				0.7189		1.2065		0.8713		0.7498		0.554		0.4199		0.6266		0.7254		0.6883			1.0523	

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI01		89GH5FI02		89GH5FI04		89GH5FI05		89GH5FI06		89GH5FI07		89GH5FI08		89GH5FI09		89GH5FI10		89GH5FI11		89GH5FI12			89GH5FI14	
Sample Date	1/19/89		4/14/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/6/89		6/13/89			6/28/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended			Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Remark	Result	Remark
PCB 105/132/153	0.1099				1.3528		1.4241		1.2476		0.9237		0.9054		0.7249		0.7868		0.9685		1.0301			1.3737	
PCB 107	0.0123				0.1557		0.0875		0.0803		0.0974		0.0668		0.0529		0.0797		0.0783		0.0768			0.133	
PCB 114/134	0.026				0.2574		0.3352		0.2819		0.104		0.1368		0.1719		0.0665		0.0836		0.1777			0.415	
PCB 118	0.0569				0.7783		0.8452		0.747		0.5598		0.5421		0.4166		0.4699		0.5677		0.6522			0.8903	
PCB 119	0.0112				0.1061		0.0728		0.0684		0.0854		0.049		0.0446		0.1061		0.0738		0.0793			0.1236	
PCB 124/135/144/147	0.0158				0.1365		0.1372		0.1236		0.0909		0.0891		0.072		0.0706		0.0858		0.087			0.1019	
PCB 128	0.0124				0.1819		0.1484		0.1251		0.1077		0.0917		0.0823		0.0653		0.1172		0.1259			0.144	
PCB 129/178	0.0061				0.0587		0.0646		0.0561		0.0429		0.044		0.0378		0.0332		0.0424		0.0436			0.0639	
PCB 130	0.0032				0.0316		0.1624		0.1366		0.055		0.0983		0.0894		0.0565		0.0675		0.0364			0.0434	
PCB 131	0.0038				0.5596		0.0763		0.0702		0.0209		0.0292		0.0435		0.0052		0.0061		0.0341			0.1998	
PCB 136	0.0071				0.2061		0	U	0	U	0.0824		0	U	0	U	0	U	0.2022		0	U	U	0	U
PCB 137/176	0.0062				0.0325		0.0303		0.027		0.0141		0.0172		0.0149		0.0127		0.0233		0.0228			0.0289	
PCB 138/158/163	0.1006				0.9239		0.8373		0.7153		0.5512		0.4956		0.4744		0.4444		0.5763		0.7194			0.8977	
PCB 141	0.0226				0.133		0	U	0	U	0.1033		0	U	0	U	0.0593		0.0775		0.0916			0.1195	
PCB 146	0.0336				0.6289		0.6575		0.4809		0.2983		0.2741		0.3172		0.2685		0.3132		0.36			0.6883	
PCB 149	0.0574				0.486		0.4933		0.4402		0.3222		0.3136		0.2501		0.224		0.2993		0.3623			0.429	
PCB 151	0.0236				0.1726		0.1732		0.1504		0.123		0.1112		0.0941		0.0775		0.1008		0.1125			0.1432	
PCB 156/171/202	0.0116				0	U	0.1506		0.1284		0.09		0.0948		0.0887		0.0747		0.0996		0	U		0.1411	
PCB 157/200	0.0024				0.0206		0.0316		0.0261		0.0149		0.0159		0.0146		0.0308		0	U	0	U	U	0	U
PCB 167	0.0035				0.0554		0.045		0.035		0.0207		0.0268		0.0231		0.0277		0.0451		0.0343			0.0549	
PCB 169																									
PCB 170/190	0.0612				2.0225		0.7892		0.561		0.1681		0.2927		0.3684		0.1606		0.2092		0.234			0.5639	
PCB 172/197	0.0034				0.0571		0.0498		0.036		0.0239		0.0252		0.0236		0.0315		0.0336		0.0268			0.0435	
PCB 173	0	U			0.003		0.0031		0.0026		0.0011		0.0013		0.0014		0	U	0	U	0	U	U	0	U
PCB 174	0.0122				0.1414		0.1748		0.1448		0.0966		0.1075		0.1006		0.1036		0.1182		0.1209			0.1635	
PCB 175	0.0014				0	U	0.0073		0.0078		0	U	0.0041		0.0039		0	U	0.0003		0.0002			0	U
PCB 177	0.009				0.0649		0.1233		0.1026		0.0445		0.0775		0.0735		0.0795		0.0885		0.0801			0.1391	
PCB 180	0.0296				0.3539		0.3558		0.31		0.24		0.2248		0.2421		0.2559		0.3221		0.2789			0.385	
PCB 182/187	0.0183				0.2182		0.2474		0.2067		0.1582		0.1485		0.1416		0.1261		0.1696		0.161			0.2405	
PCB 183	0.0064				0.1286		0.1254		0.1077		0.0853		0.0766		0.0726		0.0685		0.0908		0.0897			0.1238	
PCB 185	0.0068				0.0243		0.0334		0.023		0.011		0.0191		0.0187		0.0131		0.4474		0.0204			0.0538	
PCB 189	0.0003				0.0129		0.0071		0.012		0.008		0.0065		0.0056		0.0037		0.008		0.0059			0.0084	
PCB 191	0	U			0.022		0	U	0	U	0.0226		0	U	0	U	0	U	0	U	0	U	U	0	U
PCB 193	0.0035				0.0253		0.0196		0.0212		0.0234		0.0169		0.0167		0.0174		0.0212		0.0163			0.0221	
PCB 194	0.0073				0.0756		0.0896		0.0699		0.0466		0.046		0.0544		0.1048		0.09		0.0667			0.0987	
PCB 195/208	0.0134				0.1742		0.1879		0.1366		0.1095		0.0887		0.1023		0.1232		0.1476		0.1316			0.1942	
PCB 196/203	0.0122				0.1865		0.2277		0.1815		0.1342		0.1407		0.1408		0.158		0.206		0.1609			0.2463	
PCB 198	0.0023				0.2161		0.1157		0.0703		0.0035		0.0273		0.0446		0.0036		0	U	0	U		0	U
PCB 199	0.0005				0.015		0.0177		0.0158		0.0121		0.014		0.0111		0.0145		0.0187		0.0099			0.0162	
PCB 201	0.0139				0.2093		0.2426		0.1864		0.1156		0.1228		0.1401		0.1287		0.1642		0.1478			0.2158	
PCB 205	0.0013				0.0469		0.0491		0.0306		0.0012		0.004		0.0056		0	U	0.0378		0.0282			0.0382	
PCB 206	0.0085				0.1142		0.133		0.1059		0.0771		0.0685		0.0812		0.1105		0.1278		0.1118			0.1562	
PCB 207	0.0018				0.0143		0.0185		0.0108		0.0094		0.0072		0.0077		0.0254		0	U	0.0096		U	0.0239	
PCB 209	0.0039				0.2299		0.1598		0.0848		0.0253		0.0559		0.0682		0.0628		0.0778		0.0957			0.1647	
Total Suspended PCBs (by congener sum) =	**7.60**				**75.81**		**89.75**		**78.42**		**71.63**		**55.09**		**40.47**		**51.59**		**55.44**		**51.89**			**92.07**	
Total Congeners Analyzed (Susp) =	**92**				**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**			**92**	
Total Congeners Detected (Susp) =	**88**				**90**		**85**		**84**		**90**		**87**		**88**		**84**		**84**		**83**			**83**	
Reported TPCBs (Susp) =																									

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI15		89GH5FI16		89GH5FI17		89GH5FI18		89GH5FI19		89GH5FI20		89GH5FI21		89GH5FI22		89GH5FI23		89GH5FI24		89GH5FI25		89GH5FI26		89GH5FI27	
Sample Date	7/6/89		7/12/89		7/17/89		7/17/89		7/18/89		7/18/89		7/19/89		7/19/89		7/20/89		7/20/89		7/21/89		7/21/89		7/22/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 003	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 004/010	0.0401		0.0566		0.0589		0.0593		0.0451		0.0402		0.1631		0.1416		0.1047		0.0766		0.0626		0.0475		0.0925	
PCB 005/008	1.0069		1.9103		1.4267		1.7066		1.3812		1.1523		4.6863		4.4686		3.5325		2.1676		1.6859		1.3047		2.2724	
PCB 006	0.187		0.3352		0.2363		0.3732		0.2493		0.2325		0.8029		0.6818		0.707		0.3329		0.2732		0.1906		0.3704	
PCB 007	0.154		0.0308		0.0367		0.0418		0.02		0.016		0.083		0.0838		0.0534		0.0434		0.023		0.0227		0.0416	
PCB 012/013	0.0044		0.0262		0	U	0	U	0.0191		0	U	0	U	0.0909		0	U	0	U	0	U	0	U	0	U
PCB 016/032	1.3526		1.6811		1.1432		1.9005		1.1808		1.0555		3.809		3.4185		3.1423		1.652		1.3863		1.0648		1.8252	
PCB 017	0.9525		1.1351		0.8098		1.3111		0.8887		0.8727		2.4864		2.3452		2.1464		1.3423		1.16		0.7864		1.2639	
PCB 018	1.4159		1.6858		1.2451		1.9059		1.2777		1.2598		3.7616		3.4922		3.0707		2.0161		1.7247		1.203		1.9508	
PCB 019	0.095		0.0981		0.0608		0.0876		0.0781		0.0568		0.2158		0.1591		0.1454		0.1178		0.0873		0.069		0.1132	
PCB 021	0	U	0	U	0.0189		0.0205		0	U	0	U	0.0595		0	U	0	U	0.0069		0.0454		0.0686		0.0568	
PCB 022	1.3927		2.4915		1.6599		2.7615		1.7741		1.6048		4.6715		5.1035		4.3642		2.2767		1.6229		1.4092		2.2062	
PCB 024/027	0.1536		0.2056		0.1409		0.2269		0.157		0.1547		0.4205		0.4349		0.3783		0.2428		0.197		0.1409		0.2116	
PCB 025	0.7284		1.1696		0.6357		1.3725		0.7173		0.8639		2.0667		2.5359		2.1952		1.0733		0.8509		0.6663		0.9568	
PCB 026	1.0818		1.5508		0.9412		1.6792		1.0321		1.0749		2.9646		3.3444		3.0126		1.5267		1.2537		0.9234		1.441	
PCB 028/031	8.3185		9.3422		6.1598		10.1711		6.7687		6.4498		19.5061		20.3236		17.1518		9.9441		8.3684		6.1716		9.7237	
PCB 029	0.0589		0.0664		0.0444		0.0531		0.0483		0.0453		0.2931		0.0794		0.1269		0.0895		0.0546		0.0415		0.0457	
PCB 033	1.2513		2.1894		1.4497		2.4482		1.5297		1.3635		4.7129		4.9468		4.1426		2.0333		1.5544		1.2757		2.197	
PCB 037/042	1.8896		1.4507		1.075		1.7992		1.1154		1.0825		2.9966		2.7164		2.623		1.6384		1.7574		0.9661		1.6074	
PCB 040	0.5755		0.7059		0.558		0.9201		0.5717		0.4657		1.3661		1.3391		1.416		0.7054		0.6425		0.4552		0.703	
PCB 041/064/071	2.7093		3.1275		0	U	0	U	2.3791		1.8684		5.6896		5.8935		5.5461		2.9009		2.8669		3.0492		4.4688	
PCB 043	0.2198		0.1716		0.1601		0.278		0.1632		0.15		0.4892		0.38		0.354		0.2643		0.2267		0.184		0.2807	
PCB 044	2.6202		2.6554		2.0426		3.2147		2.0378		1.9842		5.3499		4.9694		4.8244		2.9448		2.8039		1.932		3.0031	
PCB 045	0.391		0.4801		0.3696		0.5915		0.3683		0.3617		1.0039		0.8859		0.8632		0.5397		0.4775		0.3992		0.6424	
PCB 046	0.1857		0.2188		0.1745		0.2807		0.1649		0.1639		0.5399		0.4308		0.4201		0.3009		0.2638		0.1978		0.3152	
PCB 047/048	1.6356		1.6923		1.2786		2.1066		1.2773		1.307		3.5534		3.3246		3.1297		1.9686		1.725		1.3251		2.0161	
PCB 049	1.9044		2.0433		1.5436		2.5053		1.5773		1.5842		4.2918		3.9914		3.7413		2.3849		2.1874		1.6379		2.4549	
PCB 051	0.0913		0.169		0.1047		0.2047		0.1099		0.073		0.2852		0.2716		0.2402		0.1538		0.0723		0.1052		0.1508	
PCB 052	2.0534		1.9323		1.4844		2.3668		1.488		1.5095		4.3273		3.7444		3.5718		2.4134		2.2193		1.6621		2.5106	
PCB 053	0.2875		0.3932		0.3343		0.5004		0.285		0.2284		1.1376		0.8201		0.7324		0.4904		0.3426		0.4708		0.7434	
PCB 056/060	1.7309		2.5523		1.8307		2.885		1.8743		1.675		4.7378		4.6743		4.4346		2.3373		2.2072		1.5892		2.404	
PCB 063	0.2449		0.3446		0.1906		0.2215		0.1485		0.1813		0.4899		0.5949		0.6169		0.2705		0.2623		0.102		0.3559	
PCB 066/095	3.0148		4.5571		3.2623		5.2971		4.084		3.1118		8.9731		9.5835		7.315		4.8261		4.8078		3.4426		5.1921	
PCB 070/076	2.9153		3.2162		2.3791		3.8836		2.7956		2.1114		6.3876		6.6255		5.514		4.0372		3.5775		2.627		3.7733	
PCB 074	1.1146		1.449		0.9391		1.4838		1.0147		0.8733		2.4592		2.5692		2.5169		1.4105		1.2483		0.8137		1.4539	
PCB 077/110	1.261		1.4281		1.0107		1.7368		1.098		1.0155		2.6624		2.7508		2.5064		1.4435		1.3882		1.0061		1.4698	
PCB 081	0.0449		0.0369		0.0274		0.0266		0.0279		0.0262		0.0533		0.0711		0.0738		0.0351		0.0372		0.0274		0.039	
PCB 082	0.1206		0.1896		0.1779		0.1556		0.1625		0.142		0.3683		0.2561		0.2243		0.1696		0.1426		0.1308		0.2079	
PCB 083	0.1219		0.0971		0.054		0.1114		0.0634		0.0637		0.1353		0.1721		0.173		0.079		0.0941		0.0537		0.0947	
PCB 084/092	0.7067		0.748		0.5607		0.8772		0.5609		0.5091		1.4424		1.3454		1.3475		0.7971		0.754		0.5905		0.807	
PCB 085	0.2706		0.3168		0.2423		0.407		0.2454		0.2238		0.5878		0.5738		0.5845		0.3092		0.2969		0.2175		0.3338	
PCB 087	0.3838		0.4571		0.3431		0.5576		0.3416		0.3111		0.85		0.8277		0.8269		0.4317		0.412		0.301		0.4605	
PCB 089	0.0393		0.0279		0.029		0.0528		0.027		0.0316		0.1176		0.069		0.0712		0.0716		0.0747		0.0659		0.0707	
PCB 091	0.36		0.2386		0.1649		0.2532		0.2866		0.1711		0.4831		0.647		0.4099		0.2213		0.2788		0.1678		0.2176	
PCB 097	0.3378		0.3677		0.2791		0.4595		0.2815		0.2605		0.7173		0.6781		0.6771		0.3799		0.3608		0.2637		0.4019	
PCB 099	0.4774		0.4771		0.3586		0.6149		0.3699		0.3501		0.865		0.8914		0.8729		0.4724		0.4579		0.3435		0.5607	
PCB 100	0.146		0.1934		0.0865		0.1564		0.1355		0.0927		0.2782		0.3528		0.3367		0.1414		0.1271		0.0669		0.1191	
PCB 101	0.7562		0.7431		0.6018		0.9859		0.6051		0.5654		1.4273		1.4621		1.4244		0.8076		0.7834		0.5454		0.8478	

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI15		89GH5FI16		89GH5FI17		89GH5FI18		89GH5FI19		89GH5FI20		89GH5FI21		89GH5FI22		89GH5FI23		89GH5FI24		89GH5FI25		89GH5FI26		89GH5FI27	
Sample Date	7/6/89		7/12/89		7/17/89		7/17/89		7/18/89		7/18/89		7/19/89		7/19/89		7/20/89		7/20/89		7/21/89		7/21/89		7/22/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 105/132/153	0.7365		0.9987		1.1839		0.8101		0.8455		0.7203		1.8803		1.3421		1.1709		0.9418		0.7734		0.7035		0.982	
PCB 107	0.082		0.1182		0.1044		0.1048		0.1015		0.0936		0.2402		0.1752		0.1377		0.1018		0.073		0.0719		0.1139	
PCB 114/134	0	U	0.0683		0.0808		0.1153		0.09		0.0854		0.5147		0.1623		0.133		0.1605		1.2849		0.0534		0.1076	
PCB 118	0.4751		0.6956		0.6338		0.604		0.5929		0.5243		1.3216		1.0186		0.8221		0.6165		0.5275		0.458		0.715	
PCB 119	0.077		0.1128		0.0815		0.1872		0.0828		0.0822		0.1438		0.2308		0.2163		0.089		0.0847		0.0669		0.097	
PCB 124/135/144/147	0.0635		0.0982		0.118		0.0691		0.0822		0.0766		0.1452		0.1358		0.1164		0.0823		0.0618		0.0532		0.0821	
PCB 128	0.0771		0.0859		0.0965		0.0788		0.0665		0.0626		0.2077		0.1125		0.1042		0.0909		0.077		0.0599		0.092	
PCB 129/178	0.0291		0.0512		0.0934		0.0435		0.042		0.0357		0.0925		0.0684		0.0585		0.0491		0.0378		0.0342		0.0464	
PCB 130	0.0517		0.0691		0.0651		0.0651		0.0511		0.0576		0.3027		0.085		0.0789		0.1492		0.1148		0.1067		0.3313	
PCB 131	0	U	0.0085		0.0091		0.0258		0.0188		0.0183		0.0833		0.0321		0.0273		0.023	U	0	U	0.0112		0.0145	
PCB 136	0.1882		0	U	0.1502		0.239		0	U	0.1349		0.3454		0	U	0.3486		0.1925		0.1879		0.1434		0.197	
PCB 137/176	0.0135		0.0176		0.0329		0.0145		0.0134		0.0117		0.063		0.0225		0.0204		0.0323		0.0195		0.017		0	U
PCB 138/158/163	0.4242		0.6275		0.6845		0.5417		0.501		0.4507		1.1812		0.8402		0.7523		0.5803		0.4863		0.4439		0.6285	
PCB 141	0.055		0	U	0.1602		0.0529		0	U	0.0504		0.1549		0.1104		0.1165		0.0747		0.064		0.0572		0.0767	
PCB 146	1.7719		0.2706		0.2682		0.4977		0.3842		0.3554		0.7436		0.6111		0.4965		0.3136		1.1017		0.2192		0.3162	
PCB 149	0.2481		0.3119		0.3944		0.2646		0.2478		0.2311		0.5881		0.4255		0.3608		0.2912		0.2402		0.2303		0.3193	
PCB 151	0.0751		0.1054		0.1734		0.0925		0.0938		0.0873		0.1931		0.1559		0.1336		0.0987		0.0843		0.0757		0.1059	
PCB 156/171/202	0.0412		0.1056		0.1292		0.0801		0.0763		0.063		0.2106		0.1504		0.1257		0.0854		0.0688		0.0612		0.0882	
PCB 157/200	0	U	0	U	0.0228		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 167	0.0264		0.026		0.04		0.0313		0.0223		0.0224		0.0191		0.035		0.0383		0.0481		0.0267		0.0328		0.0323	
PCB 169																										
PCB 170/190	0	U	0.2331		0.354		0.2348		0.1921		0.1554		0.7316		0.3384		0.2876		0.2405		0.5737		0.1565		0.2152	
PCB 172/197	0.0261		0.0342		0.0551		0.0304		0.0267		0.0307		0.0801		0.0462		0.0402		0.0365		0.0263		0.0273		0.0403	
PCB 173	0.0035		0	U	0.0018		0	U	0	U	0	U	0	U	0.0031		0.0032		0	U	0	U	0	U	0	U
PCB 174	0.0986		0.1353		0.2679		0.0977		0.0948		0.0967		0.2225		0.1488		0.1615		0.0942		0.0947		0.0841		0.1101	
PCB 175	0.0071		0	U	0.0227		0.0127		0	U	0	U	0	U	0.0187		0.0143		0.0043		0	U	0	U	0	U
PCB 177	0.0664		0.1117		0.1386		0.0757		0.0684		0.0789		0.1537		0.1131		0.1283		0.0786		0.0557		0.0596		0.0802	
PCB 180	0.2517		0.3038		0.5408		0.2209		0.215		0.2045		0.6142		0.3667		0.3261		0.2925		0.2306		0.2213		0.2948	
PCB 182/187	0.1089		0.1729		0.3458		0.1472		0.1386		0.1186		0.3301		0.2305		0.2037		0.1554		0.1243		0.1181		0.1553	
PCB 183	0.0577		0.0984		0.2244		0.0905		0.0713		0.0776		0.1797		0.1196		0.1259		0.0844		0.067		0.0679		0.0852	
PCB 185	0.0138		0.0183		0.0651		0.0194		0.014		0.0141		0.0469		0.0227		0.0243		0.0189		0.0158		0.0129		0.0121	
PCB 189	0.0086		0.0062		0.0072		0.005		0.0038		0.0039		0.0384		0.012		0.008		0.0194		0.0187		0.014		0.0191	
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0396		0.0249		0.0383		0.0135		0.0164		0.0122		0.0384		0.0286		0.0234		0.0189		0.0074		0.0099		0.0149	
PCB 194	0.0835		0.0742		0.1543		0.0588		0.0549		0.034		0.2134		0.0864		0.0839		0.0811		0.056		0.0445		0.0643	
PCB 195/208	0.0922		0.1426		0.2296		0.1245		0.1142		0.0774		0.369		0.1946		0.1582		0.135		0.1224		0.1118		0.1311	
PCB 196/203	0.2111		0.1847		0.3858		0.1485		0.1549		0.1096		0.4449		0.2299		0.2081		0.1525		0.105		0.1078		0.1397	
PCB 198	0	U	0.003		0.0108		0.0824		0.0528		0.0384		0.2123		0.0847		0.0496		0.0216		0.1316		0.007		0.0111	
PCB 199	0.0151		0.0126		0.0228		0.0098		0.0107		0.008		0.0273		0.017		0.0156		0.0186		0.0193		0.0052		0.0285	
PCB 201	0	U	0.1584		0.3332		0.2		0.1876		0.1233		0.457		0.2542		0.2016		0.1309		0.1976		0.0955		0.1254	
PCB 205	0.0223		0	U	0	U	0	U	0	U	0	U	0.0272		0	U	0.0171		0.0125		0.0631		0.0109		0.0673	
PCB 206	0.078		0.2903		0.135		0.0804		0.0778		0.0477		0.3297		0.1401		0.1122		0.0839		0.0635		0.0518		0.0818	
PCB 207	0	U	0.0389		0.0115		0.0056		0.0157		0.004		0.0259		0.0097		0.0204		0.0112		0.0141		0.0061		0.0095	
PCB 209	0.0399		0.0696		0.0432		0.0465		0.043		0.0323		0.1335		0.1157		0.0523		0.0642		0.0504		0.0448		0.0694	
Total Suspended PCBs (by congener sum) =	52.47		62.34		45.64		66.68		47.70		43.17		127.88		122.86		109.19		65.66		60.61		44.28		68.58	
Total Congeners Analyzed (Susp) =	92		92		92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Susp) =	81		82		86		84		82		83		85		85		86		86		84		85		84	
Reported TPCBs (Susp) =																										

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI28		89GH5FI29		89GH5FI30		89GH5FI31		89GH5FI32		89GH5FI33		89GH5FI34		89GH5FI35		89GH5FI36		89GH5FI37		89GH5FI38		89GH5FI39		89GH5FI40	
Sample Date	7/22/89		7/23/89		7/23/89		7/24/89		7/24/89		7/24/89		7/25/89		7/25/89		7/26/89		7/26/89		7/27/89		7/27/89		7/28/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0	U	0.0639		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 003	0	U	0	U	0.0594		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 004/010	0.0512		0.0498		0.0612		0.0522		0.0466		0.0413		0.0374		0.048		0.0307		0.0328		0.0686		0.0567		0.0394	
PCB 005/008	1.1332		1.0862		1.1909		1.1812		1.1817		0.9784		0.9612		1.2834		0.8143		0.7817		1.4907		2.6674		1.0555	
PCB 006	0.1638		0.1843		0.201		0.1937		0.1897		0.1442		0.1197		0.2229		0.1732		0.1886		0.3757		0.4881		0.2484	
PCB 007	0.0212		0.0222		0.0284		0.0228		0.0288		0.0257		0.0061		0.026		0.0162		0.0135		0.0686		0.0384		0.0157	
PCB 012/013	0	U	0	U	0	U	0	U	0.0065		0	U	0	U	0.0052		0	U	0	U	0.0229		0	U	0.0061	
PCB 016/032	1.2222		1.1076		1.2388		1.067		1.005		0.8775		0.7189		0.8807		0.7205		0.6937		1.6971		1.7224		1.0285	
PCB 017	1.0419		0.7931		0.945		0.9506		0.8282		0.6837		0.6312		0.6413		0.6045		0.5718		1.5315		1.0801		0.8134	
PCB 018	1.4333		1.316		1.5143		1.3895		1.2723		1.1088		0.9544		0.9816		0.9665		0.9157		1.9778		1.7554		1.2491	
PCB 019	0.0845		0.0791		0.0971		0.0804		0.0716		0.0631		0.0521		0.0556		0.0429		0.0427		0.1219		0.0884		0.0702	
PCB 021	0.0345		0.0117		0.1063		0.0814		0.0889		0.0892		0.0734		0.0531		1.2853		1.1339		0.0352		0	U	0	U
PCB 022	1.1988		1.1421		1.3618		1.3597		1.3547		1.206		1.0544		1.2481		1.0762		1.0915		1.8527		2.6566		1.3649	
PCB 024/027	0.1675		0.1531		0.1787		0.1572		0.1502		0.1361		0.1113		0.11		0.1046		0.0986		0.171		0.2087		0.1299	
PCB 025	0.7479		0.6621		0.7749		0.6839		0.6559		0.577		0.4879		0.5425		0.6652		0	U	0.8758		1.3473		0.7932	
PCB 026	1.0221		0.9457		1.0846		0.9627		0.9086		0.7967		0.6719		0.7424		0.7019		0.6589		1.2455		1.7626		1.084	
PCB 028/031	6.2134		5.8344		6.696		6.3964		6.217		5.5301		4.6497		5.2623		5.7604		5.408		8.9537		11.3717		6.2258	
PCB 029	0.0529		0.0428		0.0532		0.0516		0.0447		0.0387		0.0912		0.0884		0.0264		0.0303		0.0831		0.1039		0.0527	
PCB 033	1.1145		0.9645		1.2384		1.2477		1.2388		1.1398		0.9698		1.235		0	U	0	U	1.8986		2.3879		1.1454	
PCB 037/042	1.1261		1.0903		1.0834		1.1797		1.1799		1.0704		0.8518		0.8985		0.8281		0.7649		1.5823		1.5536		1.0183	
PCB 040	0.4823		0.4587		0.5123		0.4919		0.4862		0.445		0.3491		0.3682		0.3674		0.3535		0.6723		0.717		0.4937	
PCB 041/064/071	2.1869		2.1049		2.0956		2.0462		2.0342		1.8694		1.4211		1.5861		1.7041		1.5619		0	U	0	U	3.7996	
PCB 043	0.1832		0.1807		0.1914		0.1884		0.1551		0.165		0.1265		0.1391		0.2059		0.2284		0.2114		0.2589		0.1818	
PCB 044	2.0746		1.9833		2.1281		2.1163		2.0519		1.8769		1.4944		1.6495		1.6605		1.4518		4.7416		2.8423		1.9124	
PCB 045	0.2867		0.3801		0.441		0.3816		0.3719		0.3362		0.2786		0.3005		0.2511		0.2272		0.3456		0.4625		0.3473	
PCB 046	0.2072		0.2033		0.2191		0.1989		0.1851		0.1706		0.1375		0.1432		0.1229		0.1133		0.3194		0.2158		0.1809	
PCB 047/048	1.358		1.3164		1.4631		1.4298		1.4104		1.2802		1.0271		1.0972		1.2763		1.1359		1.8892		1.87		1.2389	
PCB 049	1.6872		1.6326		1.8219		1.7127		1.6936		1.5314		1.2452		1.3242		2.081		1.6049		2.2709		2.2662		1.5465	
PCB 051	0.0759		0.0832		0.1194		0.0946		0.0915		0.0863		0.0789		0.0747		0.0432		0.0662		0.1239		0.1263		0.092	
PCB 052	1.7393		1.6648		1.8889		1.7515		1.7085		1.5457		1.2606		1.4218		1.4434		1.3052		2.1478		2.2072		1.5674	
PCB 053	0.3191		0.3345		0.4468		0.4087		0.3958		0.3152		0.3008		0.3065		0.194		0.2316		0.2936		0.5039		0.3761	
PCB 056/060	1.4723		1.3336		1.5529		1.6723		1.7471		1.6001		1.2092		1.4572		1.5633		1.3872		1.838		2.8127		1.4827	
PCB 063	0.1837		0.1834		0.2065		0.1722		0.2104		0.1273		0.1469		0.1449		0.2187		0.1927		0.2689		0.2777		0.1756	
PCB 066/095	3.562		3.1188		3.855		3.6762		4.0674		3.8927		3.0245		3.3329		4.2611		3.2676		3.915		5.6321		3.3393	
PCB 070/076	2.5879		2.6763		2.8932		3.0136		2.9805		2.8008		2.3066		2.5018		2.7246		2.445		2.6659		4.4864		2.6585	
PCB 074	0.8252		0.8121		0.934		0.9309		1.0045		0.8989		0.6488		0.8381		0.8223		0.7421		0.9489		1.6799		1.0219	
PCB 077/110	0.939		0.9352		1.0418		1.0802		1.1477		1.0573		0.7669		1.2992		0.8881		0.7946		1.2105		1.6093		0.9975	
PCB 081	0.0253		0.0204		0.0185		0.0311		0.0333		0.028		0.019		0.0319		0.024		0.0298		0.0374		0.0072		0.0053	
PCB 082	0.1376		0.1228		0.1315		0.1475		0.1495		0.1713		0.1174		0.1536		0.1076		0.0989		0.1289		0.2253		0.1761	
PCB 083	0.064		0.0551		0.062		0.0699		0.0722		0.0581		0.0428		0.0678		0.0562		0.0681		0.1339		0.1207		0.08	
PCB 084/092	0.5559		0.4887		0.5829		0.6047		0.6053		0.5373		0.4232		0.5798		0.6417		0.5889		0.7334		0.8637		0.5638	
PCB 085	0.2042		0.1982		0.2172		0.2386		0.2546		0.2328		0.1704		0.2582		0.2029		0.1801		0.2581		0.367		0.2126	
PCB 087	0.2822		0.2765		0.2865		0.3278		0.344		0.3181		0.2353		0.4347		0.2747		0.2465		0.3811		0.5266		0.3049	
PCB 089	0.0509		0.0449		0.0527		0.0574		0.0582		0.056		0.0461		0.0325		0.0971		0.0711		0.027		0.0427		0.0267	
PCB 091	0.1485		0.1582		0.17		0.1973		0.1922		0.1763		0.1255		0.1919		0	U	0.4258		0.217		0.3364		0.2114	
PCB 097	0.2491		0.2451		0.2691		0.2853		0.298		0.2743		0.2016		0.3136		0.2494		0.2198		0.3283		0.3927		0.2409	
PCB 099	0.3156		0.3142		0.3483		0.3613		0.3814		0.3435		0.2579		0.3846		0.3807		0.342		0.419		0.5236		0.3229	
PCB 100	0.1061		0.1036		0.0762		0.1214		0.1052		0.0937		0.0673		0.097		0.1097		0.1061		0.1242		0.1994		0.1158	
PCB 101	0.5516		0.5334		0.6028		0.6178		0.6373		0.5698		0.4318		0.7032		0.6514		0.5621		0.6972		0.8248		0.5265	

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI28		89GH5FI29		89GH5FI30		89GH5FI31		89GH5FI32		89GH5FI33		89GH5FI34		89GH5FI35		89GH5FI36		89GH5FI37		89GH5FI38		89GH5FI39		89GH5FI40	
Sample Date	7/22/89		7/23/89		7/23/89		7/24/89		7/24/89		7/24/89		7/25/89		7/25/89		7/26/89		7/26/89		7/27/89		7/27/89		7/28/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 105/132/153	0.6795		0.6021		0.6075		0.7278		0.745		0.653		0.5115		0.9688		0.6231		0.6048		0.7742		1.1872		0.9376	
PCB 107	0.076		0.0658		0.0699		0.0799		0.0803		0.0591		0.0464		0.0866		0.0515		0.0477		0.1007		0.1389		0.1071	
PCB 114/134	0.1181		0.0484		0.3465		0.0787		0.346		0.1292		0.1241		0.1486		0.0645		0.0921		0	U	0.363		0	U
PCB 118	0.4766		0.4177		0.4491		0.5259		0.5185		0.4777		0.3903		0.6551		0.3971		0.368		0.7273		0.8609		0.6525	
PCB 119	0.061		0.0641		0.0724		0.0686		0.0672		0.0621		0.0452		0.0552		0.0484		0.0453		0.1944		0.0993		0.0873	
PCB 124/135/144/147	0.0591		0.0522		0.0579		0.06		0.0568		0.0525		0.048		0.0712		0.0615		0.0589		0.0607		0.0875		0.0884	
PCB 128	0.0684		0.0613		0.0659		0.0744		0.072		0.0819		0.0497		0.1209		0.0677		0.0642		0.1151		0.1057		0.0887	
PCB 129/178	0.0349		0.0296		0.0436		0.0429		0.0355		0.0327		0.0245		0.0359		0.0254		0.0284		0.0349		0.1027		0.0695	
PCB 130	0.1059		0.095		0.1076		0.1161		0.1249		0.1035		0.0851		0.1644		0.0404		0.0394		0.065		0.1869		0.1319	
PCB 131	0	U	0.0074		0	U	0.006		0	U	0.0206		0.0202		0.0267		0.011		0.0141		0	U	0	U	0	U
PCB 136	0.1284		0	U	0.1337		0.1362		0	U	0	U	0.1013		0.1387		0	U	0	U	0.0431		0.0475		0.0323	
PCB 137/176	0.0179		0.0158		0.0175		0.0179		0.0157		0.0143		0.011		0.0171		0.0105		0.0128		0.013		0.0172		0.0113	
PCB 138/158/163	0.4469		0.377		0.4422		0.5014		0.4956		0.4692		0.4094		0.7946		0.397		0.4458		0.5328		0.7641		0.6083	
PCB 141	0.06		0.0496		0.0572		0.0623		0.0598		0.0535		0.0451		0.0718		0	U	0	U	0.0399		0	U	0.0617	
PCB 146	0.2818		0.2155		0.432		0.2387		0.4207		0.2284		0.1952		0.2348		0.1817		0.2053		0	U	0.4016		0.3955	
PCB 149	0.2321		0.2094		0.2267		0.2476		0.2339		0.2043		0.1814		0.2967		0.1924		0.201		0.3279		0.3764		0.3075	
PCB 151	0.0799		0.0692		0.0777		0.0807		0.0781		0.078		0.0613		0.0885		0.0659		0.0679		0.1048		0.1287		0.1109	
PCB 156/171/202	0.0578		0.0526		0.0645		0.0629		0.0651		0.0631		0.0406		0	U	0.0665		0.0703		0.0789		0	U	0	U
PCB 157/200	0	U	0.0085		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0128		0.0124		0.0465		0.0413	
PCB 167	0.025		0.0225		0.0294		0.0242		0.0223		0.0135		0.0169		0.0464		0.0226		0.0198		0.0323		0.0542		0.0328	
PCB 169																										
PCB 170/190	0.2473		0.1252		0.3945		0.2035		0.4341		0.2493		0.1888		0.2759		0.1147		0.1358		0	U	0.2358		0	U
PCB 172/197	0.0223		0.0274		0.0219		0.0248		0.0249		0.0212		0.0179		0.0295		0.0193		0.0226		0.0223		0.0425		0.0424	
PCB 173	0	U	0	U	0	U	0	U	0	U	0.0034		0.0026		0.0029		0	U	0.0086		0	U	0	U	0	U
PCB 174	0.0835		0.0636		0.0652		0.0926		0.088		0.0812		0.0647		0.0779		0.0687		0.0844		0.0986		0.1261		0.1098	
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0024		0	U
PCB 177	0.0579		0.044		0.0496		0.0638		0.0855		0.0795		0.0372		0.0577		0.0557		0.0597		0.0702		0.0955		0.0785	
PCB 180	0.1972		0.1677		0.2126		0.2547		0.2248		0.2364		0.1493		0.25		0.1864		0.2319		0.2073		0.3451		0.2627	
PCB 182/187	0.1113		0.0976		0.1091		0.1172		0.116		0.1025		0.0803		0.1113		0.1001		0.1222		0.1511		0.2083		0.1656	
PCB 183	0.0581		0.0515		0.0531		0.0646		0.063		0.0612		0.0477		0.0663		0.0528		0.0613		0.0844		0.1093		0.0916	
PCB 185	0.0092		0.0101		0.0077		0.0223		0.0199		0.0289		0.0134		0.0294		0.0068		0	U	0	U	0.0156		0.0139	
PCB 189	0.013		0.0128		0.021		0.0156		0.0078		0.0113		0.0109		0.0211		0	U	0.0048		0	U	0.0161		0.0052	
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0084		0.0114		0.0131		0.0131		0.0071		0.0132		0.0059		0.0129		0.013		0.0154		0.0113		0.0198		0.0151	
PCB 194	0.0395		0.0363		0.0422		0.0456		0.0385		0.0377		0.0216		0.0313		0.0494		0.0621		0.0299		0.1118		0.0935	
PCB 195/208	0.0993		0.0797		0.0962		0.0827		0.1238		0.0764		0.0496		0.1043		0.0956		0.0936		0.09		0.1509		0.1262	
PCB 196/203	0.094		0.0865		0.0896		0.1053		0.1		0.0951		0.0694		0.103		0.0925		0.1209		0.1273		0.2173		0.1659	
PCB 198	0.1088		0.0381		0.2863		0.0081		0.2131		0.0092		0.0202		0.0293		0	U	0	U	0	U	0.0123		0.013	
PCB 199	0.0188		0.0135		0.0237		0.0201		0.0206		0.0191		0.0173		0.0081		0.0132		0.0134		0.0224		0.0186		0.0142	
PCB 201	0.1086		0.0741		0.1292		0.0945		0.1366		0.0838		0.0611		0.0862		0.1224		0.152		0	U	0.1925		0.1436	
PCB 205	0.0304		0.0057		0.0324		0.0293		0.0624		0.0412		0.041		0.0574		0	U	0	U	0.0226		0.0996		0.118	
PCB 206	0.0468		0.0622		0.0472		0.0766		0.0729		0.0452		0.0316		0.2125		0.0643		0.0687		0.0643		0.1399		0.0949	
PCB 207	0.0124		0.0052		0.0167		0	U	0.0164		0.0218		0.0115		0.0181		0.0025		0	U	0.0097		0.0081		0.0178	
PCB 209	0.0372		0.0347		0.0283		0.0473		0.0505		0.0647		0.0276		0.0594		0.0387		0.034		0	U	0.0199		0.0096	
Total Suspended PCBs (by congener sum) =	44.10		40.96		47.65		46.02		46.69		41.54		33.78		41.44		39.86		36.16		55.67		68.84		45.89	
Total Congeners Analyzed (Susp) =	92		92		92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Susp) =	84		85		86		84		84		85		86		86		78		79		77		82		82	
Reported TPCBs (Susp) =																										

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI41		89GH5FI42		89GH5FI43		89GH5FI44		89GH5FI45		89GH5FI46		89GH5FI47		89GH5FI48		89GH5FI49		89GH5FI50		89GH5FI51		89GH5FI52		89GH5FI53	
Sample Date	7/28/89		7/29/89		7/29/89		7/30/89		7/30/89		7/31/89		8/9/89		8/14/89		8/23/89		8/29/89		9/7/89		9/13/89		9/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0 1977		0 9089		0	U	0	U	0	U	1 5613		0 057		0	U	0	U	0	U	0	U	0	U	0	U
PCB 003	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0 2767		0 2354		0 122		0	U	0 161	
PCB 004/010	0 0575		0 0626		0 0766		0 081		0 0722		0 0756		0 0544		0 0657		0 1048		0 1033		0 0495		0 0889		0 0989	
PCB 005/008	1 4858		1 619		1 9214		2 2147		1 7072		1 9863		1 2966		2 0622		3 084		3 1712		1 6719		2 4095		3 0236	
PCB 006	0 2435		0 2998		0 4746		0 4515		0 2466		0 4069		0 2306		0 4267		0 4203		0 4628		0 2426		0 2622		0 3793	
PCB 007	0 023		0 031		0 0334		0 0284		0 0284		0 0352		0 0225		0 0331		0 0565		0 0556		0 0266		0 0579		0 0566	
PCB 012/013	0 015		0 0256		0	U	0 0075		0 0077		0 0194		0 0083		0 0123		0 0452		0 0418		0	U	0 0159		0 0243	
PCB 016/032	1 4615		1 5162		1 8308		1 9107		1 7389		1 7222		1 3208		1 4951		2 1791		1 9852		1 1677		1 8941		2 1496	
PCB 017	0 9577		1 0152		1 1651		1 2725		1 1317		1 1065		0 8859		0 9634		1 6547		1 6486		0 9222		1 4299		1 4528	
PCB 018	1 6212		1 6944		1 9466		2 0936		1 9201		1 8578		1 4862		1 6322		2 549		2 5846		1 5304		2 2364		2 2535	
PCB 019	0 0629		0 0746		0 1029		0 0957		0 0807		0 0807		0 0608		0 0654		0 1535		0 1483		0 0782		0 1223		0 1441	
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0 0143		0 0372		0 0225		0 0079		0 0505	
PCB 022	1 5547		1 667		1 7914		2 0682		1 7709		1 7884		1 4423		1 8645		3 0126		3 1291		1 9317		2 1339		2 8859	
PCB 024/027	0 1589		0 1966		0 1881		0 2039		0 1883		0 1845		0 1435		0 1613		0 2595		0 2498		0 1373		0 1892		0 2167	
PCB 025	0 7313		0 7606		0 9968		0 9419		0 9297		0 9365		0 6624		0 851		0 3168		0 3259		1 2086		0 2262		1 8409	
PCB 026	1 0949		1 1248		1 4082		1 4512		1 3648		1 3336		0 9919		1 1837		2 3994		2 6179		1 4338		1 8325		1 9691	
PCB 028/031	7 0989		7 3861		8 2269		9 1984		8 2448		7 9378		6 2512		7 7696		14 2583		14 5931		8 9609		10 745		12 5916	
PCB 029	0 0423		0 0387		0 0172		0 0201		0 0176		0 0436		0 0127		0 0164		0 0448		0 0555		0 0096		0 0815		0 0263	
PCB 033	1 4397		1 538		1 7021		1 893		1 6301		1 6746		1 3508		1 829		2 8159		3 0672		1 893		1 9694		2 981	
PCB 037/042	1 0356		1 1468		1 2777		1 3898		1 3091		1 2908		1 0758		1 1078		2 032		1 9451		1 4346		1 5417		1 7532	
PCB 040	0 5765		0 5833		0 6575		0 6892		0 6383		0 615		0 5231		0 5588		0 8996		0 8613		0 6255		0 6675		0 7844	
PCB 041/064/071	4 8758		0	U	0	U	0	U	2 4868		0	U	2 2721		2 1474		3 6067		3 516		2 598		2 8433		3 29	
PCB 043	0 2319		0 2127		0 2518		0 2581		0 2647		0 2201		0 2371		0 2462		0 3504		0 3618		0 2637		0 2206		0 3665	
PCB 044	2 1776		2 3283		2 6026		3 1035		2 5666		2 5515		2 065		2 1948		3 7007		3 6646		2 6442		2 8923		3 2324	
PCB 045	0 3573		0 4078		0 4052		0 4372		0 3939		0 3856		0 3198		0 3431		0 6187		0 6332		0 3821		0 4542		0 5601	
PCB 046	0 204		0 213		0 2373		0 3742		0 2323		0 2315		0 1851		0 1924		0 4032		0 4038		0 1991		0 2204		0 3342	
PCB 047/048	1 5472		1 5852		1 7797		1 8874		1 7454		1 6758		1 462		1 5468		2 4755		2 5216		1 8122		1 926		2 2219	
PCB 049	1 9039		1 9252		2 1947		2 214		2 1265		2 0348		1 7383		1 8445		3 0405		3 1697		2 2393		2 4456		2 6689	
PCB 051	0 1056		0 1053		0 1368		0 1344		0 1306		0 1209		0 1049		0 1063		0 1384		0 1202		0 0866		0 1177		0 1286	
PCB 052	1 9172		1 9215		2 2043		2 3161		2 13		2 0429		1 7034		1 7934		3 3501		3 3733		2 3021		2 6799		2 7829	
PCB 053	0 4597		0 4731		0 5447		0 5798		0 5502		0 5044		0 4221		0 4354		0 6834		0 6491		0 3874		0 4456		0 4878	
PCB 056/060	1 7014		1 8088		1 8014		2 0624		1 8055		1 8108		1 5265		1 7353		3 2015		3 1436		2 4385		2 1765		3 113	
PCB 063	0 1881		0 1939		0 1969		0 2186		0 205		0 2035		0 1625		0 1645		0 3786		0 397		0 3007		0 2367		0 3567	
PCB 066/095	3 8082		3 8181		3 9762		4 9794		4 1335		4 0201		3 5926		4 38		5 8888		6 1267		4 9598		4 5084		5 2273	
PCB 070/076	3 4178		3 4876		3 5037		3 6977		3 5685		3 6052		3 3354		3 7594		4 1018		4 2245		3 4382		3 0294		3 6925	
PCB 074	1 8331		1 3801		1 1852		1 3062		1 9059		1 3043		1 2319		1 4688		1 8209		1 8434		1 3513		1 2123		1 6752	
PCB 077/110	1 0815		1 0699		1 1626		1 2312		1 1313		1 127		0 9555		1 055		1 9805		1 8233		1 4182		1 3145		1 6616	
PCB 081	0 0346		0 0345		0 0368		0 0383		0 0239		0 0319		0 0276		0 0384		0 0352		0 0299		0 0177		0 0312		0 0348	
PCB 082	0 1615		0 1856		0 1801		0 2152		0 1831		0 1931		0 1591		0 1622		0 2016		0 2039		0 1867		0 2031		0 1851	
PCB 083	0 0858		0 0956		0 0944		0 0951		0 0898		0 0891		0 0733		0 0907		0 1063		0 099		0 0786		0 0668		0 0974	
PCB 084/092	0 7709		0 7788		0 7624		0 8389		0 7444		0 7306		0 6203		0 5692		0 9934		0 9896		0 7096		0 7299		0 8668	
PCB 085	0 2382		0 2482		0 2456		0 2805		0 2496		0 2583		0 2208		0 2385		0 3677		0 3697		0 2972		0 2554		0 3523	
PCB 087	0 356		0 3632		0 3731		0 4151		0 3679		0 3764		0 3179		0 3486		0 558		0 5559		0 4325		0 3719		0 5285	
PCB 089	0 0551		0 0593		0 0312		0 0343		0 0273		0 0272		0 0241		0 0258		0 0667		0 062		0 0482		0 0555		0 0555	
PCB 091	0 2209		0 2379		0 2649		0 3347		0 2519		0 2494		0 2224		0 2291		0 3353		0 2771		0 2283		0 199		0 2581	
PCB 097	0 288		0 302		0 3093		0 3384		0 3112		0 3047		0 2635		0 2914		0 4696		0 4682		0 3751		0 3254		0 4391	
PCB 099	0 3837		0 3949		0 41		0 4407		0 41		0 4003		0 3471		0 3871		0 5819		0 5879		0 4708		0 4259		0 5391	
PCB 100	0 1268		0 1297		0 1457		0 1481		0 1409		0 1338		0 1169		0 1321		0 187		0 1853		0 1243		0 0719		0 1827	
PCB 101	0 6271		0 6378		0 6635		0 7104		0 6571		0 6339		0 5461		0 5929		0 9892		0 9973		0 7756		0 7007		0 8873	

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI41		89GH5FI42		89GH5FI43		89GH5FI44		89GH5FI45		89GH5FI46		89GH5FI47		89GH5FI48		89GH5FI49		89GH5FI50		89GH5FI51		89GH5FI52		89GH5FI53	
Sample Date	7/28/89		7/29/89		7/29/89		7/30/89		7/30/89		7/31/89		8/9/89		8/14/89		8/23/89		8/29/89		9/7/89		9/13/89		9/20/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 105/132/153	0.9212		0.996		1.0321		1.1837		1.0254		1.0142		0.9429		0.9716		1.3809		1.368		1.2055		1.1715		1.21	
PCB 107	0 0678		0.0811		0.0659		0 0541		0.0823		0 0868		0.069		0.0733		0.1322		0.1295		0.1155		0.1039		0 1166	
PCB 114/134	0	U	0.3069		0	U	0	U	0	U	0 2155		0	U	0	U	0.1742		0.1023		0.1552		0.1145		0 0941	
PCB 118	0.5942		0.6658		0.6582		0.8834		0.6775		0.7032		0.5895		0.6167		0.9768		0.9581		0.8517		0.7415		0.8516	
PCB 119	0.0877		0.0765		0.0814		0 0906		0.0847		0.0807		0.0616		0.0737		0.0937		0.1773		0.0544		0.1712		0 1118	
PCB 124/135/144/147	0.0484		0.0725		0.0776		0 1038		0.056		0.0849		0.0623		0.0467		0.1112		0 1099		0.0933		0.1121		0.0891	
PCB 128	0 0998		0.115		0.1236		0 1168		0.1044		0.1051		0.095		0.0929		0.1387		0.1334		0.1201		0.129		0 1167	
PCB 129/178	0.0594		0.0622		0.1119		0 0834		0.0889		0.0837		0.0532		0.0472		0.061		0 0632		0.05		0.0549		0.0491	
PCB 130	0.064		0.1077		0.0632		0.1006		0.0781		0 0857		0.0559		0.0637		0.1085		0.1004		0 099		0.0988		0.0943	
PCB 131	0	U	0.0317		0	U	0	U	0	U	0.0212		0	U	0	U	0 0184		0.0117		0	U	0.0151		0.0129	
PCB 136	0.0394		0.0382		0.0475		0.0477		0.0434		0.0393		0.0368		0.0385		0	U	0	U	0.2083		0	U	0	U
PCB 137/176	0.012		0.0165		0.0155		0.0169		0.0147		0.0141		0.0122		0.0123		0 0261		0.0258		0.0192		0.0329		0.0216	
PCB 138/158/163	0.6301		0.6173		0 6324		0.7124		0.657		0 6298		0.5634		0.5669		0.7853		0.7699		0.6439		0.8114		0.6521	
PCB 141	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.1172		0.1183		0.0967		0	U	0	U
PCB 146	0.2967		0.329		0.3481		0	U	0.3689		0 3559		0.3147		0.3053		0 4203		0.413		0.3353		0 4471		0.3286	
PCB 149	0 3136		0.3485		0 3743		0 4274		0.3681		0 3645		0.3127		0.3139		0 4145		0.427		0.3454		0.3776		0.3596	
PCB 151	0.1063		0.1148		0.1308		0 1488		0 1237		0 1244		0.1046		0.1044		0.1399		0.1446		0 1196		0 1143		0.1158	
PCB 156/171/202	0	U	0	U	0.105		0.1359		0	U	0	U	0	U	0	U	0.1336		0 131		0 1032		0.1169		0.1067	
PCB 157/200	0.0137		0.0133		0.0276		0.0373		0.0135		0 0275		0.0286		0.0349		0.02		0.0202		0.012		0	U	0.0135	
PCB 167	0.0623		0.0477		0.051		0.048		0.0558		0.0452		0.0488		0.03		0.0329		0.026		0.026		0.0342		0.0265	
PCB 169																										
PCB 170/190	0	U	0.1867		0.2386		0	U	0 2286		0 1888		0.1799		0.2116		0.2942		0.2623		0 2444		0	U	0.277	
PCB 172/197	0.0197		0.0175		0.0261		0.0283		0.0328		0.0241		0.0267		0.0262		0.0416		0.0413		0.0325		0.0514		0.0348	
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0022		0	U	0.0013		0.0028	
PCB 174	0 0895		0.0971		0 1053		0.1303		0 1133		0 1013		0.0979		0.1056		0.1516		0.1528		0 1059		0 1226		0.1236	
PCB 175	0.0059		0.0014		0	U	0.0061		0	U	0	U	0	U	0	U	0 0059		0.0054		0	U	0	U	0.0041	
PCB 177	0.0653		0.0744		0.0795		0.0915		0.0755		0 077		0.0659		0.0722		0 1155		0.1161		0.0874		0 1018		0.0937	
PCB 180	0.212		0.2191		0.2426		0.2671		0.2467		0.2384		0.2214		0.2222		0 3741		0.3667		0.2793		0 3325		0.2967	
PCB 182/187	0.153		0.156		0.2165		0.1999		0 1724		0.1699		0.1545		0.1543		0 2449		0.248		0.1931		0.1975		0.2011	
PCB 183	0.0885		0.0929		0.1023		0.1102		0.0998		0.1002		0.0868		0.0871		0 1279		0.1319		0.1004		0.0979		0.1053	
PCB 185	0.023		0.0229		0.0203		0.0172		0.0222		0.0183		0.0184		0.01		0 0208		0.0228		0.0158		0.0334		0.0164	
PCB 189	0 0103		0.0052		0 0102		0.0091		0.0183		0.0082		0.0137		0.0044		0 0079		0.0083		0.0059		0.0082		0.0042	
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0049		0.0043		0.0025		0	U	0.003	
PCB 193	0.0118		0.0127		0.0159		0.0152		0.0142		0 0141		0.0132		0.0132		0.0194		0.0194		0.0144		0.0261		0.0161	
PCB 194	0 0756		0.0676		0 0803		0.0805		0.083		0.0759		0.0641		0.0646		0.0785		0.0792		0.0544		0.0824		0.0631	
PCB 195/208	0 0909		0 1044		0.128		0.1113		0.1083		0.1015		0.1209		0.1089		0.149		0.1438		0.1073		0.1382		0.1204	
PCB 196/203	0 1349		0.1454		0 1617		0.1684		0.1576		0.152		0.1672		0.1532		0 2199		0.202		0.1432		0.1959		0.1694	
PCB 198	0 0086		0.0046		0 0074		0	U	0 0057		0 0048		0.0046		0.0035		0.0051		0.0067		0	U	0.0496		0.0048	
PCB 199	0 0119		0.0128		0 0153		0.0168		0.016		0.0145		0.0138		0.0125		0.015		0.015		0.0114		0.0198		0.0126	
PCB 201	0.1174		0.1243		0 1417		0	U	0 1401		0.1339		0.1263		0.1333		0.1942		0.1943		0.1381		0 1958		0.1553	
PCB 205	0.1043		0.1271		0 1138		0.0418		0 0464		0 1168		0.0712		0.0459		0	U	0	U	0	U	0.0387		0	U
PCB 206	0.0801		0.078		0.0699		0.0918		0.0939		0.0818		0 081		0.1004		0.1065		0.0955		0 0702		0 0912		0.0791	
PCB 207	0 0128		0.0156		0.0172		0.0128		0.0136		0.015		0.0103		0.0168		0.0119		0.013		0.0037		0.0046		0.0056	
PCB 209	0.0446		0.0832		0.0612		0.0526		0.0868		0.0475		0.0507		0.0613		0	U	0.0703		0.0366		0.0107		0.051	
Total Suspended PCBs (by congener sum) =	**53.79**		**51.77**		**55.32**		**60.34**		**57.48**		**55.69**		**47.07**		**53.62**		**84.68**		**85.55**		**60.34**		**64.52**		**77.28**	
Total Congeners Analyzed (Susp) =	**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**	
Total Congeners Detected (Susp) =	**83**		**85**		**81**		**79**		**82**		**84**		**83**		**82**		**87**		**89**		**85**		**84**		**88**	
Reported TPCBs (Susp) =																										

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI54		89GH5FI55		89GH5FI56		89GH5FI57		89GH5FI58		89GH5FI59		89GH5FI60		89GH5FI61		89GH5FI63		89GH5FI64		89GH5FI65		89GH5FI66		89GH5FI67	
Sample Date	9/27/89		10/4/89		10/12/89		10/18/89		10/24/89		10/30/89		10/31/89		10/31/89		11/1/89		11/2/89		11/2/89		11/3/89		11/3/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.7512		0	U	0	U	0.0643		0	U			0	U	0	U	0	U	0	U	0.0125		0	U	0	U
PCB 003	0.1405		0	U	0	U	0	U	0	U			0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 004/010	0.0605		0.0553		0.0798		0.1051		0.0597				0.0798		0.0679		0.0554		0.1083		0.0723		0.0546		0.1437	
PCB 005/008	1.4907		1.262		2.5703		2.2468		0.8329				1.8293		1.7816		1.2528		1.9148		2.059		1.557		1.7696	
PCB 006	0.2572		0.2528		0.3605		0.3931		0.1524				0.2719		0.3967		0.1861		0.2962		0.2501		0.1742		0.2359	
PCB 007	0.026		0.0244		0.0442		0.0456		0.0184				0.0328		0.0297		0.0196		0.0342		0.0413		0.0172		0.0304	
PCB 012/013	0.0032		0.0461		0.065		0.0585		0.0256				0.0231		0.0146		0.0064		0.0304		0.0066		0.0088		0.0249	
PCB 016/032	1.251		1.0049		1.6069		2.4676		0.9311				1.7971		1.3626		1.0015		1.7288		1.4726		1.1301		1.4477	
PCB 017	1.3075		0.9376		1.44		1.8537		0.7826				1.4206		1.0404		0.7667		1.4015		1.0057		0.7653		1.2491	
PCB 018	1.7512		1.3291		1.9863		2.517		0.9868				1.7705		1.3263		0.9571		1.7088		1.5369		1.1323		1.551	
PCB 019	0.0957		0.0779		0.092		0.1457		0.0611				0.1273		0.0641		0.0579		0.1078		0.0963		0.0708		0.0879	
PCB 021	0	U	0	U	0	U	0	U	0	U			0	U	0.0035		0	U	0	U	0.02		0.0171		0.039	
PCB 022	1.8296		1.4612		2.4681		3.0049		1.1143				1.9515		1.7096		1.1044		1.9068		1.4714		1.0105		1.5383	
PCB 024/027	0.247		0.1448		0.2253		0.2619		0.1205				0.1978		0.1258		0.0905		0.1717		0.1447		0.115		0.1674	
PCB 025	0.924		0.7689		1.0976		1.3469		0.5388				0.9729		0.8406		0.475		0.8752		0.7659		0.544		0.6845	
PCB 026	1.4455		1.0725		1.6485		2.0293		0.7858				1.4521		1.0955		0.6788		1.2914		1.0407		0.8006		0.988	
PCB 028/031	9.0129		7.1142		11.2268		13.6834		5.4811				9.7614		7.5829		5.2121		9.5092		7.6774		5.4119		7.9909	
PCB 029	0.0131		0.0181		0.0116		0.0142		0.0042				0.0095		0.013		0.0063		0.007		0.0138		0.0713		0.013	
PCB 033	1.6576		1.4844		2.4539		2.5493		0.9837				1.8862		1.5786		1.2353		1.982		1.6604		1.0479		1.528	
PCB 037/042	1.5709		1.4134		1.9775		2.4356		0.9415				1.5317		1.1684		0.6795		0	U	1.0233		0.7847		1.0312	
PCB 040	0.6522		0.604		0.8183		1.0072		0.3876				0.6977		0.5035		0.3334		0.6582		0.4585		0.328		0.4333	
PCB 041/064/071	3.3162		0	U	0	U	3.8855		0	U			0	U	0	U	1.5389		0	U	1.8411		1.407		1.7546	
PCB 043	0.2382		0.1756		0.3294		0.3745		0.1123				0.2741		0.1987		0.1581		0.3121		0.1809		0.1774		0.2184	
PCB 044	2.5498		2.2847		3.1312		3.7965		1.4131				2.4906		1.7888		1.3847		2.3575		1.8664		1.4374		1.8162	
PCB 045	0.4192		0.3864		0.55		0.6071		0.2453				0.4306		0.3472		0.2031		0.4255		0.3174		0.211		0.3765	
PCB 046	0.2158		0.2019		0.2893		0.3105		0.1134				0.2654		0.1477		0.1263		0.2729		0.1935		0.1146		0.004	
PCB 047/048	1.673		1.4458		2.0878		2.5287		1.067				1.7877		1.2747		0.8928		1.7814		1.3741		1.0902		1.3113	
PCB 049	2.048		1.7835		2.5056		3.009		1.2258				2.1148		1.5279		1.0865		2.1085		1.6372		1.2816		1.8338	
PCB 051	0.0785		0.0719		0.1029		0.1638		0.0595				0.1107		0.0876		0.0486		0.1005		0.0968		0.0906		0.0822	
PCB 052	1.993		1.7507		2.4529		3.1566		1.0816				2.1759		1.4259		0.9515		1.8596		1.726		1.3543		2.1647	
PCB 053	0.306		0.385		0.4798		0.4557		0.161				0.279		0.2145		0.1312		0.254		0.3466		0.2967		0.4208	
PCB 056/060	2.0483		2.073		2.7457		3.4976		1.2209				2.3633		1.6398		1.0959		2.088		1.4518		1.104		1.388	
PCB 063	0.2537		0.2344		0.3009		0.3719		0.1589				0.2883		0.1963		0.1317		0.2609		0.1746		0.1247		0.1843	
PCB 066/095	4.1854		4.1494		5.5844		6.5218		2.512				4.4603		3.2778		2.2164		4.1192		3.0473		2.404		3.0425	
PCB 070/076	2.6284		2.482		3.2953		3.8763		1.4587				2.817		2.0334		1.4059		2.6646		2.2253		1.7241		2.2116	
PCB 074	1.1037		0.9752		1.265		1.5503		0.5317				1.2185		0.8669		0.5431		1.122		0.8272		0.6021		0.9125	
PCB 077/110	1.1927		1.3737		1.7328		2.1781		0.8208				1.3937		0.9627		0.621		1.3321		0.8707		0.6689		1.0095	
PCB 081	0.0261		0.0254		0.0359		0.0517		0.0154				0.0354		0.023		0.0158		0.0344		0.0122		0.0136		0.0196	
PCB 082	0.1619		0.1455		0.2205		0.2479		0.0773				0.1444		0.1241		0.0748		0.0976		0.1745		0.1052		0.1011	
PCB 083	0.076		0.0876		0.1361		0.1238		0.0689				0.0917		0.0612		0.0406		0.0754		0.0416		0.0337		0.049	
PCB 084/092	0.7252		0.753		0.9946		1.1381		0.4504				0.7717		0.5511		0.3858		0.722		0.4625		0.3593		0.5377	
PCB 085	0.2392		0.2743		0.3267		0.4351		0.1453				0.2613		0.1839		0.1201		0.2316		0.1577		0.1189		0.1556	
PCB 087	0.3572		0.3923		0.4723		0.6216		0.2236				0.3937		0.279		0.1749		0.3527		0.2351		0.1843		0.2407	
PCB 089	0.0256		0.038		0.0488		0.0387		0.013				0.0168		0.0132		0.0089		0.015		0.0333		0.024		0.0279	
PCB 091	0.2781		0.2717		0.3389		0.4249		0.1489				0.2415		0.1666		0.0659		0.1677		0.0644		0.032		0.0976	
PCB 097	0.2919		0.3229		0.3947		0.5155		0.2072				0.3376		0.2538		0.16		0.3415		0.2246		0.1795		0.2442	
PCB 099	0.3904		0.4012		0.5066		0.6351		0.2444				0.424		0.2811		0.1961		0.4104		0.276		0.2305		0.3223	
PCB 100	0.1309		0.1084		0.1669		0.204		0.0787				0.146		0.1027		0.0559		0.1132		0.0763		0.0602		0.1202	
PCB 101	0.6454		0.6548		0.8506		1.0286		0.4158				0.691		0.4809		0.3416		0.6672		0.478		0.3858		0.5522	

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI54		89GH5FI55		89GH5FI56		89GH5FI57		89GH5FI58		89GH5FI59		89GH5FI60		89GH5FI61		89GH5FI63		89GH5FI64		89GH5FI65		89GH5FI66		89GH5FI67	
Sample Date	9/27/89		10/4/89		10/12/89		10/18/89		10/24/89		10/30/89		10/31/89		10/31/89		11/1/89		11/2/89		11/2/89		11/3/89		11/3/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 105/132/153	0.8969		0.9985		1.1811		1.3262		0.6024				1.0627		0.8427		0.4786		0.7835		1.1333		0.6743		0.7985	
PCB 107	0.081		0.1073		0.1072		0.1217		0.0545				0.0952		0.1015		0.0337		0.0701		0.1167		0.0653		0.0753	
PCB 114/134	0.0964		0.0634		0.1001		0.1028		0.0654				0.0618		0.0861		0	U	0.0461		0	U	0	U	0.059	
PCB 118	0.6628		0.6656		0.8764		0.9678		0.4104				0.7099		0.6234		0.3204		0.5234		0.7168		0.4118		0.6263	
PCB 119	0.0784		0.0725		0.0987		0.0948		0.0579				0.0845		0.0634		0.041		0.0684		0.048		0.0484		0.0582	
PCB 124/135/144/147	0.0861		0.082		0.1159		0.1147		0.0576				0.0949		0.0844		0.0442		0.0613		0.1093		0.0776		0.0831	
PCB 128	0.1096		0.1106		0.1393		0.1615		0.0731				0.1305		0.1057		0.0606		0.0886		0.1341		0.0934		0.0615	
PCB 129/178	0.0422		0.0386		0.0483		0.0549		0.0289				0.0439		0.0396		0.0225		0.0352		0.0536		0.033		0.0426	
PCB 130	0.0695		0.0787		0.0896		0.1027		0.045				0.0779		0.0701		0.0373		0.0615		0.1068		0.0556		0.0419	
PCB 131	0.0088		0.0083		0.0174		0.0182		0.0065				0.0088		0.0092		0	U	0.008		0	U	0	U	0.0059	
PCB 136	0.0305		0	U	0.043		0.0453		0.0222				0.0349		0	U	0.0175		0.0337		0	U	0	U	0	U
PCB 137/176	0.0205		0.0243		0.0287		0.0338		0.0117				0.0212		0.0198		0.0095		0.0175		0.0239		0.0113		0.0168	
PCB 138/158/163	0.5343		0.5185		0.6816		0.7819		0.3468				0.5862		0.5184		0.2748		0.4547		0.6673		0.415		0.4663	
PCB 141	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U	0	U	0.1011		0.0625		0	U
PCB 146	0.3163		0.2734		0.3867		0.3773		0.2036				0.3766		0.3356		0	U	0.3		0	U	0.371		0.3231	
PCB 149	0.2918		0.2866		0.3597		0.3885		0.1945				0.3026		0.2628		0.1454		0.2373		0.3841		0.2548		0.2815	
PCB 151	0.1019		0.0839		0.1505		0.1304		0.0601				0.1013		0.0825		0.0518		0.0747		0.134		0.0778		0.0928	
PCB 156/171/202	0.0785		0.0899		0.1005		0.1178		0.053				0.085		0.071		0.0402		0.0804		0.1033		0.0619		0.0868	
PCB 157/200	0.0402		0	U	0	U	0	U	0.0061				0.0307		0.0341		0.002		0.0396		0.0001		0.0114		0.0154	
PCB 167	0.0291		0.0319		0.0394		0.0451		0.0188				0.0373		0.0294		0.0149		0.0263		0.0366		0.0288		0.0189	
PCB 169																										
PCB 170/190	0.2082		0.204		0.2788		0.2715		0.1538				0.2413		0.2103		0	U	0.2002		0	U	0.2125		0.1604	
PCB 172/197	0.0358		0.0283		0.0341		0.0403		0.0173				0.0292		0.0277		0.012		0.0296		0.0399		0.0277		0.0267	
PCB 173	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U	0	U	0.0021		0	U	0	U
PCB 174	0.11		0.0939		0.1126		0.1305		0.0565				0.1005		0.1011		0.0448		0.0759		0.1122		0.0858		0.1053	
PCB 175	0.0035		0	U	0.0051		0.0069		0.0118				0.0105		0	U	0	U	0.0039		0.0043		0	U	0	U
PCB 177	0.0638		0.083		0.0829		0.0942		0.0451				0.0707		0.0695		0.037		0.0625		0.0971		0.0559		0.0795	
PCB 180	0.2791		0.2502		0.3145		0.3751		0.1643				0.2804		0.2422		0.1246		0.2202		0.2886		0.1952		0.2431	
PCB 182/187	0.1624		0.1619		0.2079		0.2169		0.0951				0.1731		0.16		0.0911		0.1482		0.2049		0.1368		0.1795	
PCB 183	0.0828		0.0869		0.1099		0.1209		0.0507				0.1033		0.089		0.0494		0.0773		0.0933		0.0658		0.0881	
PCB 185	0.0151		0.0142		0.0179		0.0212		0.0132				0.0159		0.0131		0.0053		0.0108		0.0203		0.0159		0.0254	
PCB 189	0.0076		0.0087		0.0088		0.0061		0	U			0.0074		0.0053		0.0025		0.0071		0.0046		0	U	0.0021	
PCB 191	0.0037		0.0045		0.0029		0.0034		0	U			0	U	0.0009		0	U	0.0009		0.0047		0	U	0.0067	
PCB 193	0.0124		0.0154		0.017		0.0203		0.0082				0.0147		0.0102		0.0051		0.0141		0.0166		0.0112		0.0135	
PCB 194	0.0565		0.0546		0.0575		0.0882		0.0304				0.0658		0.076		0.0308		0.063		0.0645		0.0413		0.0594	
PCB 195/208	0.1041		0.1107		0.139		0.1444		0.0582				0.1235		0.1099		0.0614		0.1269		0.128		0.0778		0.0886	
PCB 196/203	0.1539		0.164		0.2173		0.2268		0.1202				0.1851		0.1574		0.0823		0.1712		0.2004		0.1075		0.1487	
PCB 198	0.0029		0.003		0.0042		0.0051		0.0015				0.0049		0.0043		0	U	0.0049		0	U	0.0298		0.0038	
PCB 199	0.0159		0.0147		0.0176		0.019		0.0162				0.0164		0.0132		0.0077		0.0135		0.0132		0.011		0.011	
PCB 201	0.127		0.1272		0.1676		0.1712		0.0796				0.1428		0.1292		0	U	0.1578		0.1915		0.0954		0.1277	
PCB 205	0	U	0.0193		0	U	0	U	0	U			0	U	0.0174		0.0072		0.0082		0	U	0.0225		0.0206	
PCB 206	0.0815		0.0838		0.1082		0.1113		0.0536				0.0978		0.0858		0.045		0.1539		0.0891		0.0525		0.056	
PCB 207	0.0096		0.01		0.0115		0.0121		0.0061				0.01		0.0081		0.0049		0.0131		0.0079		0.0079		0.0069	
PCB 209	0	U	0.0713		0	U	0	U	0	U			0	U	0.0763		0	U	0	U	0.049		0.0316		0.0303	
Total Suspended PCBs (by congener sum) =	**57.20**		**47.47**		**68.00**		**85.05**		**31.78**				**57.48**		**44.20**		**30.50**		**52.62**		**46.71**		**34.89**		**46.79**	
Total Congeners Analyzed (Susp) =	**92**		**92**		**92**		**92**		**92**				**92**		**92**		**92**		**92**		**92**		**92**		**92**	
Total Congeners Detected (Susp) =	**87**		**83**		**83**		**85**		**82**				**83**		**85**		**78**		**84**		**84**		**83**		**86**	
Reported TPCBs (Susp) =																										

NOTE no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI68		89GH5FI70		89GH5FI71		89GH5FI72		89GH5FI73		89GH5FI74		89GH5FI75		89GH5FI76		89GH5FI77		89GH5FI78		89GH5FI79		89GH5FI80		89GH5FI81	
Sample Date	11/4/89		11/7/89		11/7/89		11/8/89		11/8/89		11/9/89		11/9/89		11/10/89		11/10/89		11/11/89		11/11/89		11/12/89		11/12/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0	U	0	U	0 1064		0.2825		0 0564		0	U	0	U	0	U	0.0379		0	U	0	U	0.0219	
PCB 003	0 0446		0	U	0	U	0	U	0.4559		0	U	0	U	0	U	0	U	0.1078		0	U	0	U	0.0754	
PCB 004/010	0 0782		0.0847		0.09		0.1058		0.0523		0 0511		0.0703		0.0815		0.0848		0.1285		0 0905		0 061		0.0884	
PCB 005/008	1.1776		1.197		2.3419		1.2628		1.2444		0 9971		1.9201		1.711		2.327		2.1245		2.4337		1.2075		1.714	
PCB 006	0.1668		0 1429		0 338		0 1517		0.2094		0 1557		0.3064		0.2616		0 3584		0.3072		0.3817		0.2908		0.3287	
PCB 007	0 0454		0 0266		0.0395		0.027		0.0255		0 0208		0.0353		0.0315		0 0411		0.0412		0 0457		0 0261		0.0323	
PCB 012/013	0 0105		0 0123		0.0395		0.0123		0.0089		0.0271		0.0341		0.0075		0.0508		0.0027		0 0591		0 0181		0.0051	
PCB 016/032	0.8423		1 0293		1.6333		1 0921		1.0934		0 9051		1.413		1.2655		1 6712		1.7595		1.6133		1.0478		1.3547	
PCB 017	0.5915		0.7747		1.1588		0.8139		0.8209		0.7545		1.0079		1.0005		1.2728		1.3981		1.1246		0 8069		1.1409	
PCB 018	0.851		1 0706		1.5059		1.0842		1 0417		0 9025		1.2825		1 325		1 5407		1.8021		1.4542		0.9842		1.4657	
PCB 019	0.0548		0.0644		0.0892		0.0671		0.0636		0.0563		0.075		0.1164		0.0924		0.1164		0.0754		0.0422		0.0789	
PCB 021	0.001		0 0042		0	U	0.0052		0	U	0.002		0	U	0 0038		0	U	0.0056		0	U	0.0053		0.0067	
PCB 022	0.8027		1.0389		1.9645		1.1229		1.2805		1.1261		1.8856		1.4798		2.1598		1.5434		2.0843		1.3277		1.3799	
PCB 024/027	0.0831		0.1092		0.1463		0.111		0.1015		0.0799		0.116		0.1353		0.1732		0.1834		0.144		0.0867		0.1438	
PCB 025	0.4325		0.5084		0.8821		0.5545		0.563		0.5128		0.8244		0.6546		0.9099		0.7157		1.0119		0.5372		0.5779	
PCB 026	0.6323		0.7431		1.2352		0.7849		0.8215		0.7189		1.1346		0.9196		1.2785		0.9424		1.3074		0.7544		0.8537	
PCB 028/031	4.291		5.5667		9.2556		5.6199		6.1205		5.3451		8.4274		6.8924		9.5284		8.3547		9.1846		5.4839		7.1993	
PCB 029	0.0056		0.0175		0.0118		0.0113		0.0076		0.0042		0.003		0.0215		0.1141		0	U	0.0374		0.0331		0.0134	
PCB 033	0.8789		1.0816		2 1004		1.1362		1.3681		1 1402		2.0325		1.4598		2.2353		1.853		2.2047		1.1857		1.4602	
PCB 037/042	0.5769		0.7066		1.4995		0.7454		0.9387		0.8136		1.2427		0 9543		1.3658		1.0569		1.3321		0.9904		0 879	
PCB 040	0 2456		0 3077		0.556		0.3312		0.419		0.3776		0.5246		0 3966		0 5833		0.4679		0.5296		0.375		0.3793	
PCB 041/064/071	1.0857		1 2808		0	U	1.3601		1.5291		1.351		0	U	1.6801		0	U	2.0345		0	U	0	U	1.7502	
PCB 043	0 1513		0 1392		0.1944		0.1487		0.1525		0.1106		0.2161		0.1688		0.1676		0.1957		0.2193		0.1694		0.1631	
PCB 044	1.0732		1 3624		2.1365		1.3877		1.4952		1 3544		1.8899		1.7147		2.1344		2.0854		1.9385		1.3898		1.7235	
PCB 045	0 1614		0.223		0.3507		0.2478		0.2322		0.2422		0.3187		0.3581		0.3691		0.3438		0.3272		0.2488		0.3057	
PCB 046	0.098		0.1624		0 2149		0.1502		0 1324		0.1208		0.1524		0 1903		0 2244		0.212		0.1611		0.1182		0.1813	
PCB 047/048	0.8595		1.0116		1.443		0.9829		1.0729		0.9645		1.3576		1.1463		1.5122		1.4598		1.3924		0.8935		1.1664	
PCB 049	1.0273		1 3104		1 7179		1.2811		1.3014		1.1476		1.6079		1 4609		1.7843		1.9553		1.6364		1.1011		1.5901	
PCB 051	0.0546		0.0662		0 0805		0.0647		0 0666		0.0604		0.081		0 0849		0.1011		0.1093		0.0873		0.0676		0.0824	
PCB 052	1.0328		1.3857		1.5323		1.4334		1.1561		1.0298		1.412		1.6622		1.6407		2.245		1.4177		1.021		1.8212	
PCB 053	0 2012		0 2738		0.243		0.2941		0.1711		0.1515		0.1961		0.37		0.2558		0 3579		0.2071		0.1604		0.3251	
PCB 056/060	0.7966		0 9426		2 1182		1.0635		1.3104		1.1853		1.8745		1.2742		1.9836		1 4063		1 955		1.1947		1.2227	
PCB 063	0 0835		0.1248		0 2352		0.1435		0 1724		0.1425		0 2154		0 1857		0.2566		0 1782		0.2302		0.1452		0 1554	
PCB 066/095	1.9432		2.2007		3.7728		2.1831		2.7652		2.5389		3.7464		2.6874		3.9088		3.0822		3.4887		2.4247		2.5354	
PCB 070/076	1 1622		1.6543		2 2412		1.5429		1.555		1.4711		2.2056		1.9484		2.3631		3 417		2.0882		1.4812		2 3902	
PCB 074	0 4959		0.6151		0.811		0.6588		0.6409		0.6005		0.8778		0.7725		0.9753		0.8316		0.9024		0.6604		0.7057	
PCB 077/110	0.5231		0.5945		1.1657		0.7097		0.7733		0 7995		1.177		0.7488		1.2429		0.8525		1.1923		0.7248		0.744	
PCB 081	0.0091		0.0098		0.0266		0.0105		0.0234		0.0176		0.0243		0.0151		0.0312		0.0169		0.0326		0.0234		0.0135	
PCB 082	0 0787		0 1133		0 1123		0.0863		0.0767		0.0678		0.1235		0 1319		0.1019		0 1352		0.1488		0 0626		0.1157	
PCB 083	0 0312		0 0292		0.067		0.0377		0 0742		0.0414		0.0582		0 0494		0.0734		0.0485		0.0703		0.0654		0.0407	
PCB 084/092	0 2756		0.3423		0 6322		0.3606		0 4734		0.4462		0 5783		0 4363		0.6452		0.4727		0.5992		0.4254		0 4102	
PCB 085	0.0897		0.1019		0 2081		0.1192		0 1478		0 132		0 2007		0 1435		0.2112		0.1676		0.1998		0 1289		0.1387	
PCB 087	0 1388		0 1547		0 3147		0.1873		0.2283		0.2003		0.3083		0.2148		0.323		0.24		0.3039		0 2044		0.2101	
PCB 089	0.0218		0.0198		0 0164		0.0225		0 0063		0.0083		0 0078		0.0278		0.0144		0.0307		0.0177		0.0074		0.0276	
PCB 091	0.0535		0.0605		0.2392		0.0774		0 1821		0.1461		0.209		0.1621		0.2332		0.107		0.174		0.1194		0.0903	
PCB 097	0 1388		0 1569		0 2879		0.1758		0.1931		0.1834		0.2802		0.1848		0.2749		0 2387		0.26		0 2164		0.2013	
PCB 099	0 1933		0 2091		0 3488		0.2261		0.2447		0.2246		0.3127		0.2608		0.3501		0 3095		0.3218		0 2247		0.2597	
PCB 100	0.0391		0.0675		0.121		0.0784		0 0718		0.0532		0 0978		0 1156		0.1265		0 1017		0.1168		0.0622		0.0794	
PCB 101	0.3046		0.3403		0.5594		0.3818		0.4277		0 3983		0.5464		0 4254		0.5924		0.4977		0.5445		0.3771		0.4221	

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI68		89GH5FI70		89GH5FI71		89GH5FI72		89GH5FI73		89GH5FI74		89GH5FI75		89GH5FI76		89GH5FI77		89GH5FI78		89GH5FI79		89GH5FI80		89GH5FI81	
Sample Date	11/4/89		11/7/89		11/7/89		11/8/89		11/8/89		11/9/89		11/9/89		11/10/89		11/10/89		11/11/89		11/11/89		11/12/89		11/12/89	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 105/132/153	0.5561		0.6123		0.79		0.5583		0.6594		0.5659		0.7989		0.718		0.8263		0.7989		1.1321		0.5085		0.6472	
PCB 107	0.0532		0.0584		0.0638		0.057		0.0577		0.0456		0.0694		0.0902		0.0805		0.0833		0.1036		0.0318		0.058	
PCB 114/134	0.0522		0.0916		0.0705		0.0594		0.0646		0.0396		0.06		0.0926		0.0694		0.1104		0.1357		0.0381		0	U
PCB 118	0.3429		0.4411		0.5683		0.4254		0.4176		0.3656		0.5493		0.5601		0.5636		0.5759		0.7947		0.3368		0.4482	
PCB 119	0.0664		0.0454		0.0732		0.0591		0.0493		0.0499		0.0715		0.0613		0.0767		0.0723		0.0694		0.0482		0.053	
PCB 124/135/144/147	0.0654		0.0606		0.0718		0.0492		0.0603		0.0437		0.0745		0.0769		0.0734		0.0735		0.1007		0.0404		0.0569	
PCB 128	0.063		0.0495		0.0937		0.0449		0.072		0.0663		0.0959		0.058		0.1001		0.0652		0.134		0.0537		0.0586	
PCB 129/178	0.0264		0.0262		0.0315		0.0229		0.0286		0.0281		0.0376		0.0317		0.0461		0.0359		0.0475		0.0146		0.0296	
PCB 130	0.0655		0.0354		0.0626		0.0321		0.0492		0.0457		0.065		0.0401		0.0664		0.0493		0.0928		0.0375		0.0426	
PCB 131	0.0041		0.011		0.0095		0.0075		0.0217		0.0046		0.0066		0.0084		0.0079		0.009		0.0123		0.0041		0	U
PCB 136	0	U	0	U	0.0278		0	U	0.0205		0.0233		0.0261		0	U	0.0284		0	U	0	U	0	U	0.1625	
PCB 137/176	0.0111		0.0122		0.0203		0.012		0.0128		0.0165		0.0233		0	U	0.0206		0	U	0.0294		0.0118		0	U
PCB 138/158/163	0.3423		0.3359		0.4546		0.3205		0.3567		0.3501		0.4788		0.4278		0.465		0.4754		0.6528		0.3015		0.3938	
PCB 141	0.0458		0.0546		0	U	0.0464		0.0412		0	U	0.06		0.0536		0.0636		0.0724		0	U	0.0391		0.061	
PCB 146	0.2162		0.2756		0.2728		0.2007		0.2192		0.2		0.2798		0.3471		0.2949		0.4391		0.3883		0.1833		0.2862	
PCB 149	0.1941		0.2068		0.2258		0.1896		0.1874		0.1897		0.245		0.2701		0.2539		0.2905		0.3258		0.1468		0.2216	
PCB 151	0.0627		0.0813		0.0739		0.0688		0.0584		0.0609		0.0824		0.1042		0.0752		0.0971		0.1024		0.044		0.0791	
PCB 156/171/202	0.0527		0.0537		0.0762		0.0531		0.0538		0.0574		0.0733		0.0679		0.0715		0.0764		0.1079		0.06		0.0648	
PCB 157/200	0	U	0.0074		0.0025		0.0072		0	U	0.001		0	U	0	U	0.0379		0.0146		0.027		0	U	0.0103	
PCB 167	0.0122		0.012		0.028		0.008		0.0211		0.0162		0.0257		0.0089		0.0272		0.0207		0.0341		0.0104		0.0109	
PCB 169																										
PCB 170/190	0.1772		0.0979		0.1752		0.1482		0.1758		0.1671		0.1824		0.1208		0.1851		0.1479		0.2635		0.1114		0.1519	
PCB 172/197	0.0197		0.0178		0.0219		0.0165		0.0158		0.0172		0.0264		0.0227		0.0318		0.0264		0.0338		0.0163		0.0222	
PCB 173	0.0012		0.001		0	U	0.0007		0	U	0	U	0	U	0	U	0	U	0.0047		0	U	0	U	0.0022	
PCB 174	0.0615		0.0645		0.0719		0.0567		0.0616		0.0755		0.0883		0.0809		0.081		0.0899		0.1201		0.0608		0.0751	
PCB 175	0	U	0	U	0.004		0.0022		0.0074		0	U	0	U	0.0032		0.0071		0.0035		0.0043		0	U	0.0023	
PCB 177	0.049		0.05		0.0595		0.0433		0.0392		0.0469		0.0656		0.0618		0.0606		0.0673		0.08		0.0442		0.0551	
PCB 180	0.1407		0.1375		0.2114		0.1381		0.21		0.183		0.2414		0.1855		0.2274		0.2146		0.3097		0.1487		0.2165	
PCB 182/187	0.1046		0.0874		0.1386		0.0982		0.0999		0.1106		0.1535		0.1277		0.1265		0.1462		0.2009		0.0799		0.1184	
PCB 183	0.0434		0.0474		0.0748		0.0467		0.0551		0.0617		0.0832		0.0657		0.0773		0.0671		0.1051		0.0422		0.0555	
PCB 185	0.0067		0.0087		0.0123		0.0081		0.0072		0.0091		0.014		0.0113		0.016		0.0192		0.0135		0.0094		0.0096	
PCB 189	0.0064		0.001		0.0043		0.002		0.0025		0.0021		0.0041		0.0054		0.0044		0.0041		0.0056		0.0016		0.003	
PCB 191	0	U	0	U	0.0009		0.0038		0	U	0	U	0	U	0	U	0.0015		0.0029		0.0015		0.0011		0.0028	
PCB 193	0.0085		0.0086		0.0112		0.0079		0.0123		0.0133		0.01		0.0139		0.0149		0.0132		0.0205		0.0087		0.0109	
PCB 194	0.0299		0.0318		0.0472		0.033		0.046		0.0408		0.0593		0.0352		0.0504		0.0488		0.0678		0.034		0.0404	
PCB 195/208	0.0604		0.0578		0.1017		0.0569		0.0792		0.0718		0.1098		0.0731		0.1117		0.1004		0.1433		0.0662		0.0812	
PCB 196/203	0.0806		0.0935		0.1509		0.0915		0.1087		0.1125		0.1527		0.1027		0.1508		0.1284		0.2099		0.0879		0.1069	
PCB 198	0.0026		0.0024		0.0042		0.0019		0.0015		0.0019		0.0037		0.0058		0.0033		0.0034		0.0063		0.0022		0	U
PCB 199	0.0068		0.0058		0.0144		0.0067		0.0167		0.0118		0.0087		0.011		0.0204		0.0106		0.0253		0.0145		0.0086	
PCB 201	0.076		0.0788		0.1119		0.077		0.0876		0.0879		0.1232		0.0939		0.1198		0.1186		0.1637		0.0728		0.0984	
PCB 205	0.0013		0.0048		0	U	0.0013		0	U	0.0116		0	U	0.013		0	U	0.0185		0	U	0.0076		0.0129	
PCB 206	0.0376		0.0369		0.0746		0.0393		0.0633		0.0549		0.0739		0.0473		0.0808		0.071		0.1095		0.0594		0.058	
PCB 207	0.0038		0.0058		0.0079		0.004		0.0071		0.0058		0.0082		0.0054		0.0079		0.0112		0.0206		0.0067		0.0071	
PCB 209	0.0184		0.0211		0	U	0.02		0	U	0.0447		0	U	0	U	0	U	0.0429		0	U	0.0384		0.0359	
Total Suspended PCBs (by congener sum) =	27.10		32.77		50.39		33.69		37.12		32.54		46.94		41.45		52.31		50.80		51.34		31.82		41.93	
Total Congeners Analyzed (Susp) =	92		92		92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Susp) =	87		87		84		90		86		87		82		84		85		89		83		85		88	
Reported TPCBs (Susp) =																										

NOTE no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI82		89GH5FI83		89GH5FI84		90GH5FI100		90GH5FI101		90GH5FI102		90GH5FI103		90GH5FI104		90GH5FI105		90GH5FI106		90GH5FI107		90GH5FI108		90GH5FI109	
Sample Date	11/13/89		11/30/89		12/13/89		3/24/90		3/25/90		3/25/90		3/26/90		3/26/90		3/27/90		3/27/90		3/28/90		3/28/90		3/29/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.2902		0	U	0.012		0.0178		0	U	0	U	0	U	0.0915		0.0758		0	U	0	U	0	U	0	U
PCB 003	0	U	0	U	0.0989		0.0378		0	U	0.0565		0.0749		0.0615		0.014		0	U	0.0283		0	U	0.0106	
PCB 004/010	0.1297		0.1146		0.0112		0.0228		0.0282		0.0346		0.0481		0.0514		0.0147		0.0155		0.0229		0.0252		0.0198	
PCB 005/008	2.2967		3.3711		0.2363		0.7777		0.7237		0.9625		1.8251		1.818		0.6295		0.5446		0.8941		0.9155		0.6609	
PCB 006	0.4065		0.4928		0.0468		0.1101		0.1212		0.1333		0.2732		0.2581		0.0832		0.0753		0.1305		0.131		0.0939	
PCB 007	0.0442		0.0648		0.006		0.0114		0.0123		0.0129		0.0243		0.0231		0.0096		0.0087		0.0142		0.0145		0.01	
PCB 012/013	0.0126		0.0091		0.0081		0.0018		0.0021		0.0058		0.0021		0.0047		0.0025		0	U	0.0049		0.0047		0.0037	
PCB 016/032	1.7112		2.1651		0.2032		0.435		0.4045		0.4878		0.8859		0.9419		0.3438		0.3292		0.5304		0.5473		0.4266	
PCB 017	1.2411		1.7139		0.1685		0.2856		0.2789		0.3231		0.5669		0.5875		0.2137		0.2035		0.3133		0.3341		0.2682	
PCB 018	1.6893		1.9442		0.1909		0.372		0.378		0.4458		0.791		0.8384		0.309		0.3004		0.4514		0.5018		0.3902	
PCB 019	0.1131		0.0878		0.0057		0.0193		0.0224		0.0255		0.0441		0.0463		0.0162		0.0156		0.0241		0.0261		0.0208	
PCB 021	0.0058		0.0088		0	U	0	U	0	U	0.0029		0	U	0	U	0	U	0	U	0.0004		0	U	0	U
PCB 022	1.6193		2.513		0.1934		0.5896		0.5021		0.5828		1.1299		1.1469		0.4985		0.4103		0.7083		0.7289		0.5538	
PCB 024/027	0.1664		0.2256		0.0191		0.0527		0.0321		0.0479		0.091		0.097		0.0341		0.0328		0.0481		0.06		0.0444	
PCB 025	0.7636		1.1036		0.0877		0.2191		0.2085		0.2493		0.5814		0.5256		0.1893		0.1797		0.2841		0.2967		0.2241	
PCB 026	1.1379		1.4097		0.1356		0.3281		0.2895		0.3442		0.8645		0.8041		0.2719		0.2473		0.4124		0.4701		0.3309	
PCB 028/031	8.4455		12.1174		0.9803		2.4361		2.1678		2.5787		5.2478		5.0357		2.0394		1.7929		2.9372		3.1348		2.3663	
PCB 029	0.0387		0.0587		0	U	0.0086		0.002		0.0042		0.0109		0.0087		0.0125		0.0121		0.0172		0.0156		0.0119	
PCB 033	1.8487		2.707		0.2083		0.8215		0.5294		0.6435		1.2757		1.29		0.5013		0.4213		0.6867		0.7541		0.5477	
PCB 037/042	0.9905		1.6837		0.2438		0.3164		0.2559		0.3459		0.5615		0.523		0.2546		0.2344		0.373		0.3771		0.3037	
PCB 040	0.4384		0.6468		0.0978		0.1729		0.1378		0.1625		0.2681		0.2481		0.1272		0.1038		0.1949		0.169		0.1359	
PCB 041/064/071	1.8897		0	U	0.3181		0.5675		0	U	0	U	0	U	0	U	0.4889		0	U	0	U	0	U	0.5536	
PCB 043	0.1835		0.1736		0.0267		0.0355		0.0426		0.0447		0.07		0.0681		0.0383		0.0362		0.0463		0.0491		0.0397	
PCB 044	1.9324		2.5366		0.2981		0.5679		0.4848		0.583		0.9629		0.9795		0.4615		0.4207		0.6353		0.6791		0.5484	
PCB 045	0.3158		0.437		0.0406		0.0988		0.0878		0.1032		0.1643		0.189		0.0823		0.0693		0.1093		0.1178		0.1003	
PCB 046	0.2133		0.2184		0.0297		0.0432		0.0433		0.0466		0.1072		0.0825		0.0433		0.0328		0.0569		0.0494		0.0455	
PCB 047/048	1.3851		1.6668		0.246		0.3804		0.3519		0.384		0.6531		0.6504		0.3106		0.2844		0.4278		0.4514		0.3668	
PCB 049	1.8083		1.9915		0.2261		0.4657		0.4123		0.4744		0.8055		0.8207		0.3749		0.3429		0.5178		0.5594		0.4509	
PCB 051	0.098		0.1023		0.0136		0.0248		0.0254		0.0221		0.0354		0.043		0.0172		0.0167		0.0288		0.0297		0.0267	
PCB 052	2.0392		2.1449		0.1679		0.4196		0.3827		0.4773		0.7997		0.8186		0.3741		0.34		0.5135		0.498		0.4099	
PCB 053	0.3665		0.3291		0.0085		0.0721		0.0597		0.0693		0.1486		0.1484		0.0667		0.0508		0.0856		0.0756		0.0631	
PCB 056/060	1.4259		2.4892		0.1952		0.5491		0.4238		0.4817		0.882		0.8347		0.4552		0.3823		0.6762		0.6514		0.5126	
PCB 063	0.1804		0.2046		0.1018		0.0527		0.0528		0.0575		0.1001		0.0979		0.0525		0.0388		0.0734		0.066		0.0632	
PCB 066/095	3.2244		4.7524		0.5693		1.0678		0.7776		0.9928		1.6753		1.6634		0.923		0.7207		1.2116		1.1589		0.9469	
PCB 070/076	2.6709		3.3444		0.3063		0.7126		0.5162		0.6319		1.1395		1.016		0.6078		0.4781		0.6643		0.6879		0.6121	
PCB 074	0.8568		1.3073		0.1527		0.2977		0.1914		0.2426		0.416		0.4302		0.301		0.4241		0.4154		0.5288		0.4407	
PCB 077/110	0.8281		1.1595		0.1349		0.325		0.2557		0.3052		0.4738		0.4774		0.274		0.2301		0.3693		0.3948		0.3056	
PCB 081	0.0148		0.0254		0.0051		0.0059		0.0061		0.0128		0.0203		0.0161		0.005		0.0094		0.0127		0	U	0.0086	
PCB 082	0.1387		0.2205		0.0126		0.0336		0.0294		0.0378		0.0808		0.0959		0.0245		0.0232		0.0346		0.0365		0.0277	
PCB 083	0.0525		0.073		0.0067		0.0184		0.0251		0.0152		0.0495		0.0479		0.0103		0.0114		0.0232		0.0188		0.0136	
PCB 084/092	0.4724		0.6875		0.079		0.1855		0.1599		0.2032		0.3227		0.325		0.1408		0.1278		0.2091		0.2146		0.1715	
PCB 085	0.1582		0.2625		0.0243		0.0658		0.0467		0.0523		0.0954		0.0915		0.0521		0.0444		0.073		0.0746		0.0584	
PCB 087	0.2297		0.3738		0.0402		0.0968		0.0783		0.0856		0.1497		0.15		0.0803		0.0723		0.1089		0.117		0.0913	
PCB 089	0.0275		0.0341		0.0007		0	U	0.0013		0.004		0.0072		0.0074		0.003		0	U	0.0139		0	U	0.0056	
PCB 091	0.1079		0.2293		0.033		0.0591		0.0258		0.0363		0.0496		0.0953		0.0292		0.0328		0.0675		0.0688		0.0498	
PCB 097	0.2241		0.308		0.0368		0.0911		0.0659		0.0748		0.1397		0.1355		0.0697		0.0691		0.0993		0.1015		0.0868	
PCB 099	0.3137		0.3784		0.0407		0.1124		0.0818		0.0897		0.1491		0.1456		0.0866		0.0758		0.1166		0.1222		0.0975	
PCB 100	0.1309		0.1415		0.0594		0.0293		0.0195		0.0741		0.0468		0.1167		0.0337		0.0209		0.0542		0.0322		0.0253	
PCB 101	0.515		0.6229		0.076		0.2019		0.1556		0.1683		0.2733		0.2737		0.1604		0.1407		0.2072		0.2185		0.1719	

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5FI82		89GH5FI83		89GH5FI84		90GH5FI100		90GH5FI101		90GH5FI102		90GH5FI103		90GH5FI104		90GH5FI105		90GH5FI106		90GH5FI107		90GH5FI108		90GH5FI109	
Sample Date	11/13/89		11/30/89		12/13/89		3/24/90		3/25/90		3/25/90		3/26/90		3/26/90		3/27/90		3/27/90		3/28/90		3/28/90		3/29/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 105/132/153	0.7711		1.0248		0.1622		0.2774		0.2767		0.2841		0.4846		0.5579		0.2101		0.1919		0.2661		0.2749		0.2166	
PCB 107	0.0966		0.1341		0.0073		0.0236		0.021		0.0276		0.043		0.0507		0.017		0.0145		0.0217		0.0229		0.0195	
PCB 114/134	0	U	0.0692		0	U	0.0356		0.0282		0.0224		0.0588		0.0904		0.0182		0.0173		0.0217		0.0245		0.0194	
PCB 118	0.5893		0.8635		0.0749		0.1637		0.157		0.1783		0.3159		0.3436		0.1256		0.1123		0.1661		0.1725		0.134	
PCB 119	0.0755		0.0576		0.0089		0.0257		0.0176		0.0211		0.0282		0.0276		0.0188		0.0203		0.0274		0.0221		0.0186	
PCB 124/135/144/147	0.0938		0.0703		0.0095		0.029		0.0258		0.0368		0.0435		0.0677		0.0184		0.0162		0.0227		0.021		0.0196	
PCB 128	0.0613		0.1037		0.0172		0.033		0.0276		0.0336		0.0495		0.0638		0.0242		0.0221		0.032		0.0311		0.0241	
PCB 129/178	0.0355		0.0397		0.0051		0.0155		0.0138		0.0171		0.0279		0.0289		0.0091		0.0089		0.0134		0.0141		0.0104	
PCB 130	0.0462		0.0477		0.0091		0.0259		0.0227		0.0245		0.2912		0.3055		0.0178		0.0155		0.0276		0.0299		0.0184	
PCB 131	0	U	0.009		0	U	0	U	0.0033		0.0024		0.0084		0.0187		0.0022		0.0015		0.0024		0.0028		0.0025	
PCB 136	0.1646		0	U	0.0047		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137/176	0	U	0.0172		0.0029		0.0077		0.0067		0.0082		0.0123		0.0135		0.0058		0.0073		0.0078		0.0068		0.0056	
PCB 138/158/163	0.4821		0.54		0.0829		0.2227		0.1611		0.1743		0.2875		0.3326		0.1443		0.132		0.1814		0.182		0.1459	
PCB 141	0.0766		0.093		0.0113		0.0291		0.0239		0.0281		0.045		0.0532		0.0194		0.0175		0.0238		0.0246		0.0198	
PCB 146	0.4564		0.2976		0.0367		0.1012		0.0978		0.1102		0.1863		0.2098		0.0735		0.0662		0.0939		0.0979		0.0754	
PCB 149	0.2831		0.3056		0.0475		0.0941		0.1066		0.1135		0.1708		0.2004		0.0653		0.059		0.0818		0.0868		0.0688	
PCB 151	0.1256		0.0949		0.0153		0.0335		0.0298		0.0406		0.0646		0.0893		0.0223		0.0211		0.027		0.0272		0.0254	
PCB 156/171/202	0.0648		0.1013		0.0125		0.0289		0.0239		0.0278		0	U	0.0524		0.0235		0.0199		0.0271		0	U	0.022	
PCB 157/200	0.0118		0.0241		0.0056		0.0025		0.0108		0.0152		0.0247		0.0269		0.0046		0.0051		0	U	0	U	0	U
PCB 167	0.0174		0.0264		0.0031		0.0079		0.0068		0.0089		0.014		0.0221		0.0074		0.0076		0.0091		0.0091		0.0077	
PCB 169																										
PCB 170/190	0.1961		0.1621		0.0228		0.0941		0.0504		0.0442		0.0784		0.0945		0.0541		0.0559		0.0674		0.0764		0.061	
PCB 172/197	0.025		0.0291		0.0036		0.0101		0.0077		0.0087		0.0155		0.0172		0.0079		0.0068		0.01		0.0102		0.0076	
PCB 173	0.003		0.0007		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0857		0.0983		0.0161		0.0421		0.0314		0.0323		0.0548		0.0554		0.0225		0.0199		0.0303		0.0304		0.0262	
PCB 175	0.0041		0	U	0	U	0.0031		0.0016		0	U	0	U	0.0031		0	U	0	U	0	U	0	U	0	U
PCB 177	0.0592		0.0769		0.011		0.0357		0.0229		0.0251		0.0364		0.0411		0.0196		0.0155		0.0232		0.0232		0.0192	
PCB 180	0.1919		0.2535		0.0376		0.0814		0.0656		0.0707		0.1363		0.1281		0.068		0.059		0.0935		0.0847		0.0689	
PCB 182/187	0.1516		0.1418		0.0199		0.0512		0.0451		0.0637		0.1005		0.0979		0.0397		0.032		0.0464		0.0461		0.0374	
PCB 183	0.0658		0.0763		0.0103		0.0304		0.0237		0.0341		0.0445		0.0571		0.0197		0.016		0.0256		0.0238		0.0198	
PCB 185	0.0189		0.0214		0.0006		0	U	0.0044		0.0042		0.009		0.0105		0.0045		0.0048		0.0069		0.0057		0.0051	
PCB 189	0.004		0.0046		0	U	0.003		0.0014		0.0012		0.0037		0.0031		0.0019		0	U	0.003		0.0036		0	U
PCB 191	0	U	0.0032		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.012		0.0128		0.0014		0.0068		0.006		0.0029		0.0054		0.0056		0.0072		0.0043		0.0086		0.0054		0.0074	
PCB 194	0.0419		0.0637		0.0089		0.0212		0.0121		0.0163		0.0646		0.0235		0.0207		0.0178		0.0282		0.0268		0.0209	
PCB 195/208	0.0891		0.1139		0.0147		0.0393		0.0291		0.0302		0.1301		0.0547		0.0363		0.0371		0.0498		0.0558		0.0371	
PCB 196/203	0.1167		0.1718		0.0186		0.0505		0.0409		0.0435		0	U	0.0867		0.0441		0.0384		0.0608		0.0578		0.0441	
PCB 198	0.0093		0.0022		0	U	0.0029		0.001		0.001		0.005		0.0029		0.0015		0.0015		0.0015		0.0024		0.0017	
PCB 199	0.0099		0.0157		0.0033		0.0038		0.0052		0.0048		0.0104		0.0069		0.0038		0.0028		0.004		0.0035		0.0026	
PCB 201	0.1063		0.1305		0.017		0.0456		0.0339		0.0381		0.1739		0.0697		0.038		0.0335		0.0511		0.051		0.0378	
PCB 205	0.0239		0.0233		0.0031		0.0093		0	U	0.0033		0.012		0	U	0	U	0	U	0.0092		0	U	0	U
PCB 206	0.0608		0.085		0.0088		0.0343		0.0172		0.0219		0.2187		0.0379		0.0312		0.0273		0.0508		0.0441		0.0301	
PCB 207	0.0098		0.0156		0.0012		0.0056		0.004		0.0046		0.022		0.0065		0.0035		0.0055		0.0066		0.0051		0.0036	
PCB 209	0.0326		0	U	0.0057		0.0198		0.0153		0.0178		0.0362		0.0307		0.0188		0.0184		0.0267		0.0254		0.0185	
Total Suspended PCBs (by congener sum) =	49.96		64.07		6.92		15.16		12.38		14.86		27.70		27.61		12.48		10.58		16.58		17.14		14.02	
Total Congeners Analyzed (Susp) =	92		92		92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Susp) =	87		86		83		85		84		86		83		86		86		80		85		79		83	
Reported TPCBs (Susp) =																										

NOTE no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5FI110		90GH5FI111		90GH5FI112		90GH5FI113		90GH5FI114		90GH5FI115		90GH5FI116		90GH5FI117		90GH5FI118		90GH5FI119		90GH5FI85		90GH5FI86		90GH5FI87	
Sample Date	3/30/90		3/30/90		3/31/90		4/1/90		4/1/90		4/3/90		4/11/90		4/18/90		4/24/90		5/1/90		1/11/90		1/29/90		2/6/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.0493		0.0898		0	U	0	U	0	U	0.0255		0	U	0.009		0	U	0	U	0	U	0	U		
PCB 003	0.0216		0.0053		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 004/010	0.0303		0.0221		0.0418		0.0504		0.0584		0.0484		0.0578		0.0873		0.0518		0.041		0.0088		0.0281			
PCB 005/008	1.1331		0.726		1.4692		1.3204		1.5164		1.563		1.2532		1.4097		1.5629		0.9506		0.2694		0.2594			
PCB 006	0.1669		0.0984		0.2256		0.2134		0.2496		0.2482		0.2069		0.2105		0.2315		0.1422		0.0288		0.0318			
PCB 007	0.0182		0.0122		0.0244		0.0201		0.0222		0.0229		0.0115		0.0197		0.024		0.0162		0.0081		0.0054			
PCB 012/013	0.0124		0.0039		0.0046		0.0044		0.0052		0.0062		0.0103		0.0209		0.0151		0.0075		0.0026		0.0056			
PCB 016/032	0.7315		0.5048		0.9143		0.8387		1.0048		1.1998		1.3146		1.4581		1.4095		0.882		0.1666		0.1789			
PCB 017	0.4534		0.3339		0.5763		0.5458		0.6802		0.7819		1.0474		1.3886		0.9234		0.6139		0.0874		0.1357			
PCB 018	0.6754		0.4534		0.8129		0.7617		0.9427		1.1327		1.2334		1.7129		1.3936		0.9909		0.1332		0.1467			
PCB 019	0.0339		0.0242		0.0432		0.0417		0.0506		0.0582		0.0717		0.0814		0.0826		0.0546		0.0127		0.0073			
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0227		0	U	0	U		
PCB 022	0.9433		0.6163		1.1453		0.8795		1.0826		1.3032		1.0628		1.243		1.6225		1.1131		0.0948		0.1759			
PCB 024/027	0.0773		0.0494		0.0953		0.0863		0.0952		0.1237		0	U	0.1983		0.1875		0.1176		0.0206		0.0218			
PCB 025	0.3916		0.2781		0.4914		0.4522		0.6083		0.632		0.5952		0.7353		0.8199		0.5531		0.0636		0.0667			
PCB 026	0.7526		0.4066		0.8783		0.6755		0.6471		0.7927		0.7417		0.9485		1.1682		0.7766		0.0972		0.1168			
PCB 028/031	4.3842		2.7534		5.1489		4.0648		5.2095		6.9662		5.719		7.6526		7.0391		4.8723		0.6991		0.7919			
PCB 029	0.0156		0.0124		0.0202		0.0072		0.0092		0.0333		0.0284		0.0276		0.052		0.0221		0.0064		0.0057			
PCB 033	0.9675		0.6426		1.1961		0.9805		1.1635		1.4189		0.8944		1.1463		1.4646		0.9612		0.1559		0.1828			
PCB 037/042	0.5111		0.3616		0.5844		0.4815		0.586		0.7675		0.8898		1.2033		1.2121		0.8673		0.1176		0.1748			
PCB 040	0.2448		0.157		0.2648		0.2212		0.2849		0.3824		0.4231		0.5388		0.5349		0.4153		0.0452		0.0583			
PCB 041/064/071	0.9716		0.6572		0	U	0	U	0	U	1.4864		0	U	2.2011		0	U	0	U	0.1869		0	U		
PCB 043	0.0667		0.0425		0.0737		0.0622		0.0797		0.1072		0.2258		0.2084		0.1759		0.1423		0.0212		0.0103			
PCB 044	0.9437		0.6596		1.0544		0.88		1.1076		1.4768		1.7476		2.4531		2.1619		1.5901		0.1873		0.2659			
PCB 045	0.163		0.1159		0.1848		0.1625		0.1999		0.2417		0.3105		0.4331		0.4409		0.2911		0.0205		0.05			
PCB 046	0.0773		0.0535		0.0964		0.0857		0.1098		0.1319		0.1866		0.241		0.2014		0.1647		0.0163		0.0223			
PCB 047/048	0.6219		0.4404		0.6951		0.5808		0.7382		0.9808		1.1626		1.634		1.4546		1.0801		0.1781		0.1865			
PCB 049	0.7837		0.5495		0.8802		0.7405		0.9623		1.3318		1.7514		1.5232		1.7792		1.2731		0.174		0.2081			
PCB 051	0.0401		0.0275		0.0465		0.0378		0.0501		0.056		0.0831		0.0976		0.1105		0.0715		0.0153		0.014			
PCB 052	0.7238		0.4832		0.8084		0.7448		0.9185		1.1236		1.4804		1.8632		1.7651		1.2408		0.2183		0.1621			
PCB 053	0.102		0.0781		0.1199		0.1172		0.1418		0.1569		0.379		0.4328		0.3438		0.2581		0.0258		0.0139			
PCB 056/060	0.8901		0.5764		1.0192		0.8781		0.8587		1.1605		1.1654		1.3728		1.8147		1.5258		0.1489		0.2048			
PCB 063	0.1195		0.0731		0.113		0.0845		0.115		0.1494		0.1589		0.1863		0.1999		0.1566		0.0136		0.029			
PCB 066/095	1.7504		0.993		1.9384		1.3872		1.66		2.0535		2.3929		2.8965		2.9541		2.5373		0.3329		0.4532			
PCB 070/076	1.0136		0.5976		1.1617		0.8879		1.0521		1.2872		1.5505		1.7513		1.6565		1.6133		0.2381		0.2979			
PCB 074	0.4981		0.353		1.0176		0.357		0.457		0.6294		0.6627		0.7806		0.8826		0.8271		0.107		0.2693			
PCB 077/110	0.5251		0.3433		0.5478		0.3925		0.4978		0.6704		0.7836		1.0221		1.1009		0.885		0.0982		0.1635			
PCB 081	0.0142		0.0062		0.0134		0.0151		0.0196		0.018		0.015		0.0236		0.0254		0.0204		0.0013		0.0048			
PCB 082	0.0507		0.0347		0.058		0.0582		0.0849		0.0764		0.0983		0.1402		0.1459		0.1281		0.0153		0.0105			
PCB 083	0.0357		0.023		0.0384		0.0254		0.047		0.0601		0.0482		0.0669		0.0593		0.0503		0.0019		0.0067			
PCB 084/092	0.273		0.1853		0.3248		0.2715		0.3368		0.4099		0.5013		0.7407		0.7566		0.5284		0.0442		0.0925			
PCB 085	0.1034		0.071		0.1135		0.0798		0.0999		0.1467		0.1785		0.2032		0.2316		0.2046		0.0174		0.0262			
PCB 087	0.1584		0.1117		0.1726		0.1228		0.1553		0.2244		0.2597		0.2954		0.3505		0.2957		0.0304		0.0433			
PCB 089	0.0083		0.009		0.0162		0.0071		0.0092		0.0211		0.0283		0.0616		0.0264		0.0144		0.004		0	U		
PCB 091	0.1106		0.0489		0.1338		0.0645		0.1019		0.098		0.1672		0.2187		0.1822		0.1478		0.001		0.0145			
PCB 097	0.1368		0.0929		0.1542		0.1048		0.139		0.1977		0.1957		0.2642		0.2961		0.2424		0.0291		0.0467			
PCB 099	0.1616		0.1172		0.1838		0.1348		0.17		0.2248		0.2542		0.3567		0.3676		0.2996		0.0338		0.0506			
PCB 100	0.0487		0.0306		0.058		0.0513		0.0693		0.0848		0.0934		0.0947		0.1022		0.077		0.0085		0.0126			
PCB 101	0.2806		0.209		0.3125		0.2305		0.2875		0.4052		0.4105		0.5744		0.6136		0.479		0.06		0.0939			

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5FI110		90GH5FI111		90GH5FI112		90GH5FI113		90GH5FI114		90GH5FI115		90GH5FI116		90GH5FI117		90GH5FI118		90GH5FI119		90GH5FI85		90GH5FI86		90GH5FI87	
Sample Date	3/30/90		3/30/90		3/31/90		4/1/90		4/1/90		4/3/90		4/11/90		4/18/90		4/24/90		5/1/90		1/11/90		1/29/90		2/6/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 105/132/153	0.3632		0.2665		0.3958		0.4183		0.5139		0.5006		0.552		0.7642		0.725		0.6605		0.1347		0.117			
PCB 107	0.0317		0.0229		0.0326		0.0353		0.0612		0.0418		0.0476		0.0683		0.0776		0.0725		0.0138		0.0108			
PCB 114/134	0.0296		0.0233		0.0377		0.0429		0.0621		0.0447		0.0488		0.0748		0.0626		0.0553		0.0297		0.0102			
PCB 118	0.2297		0.163		0.257		0.245		0.3171		0.3196		0.3466		0.4821		0.4738		0.438		0.0703		0.0639			
PCB 119	0.0276		0.0253		0.031		0.0274		0.0326		0.0497		0.031		0.0531		0.0801		0.0644		0.0104		0.0102			
PCB 124/135/144/147	0.0311		0.0226		0.0326		0.0458		0.0535		0.0441		0.0406		0.0787		0.0816		0.0634		0.0128		0.0099			
PCB 128	0.0418		0.0274		0.048		0.0413		0.0577		0.0578		0.0616		0.0777		0.1004		0.0915		0.0137		0.0152			
PCB 129/178	0.0182		0.0115		0.019		0.0217		0.0259		0.026		0.0263		0.0381		0.0361		0.03		0.0056		0.0048			
PCB 130	0.0436		0.0224		0.0389		0.0345		0.0619		0.0448		0.0557		0.0725		0.0595		0.0533		0.0088		0.0093			
PCB 131	0.0035		0.0032		0.0039		0.0034		0.0045		0.006		0.0062		0.0065		0.0068		0.0064		0.0032		0.0012			
PCB 136	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 137/176	0.0097		0.0076		0.0108		0.011		0.012		0.0123		0.0125		0.0184		0.0169		0.0149		0.0048		0.0039			
PCB 138/158/163	0.2428		0.1734		0.2506		0.2357		0.301		0.33		0.3423		0.455		0.4269		0.3836		0.0912		0.0859			
PCB 141	0.0296		0.0241		0.0326		0.0381		0.0429		0.0469		0.0525		0.0696		0.0581		0.0558		0.0117		0.013			
PCB 146	0.1265		0.0904		0.1436		0.1498		0.1828		0.1961		0.1973		0.3062		0.2355		0.2023		0.0438		0.0403			
PCB 149	0.1067		0.0855		0.1192		0.1619		0.1839		0.1512		0.1701		0.2496		0.2359		0.1897		0.0487		0.0393			
PCB 151	0.0343		0.0281		0.0408		0.056		0.0678		0.0518		0.0557		0.0866		0.0822		0.0674		0.0148		0.0124			
PCB 156/171/202	0.0408		0.0253		0.0445		0.0344		0.0437		0.0535		0.0632		0.0829		0.0633		0.0778		0.0121		0.0099			
PCB 157/200	0	U	0	U	0.0039		0.0159		0.0234		0	U	0.0266		0.0288		0	U	0	U	0	U	0	U		
PCB 167	0.0104		0.0079		0.0133		0.0083		0.0155		0.0167		0.0144		0.0195		0.0357		0.034		0.0038		0.0073			
PCB 169																										
PCB 170/190	0.1113		0.0791		0.1064		0.0611		0.0981		0.1577		0.1308		0.1595		0.1254		0.1341		0.0348		0.0343			
PCB 172/197	0.0132		0.0096		0.0153		0.0118		0.0152		0.0194		0.0248		0.0272		0.022		0.0209		0.0037		0.0048			
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0.0007		0	U	0	U	0	U	0	U	0	U		
PCB 174	0.0393		0.0279		0.0475		0.0417		0.0527		0.06		0.0623		0.0872		0.0688		0.0692		0.014		0.0122			
PCB 175	0	U	0	U	0	U	0.0026		0	U	0	U	0	U	0	U	0	U	0.0043		0	U	0	U		
PCB 177	0.0313		0.0208		0.0333		0.0335		0.0401		0.0419		0.0477		0.0623		0.0585		0.0563		0.0095		0.011			
PCB 180	0.109		0.0752		0.1315		0.1008		0.1213		0.1491		0.1729		0.216		0.1792		0.1826		0.0352		0.0388			
PCB 182/187	0.0575		0.0446		0.0697		0.066		0.083		0.089		0.1004		0.1278		0.1234		0.1117		0.0229		0.0221			
PCB 183	0.035		0.0224		0.0363		0.0335		0.0497		0.0488		0.0519		0.0738		0.0761		0.0683		0.0104		0.0116			
PCB 185	0.0105		0.0062		0.0085		0.0051		0.011		0.0355		0.0126		0.0134		0.0131		0.0111		0.001		0.0019			
PCB 189	0.0039		0.0032		0.0049		0.0043		0.0045		0.0052		0.0038		0.0049		0.0059		0.0052		0.0005		0.0012			
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 193	0.0058		0.0039		0.0088		0.0076		0.01		0.0105		0.0145		0.019		0.0078		0.01		0.002		0.0012			
PCB 194	0.0348		0.0244		0.0405		0.0164		0.0225		0.048		0.0546		0.0595		0.0532		0.0582		0.0115		0.0235			
PCB 195/208	0.0568		0.0388		0.0678		0.0375		0.0501		0.0807		0.0852		0.1014		0.095		0.1016		0.0141		0.0196			
PCB 196/203	0.0728		0.051		0.0893		0.0682		0.078		0.1027		0.1201		0.1711		0.1168		0.1321		0.0178		0.0288			
PCB 198	0.0025		0.0019		0.0029		0.0012		0.0023		0.0034		0.0043		0.0042		0.0034		0.0048		0.007		0.0002			
PCB 199	0.0048		0.0032		0.0058		0.0073		0.0081		0.006		0.0079		0.0094		0.0078		0.0081		0.0015		0.0019			
PCB 201	0.0615		0.0413		0.0726		0.0484		0.0621		0.0877		0.0951		0.1308		0.1015		0.112		0.0156		0.0183			
PCB 205	0	U	0	U	0	U	0.0091		0.0055		0	U	0.0187		0.0033		0.0178		0.0214		0	U	0.0053			
PCB 206	0.0522		0.0335		0.0676		0.024		0.0383		0.0681		0.0746		0.0897		0.0694		0.0922		0.0083		0.0159			
PCB 207	0.0067		0.0047		0.0079		0.0054		0.0056		0.0083		0.0061		0.0112		0.0133		0.0174		0.0052		0.0028			
PCB 209	0.0285		0.0212		0.0379		0.0192		0.0267		0.0333		0	U	0.0411		0.0528		0	U	0.0025		0.012			
Total Suspended PCBs (by congener sum) =	**24.44**		**16.08**		**27.68**		**22.24**		**27.53**		**35.57**		**35.09**		**46.67**		**44.06**		**33.35**		**5.00**		**5.88**			
Total Congeners Analyzed (Susp) =	**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**			
Total Congeners Detected (Susp) =	**85**		**85**		**83**		**85**		**84**		**84**		**83**		**86**		**83**		**84**		**83**		**82**			
Reported TPCBs (Susp) =																										

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5FI88		90GH5FI89		90GH5FI90		90GH5FI91		90GH5FI92		90GH5FI93		90GH5FI94		90GH5FI95		90GH5FI96		90GH5FI97		90GH5FI98		90GH5FI99	
Sample Date	2/21/90		3/6/90		3/19/90		3/20/90		3/20/90		3/21/90		3/21/90		3/22/90		3/22/90		3/23/90		3/23/90		3/24/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0.0178		0.0689		0 0684		0.0165		0.0551		0.0113		0	U	0	U	0	U	0	U	0	U
PCB 003	0	U	0	U	0	U	0	U	0.0479		0	U	0.0412		0.0549		0	U	0	U	0	U	0	U
PCB 004/010	0.0151		0.0315		0.0558		0 0235		0.0308		0.025		0.0314		0.0439		0.0725		0.041		0.0565		0.0259	
PCB 005/008	0.4808		0.43		1.247		0.8933		1.0443		0.7311		0 9901		1 8355		1 6461		1 0395		1.6888		0 6819	
PCB 006	0 0625		0.0486		0 159		0 1052		0 146		0.0871		0.1502		0.257		0.2008		0.1255		0.2399		0.0975	
PCB 007	0 0084		0 0064		0.0171		0.0121		0.0137		0.0096		0 0145		0.0239		0 022		0 0177		0 0233		0 0099	
PCB 012/013	0.0025		0 0064		0.0055		0 0018		0	U	0	U	0	U	0.0111		0.0066		0.0026		0.0044		0.0028	
PCB 016/032	0.2737		0 3279		0 646		0 4779		0.5294		0.4267		0.5989		0.883		0.8295		0.5823		0.8345		0.3703	
PCB 017	0.1933		0 2206		0.4077		0.3174		0.4008		0.3042		0 4239		0.5948		0.5534		0.3926		0.5725		0.2602	
PCB 018	0.2528		0.2908		0.5608		0.4096		0.4863		0.3637		0.5219		0.7679		0.7627		0 5155		0.7611		0.3467	
PCB 019	0.0221		0 0157		0.032		0.0212		0.024		0.0207		0.0318		0.0402		0.0383		0 0299		0.0427		0 0182	
PCB 021	0.0039		0	U	0	U	0	U	0	U	0	U	0	U	0.0001		0	U	0	U	0	U	0	U
PCB 022	0.259		0.3364		0 8653		0.6203		0.7201		0.5311		0.7644		1.2112		0.9511		0.6793		1.0413		0.4382	
PCB 024/027	0.0371		0.0421		0.0757		0.0514		0.0605		0.0427		0 0701		0.1017		0.0636		0 0611		0.091		0 0328	
PCB 025	0.1511		0.1647		0.3509		0.2549		0.315		0.204		0.3228		0.4569		0.4723		0.2832		0.5015		0.1768	
PCB 026	0.2206		0.2437		0 5469		0.3723		0.4587		0.3088		0.4903		0.7712		0.5094		0.4047		0.5252		0.2489	
PCB 028/031	1.4118		1.6184		3.6435		2.655		3.1003		2.2886		3.2865		4.8648		4.6963		2.9275		4 7528		1.9252	
PCB 029	0 0042		0.0194		0.0235		0.0071		0 0115		0 0067		0.0149		0.0247		0.006		0	U	0.0065		0.0009	
PCB 033	0.2798		0.3266		0 1251		0.0885		0.9164		0.5293		0.7693		1.2231		1.12		0.7033		1.1597		0.4687	
PCB 037/042	0 1992		0.2609		0.4645		0.3108		0 3684		0.3208		0.4166		0.5719		0.4741		0.3347		0.4975		0.2219	
PCB 040	0.0737		0.1135		0.2245		0.1605		0.2078		0.154		0.2313		0.2737		0.2328		0 1841		0 2443		0.1312	
PCB 041/064/071	0.3228		0.4511		0 8888		0.6155		0.6813		0.5783		0.7967		1.0962		0	U	0	U	0.9454		0	U
PCB 043	0.0337		0.0371		0.055		0.0386		0.0474		0 0357		0.0476		0.0743		0.0589		0.048		0.0666		0.0339	
PCB 044	0.3184		0 4606		0.8183		0.5984		0.678		0.5648		0.7787		1.0185		0.8908		0 6716		0 9172		0.4314	
PCB 045	0.0555		0.0831		0 1535		0.1025		0 1219		0.1045		0.1446		0.2185		0.1399		0.1219		0.1723		0.0827	
PCB 046	0.0237		0.0341		0.0708		0.0482		0.06		0 0413		0.0657		0.0921		0.0669		0.0876		0.0855		0.0389	
PCB 047/048	0.2519		0.3091		0.5623		0.4177		0.4595		0.3785		0.5479		0.6846		0.5928		0.4448		0.6192		0.3851	
PCB 049	0.2927		0.381		0.6865		0.5146		0 5757		0 472		0.6599		0.8459		0 7655		0.5402		0 7892		0.3692	
PCB 051	0.0188		0.0191		0 0387		0.0234		0.028		0.0257		0.0364		0.0479		0.0292		0.034		0.0398		0.0315	
PCB 052	0 3258		0.3252		0.6396		0.46		0 4975		0 4122		0.5823		0.8266		0.7431		0.5713		0.7269		0.3497	
PCB 053	0.0584		0.0466		0	U	0	U	0	U	0.0923		0.1319		0	U	0	U	0	U	0	U	0.0602	
PCB 056/060	0.2633		0.3651		0.8226		0.5747		0.6164		0.4876		0.7		0.9568		0.7518		0.5473		0.7563		0.353	
PCB 063	0.0309		0.0313		0 0856		0.074		0.0823		0.0525		0.0781		0.1126		0.0882		0.0722		0.082		0.0455	
PCB 066/095	0.6428		0.7981		1.5998		1 195		1.3078		0.9991		1.399		1.9377		1.5834		1.1878		1.5535		0.7791	
PCB 070/076	0.437		0.4815		0.9617		0.7719		0.6701		0.6283		0.8844		1.1881		1 0083		0.7184		0 9326		0.4856	
PCB 074	0.2141		0.2088		0.4399		0 3675		0.3818		0.2719		0.3827		0.5325		0.3895		0.3131		0.4097		0.1855	
PCB 077/110	0.1736		0.2683		0.4973		0.3485		0.3766		0 3056		0.4256		0.5461		0 4409		0.3311		0 4417		0.2294	
PCB 081	0.0028		0.0053		0.0148		0.0115		0.011		0 0097		0.0162		0.0151		0 0126		0.0121		0.0135		0	U
PCB 082	0.03		0.0247		0.0458		0.034		0.0409		0 0319		0.0485		0.0602		0 0648		0.0437		0 0648		0 0312	
PCB 083	0.0075		0.0125		0.0324		0 0351		0.0194		0 0168		0.022		0.0352		0.0234		0.0221		0.0405		0.0106	
PCB 084/092	0.0881		0.153		0.3187		0 2426		0.2162		0.1894		0.2413		0.3324		0.2993		0.2308		0.3108		0.1708	
PCB 085	0.0283		0 042		0.0955		0 0682		0.0724		0.0597		0.0851		0.1115		0.0718		0.0621		0.0847		0.0512	
PCB 087	0.0467		0 0731		0.1508		0.1078		0.1177		0.0984		0.1348		0.1728		0.1262		0.103		0.139		0.0884	
PCB 089	0.006		0	U	0.0113		0 0078		0	U	0	U	0.0033		0.007		0.0034		0.0035		0.0038		0 0018	
PCB 091	0.023		0 0319		0.0856		0.0683		0.0555		0.0442		0.0757		0.0965		0.0733		0 0514		0.0933		0 0519	
PCB 097	0.0443		0.0708		0.1361		0 0991		0.1086		0.0919		0.1192		0.1475		0.1141		0.1008		0.1162		0.0596	
PCB 099	0 0602		0.0877		0.166		0 1239		0.1264		0.1018		0.1457		0 1977		0.1466		0.114		0.1439		0 0784	
PCB 100	0 0184		0.0238		0.0426		0 0298		0.0313		0.0258		0.0382		0.0586		0.0413		0.03		0.0427		0.0185	
PCB 101	0.1019		0.1492		0 288		0 2126		0.2303		0.1915		0.2605		0.32		0.2616		0.2106		0.263		0.1467	

Table H-12. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Suspended)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5FI88		90GH5FI89		90GH5FI90		90GH5FI91		90GH5FI92		90GH5FI93		90GH5FI94		90GH5FI95		90GH5FI96		90GH5FI97		90GH5FI98		90GH5FI99	
Sample Date	2/21/90		3/6/90		3/19/90		3/20/90		3/20/90		3/21/90		3/21/90		3/22/90		3/22/90		3/23/90		3/23/90		3/24/90	
Fraction	Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended		Suspended	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 105/132/153	0.2036		0.184		0.3701		0.2798		0.3198		0.2531		0.3751		0.4532		0.4999		0.3824		0.4796		0.2681	
PCB 107	0.0142		0.0148		0.0335		0.0249		0.0268		0.0248		0.0338		0.0376		0.0344		0.036		0.0477		0.0191	
PCB 114/134	0.0307		0.0146		0.0329		0.0239		0.0292		0.0475		0.0333		0.0447		0	U	0	U	0.0543		0.0331	
PCB 118	0.1227		0.1078		0.2302		0.1736		0.1919		0.1563		0.2213		0.2791		0.3008		0.2127		0.3041		0.146	
PCB 119	0.0214		0.016		0.0305		0.0266		0.0242		0.024		0.0325		0.0365		0.0294		0.0248		0.024		0.0169	
PCB 124/135/144/147	0.0219		0.0157		0.0383		0.0254		0.0283		0.027		0.0352		0.0464		0.0454		0.05		0.045		0.0252	
PCB 128	0.0236		0.0234		0.0511		0.0322		0.0367		0.0319		0.0435		0.0578		0.0602		0.0461		0.0516		0.0311	
PCB 129/178	0.0092		0.01		0.0236		0.0158		0.019		0.0153		0.022		0.0302		0.0248		0.0203		0.0247		0.0148	
PCB 130	0.0178		0.0161		0.0355		0.0273		0.0354		0.0257		0	U	0.0431		0.0589		0.0343		0.2727		0.0197	
PCB 131	0.0021		0.0015		0.003		0.0023		0.0037		0.0102		0.0073		0.0079		0	U	0	U	0.0042		0.0026	
PCB 136	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137/176	0.0056		0.0056		0.0109		0.0077		0.0081		0.0076		0.0104		0.0134		0.0121		0.0099		0.0111		0.0073	
PCB 138/158/163	0.1243		0.1239		0.2752		0.1843		0.2978		0.1946		0.2519		0.2969		0.2917		0.2218		0.2803		0.1585	
PCB 141	0.0192		0.0219		0.0344		0.0255		0.0286		0.0234		0.0374		0.0365		0.0462		0.0351		0.043		0.0256	
PCB 146	0.0727		0.0662		0.1355		0.1008		0.1195		0.1002		0.1477		0.1838		0.1929		0.1536		0.1884		0.0896	
PCB 149	0.0779		0.0613		0.1192		0.0935		0.102		0.0895		0.1251		0.1451		0.1957		0.1473		0.18		0.1106	
PCB 151	0.0282		0.0204		0.039		0.0317		0.0357		0.0321		0.046		0.0464		0.0672		0.0538		0.0637		0.0386	
PCB 156/171/202	0.0184		0.0174		0.042		0.0302		0.0313		0.0258		0.0374		0.055		0.0415		0.0343		0.0483		0.0222	
PCB 157/200	0	U	0	U	0.0054		0.0151		0.0149		0.0121		0.0165		0.0106		0.0243		0.0189		0.0252		0.0102	
PCB 167	0.0062		0.0109		0.0149		0.009		0.0088		0.0077		0.0115		0.0152		0.0186		0.0139		0.0132		0.008	
PCB 169																								
PCB 170/190	0.0384		0.0447		0.1002		0.0766		0.2397		0.0697		0.1		0.1114		0.0854		0	U	0.0774		0.0482	
PCB 172/197	0.0065		0.0068		0.0151		0.0106		0.011		0.0094		0.0148		0.0167		0.0138		0.0115		0.0145		0.0075	
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0222		0.0181		0.0438		0.0291		0.0346		0.028		0.0472		0.0543		0.0487		0.041		0.0527		0.0282	
PCB 175	0.0023		0	U	0	U	0	U	0	U	0.0017		0.0038		0.0041		0.0041		0.0022		0.0025		0	U
PCB 177	0.0259		0.0164		0.0305		0.0256		0.0292		0.0208		0.0371		0.0434		0.0436		0.0342		0.0421		0.0237	
PCB 180	0.0517		0.0559		0.1129		0.0782		0.0842		0.0728		0.1162		0.1379		0.1201		0.0948		0.1148		0.0629	
PCB 182/187	0.0434		0.0313		0.0654		0.0502		0.0542		0.0449		0.073		0.0839		0.0821		0.0693		0.0834		0.0452	
PCB 183	0.0185		0.0167		0.0366		0.0256		0.0259		0.0234		0.0395		0.0477		0.046		0.04		0.046		0.0288	
PCB 185	0.0053		0.0036		0	U	0	U	0	U	0	U	0.0114		0.013		0.0102		0.0078		0.0086		0.0052	
PCB 189	0.0024		0	U	0.003		0.0043		0.0071		0.0084		0.0038		0.0071		0.002		0.0046		0.0024		0	U
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0033		0.0022		0.0057		0.0041		0.0054		0.0056		0.0064		0.0075		0.0113		0.0068		0.0092		0.0025	
PCB 194	0.0126		0.0234		0.0395		0.0227		0.0225		0.0198		0.0332		0.0445		0.0202		0.0173		0.021		0.0122	
PCB 195/208	0.0227		0.0228		0.0623		0.0441		0.0446		0.0403		0.0656		0.0738		0.0465		0.0437		0.0581		0.0242	
PCB 196/203	0.0303		0.038		0.078		0.055		0.0546		0.0456		0.0816		0.1025		0.0761		0.0575		0.076		0.0394	
PCB 198	0	U	0.0023		0.0028		0.0045		0.0063		0.002		0.0021		0.0122		0.0011		0	U	0.0019		0.0011	
PCB 199	0.002		0.0032		0.0048		0.0038		0.0049		0.0032		0.0049		0.0068		0.0076		0.0056		0.006		0.0031	
PCB 201	0.0279		0.0285		0.0711		0.0493		0.048		0.0412		0.0609		0.0837		0.0577		0.0468		0.0611		0.0311	
PCB 205	0.0028		0.0063		0.0143		0.0074		0.0092		0.0065		0.0086		0.0137		0.0025		0	U	0.0029		0	UU
PCB 206	0.013		0.0226		0.0556		0.0362		0.0323		0.0253		0.0495		0.0659		0.0329		0.0303		0.0348		0.0138	
PCB 207	0.0034		0.0035		0.0087		0.0054		0.0056		0.0042		0.0059		0.0083		0.006		0.0048		0.0069		0.0041	
PCB 209	0.0042		0.0177		0	U	0.0208		0.0235		0.0186		0.0314		0	U	0.0239		0.023		0.0236		0.0127	
Total Suspended PCBs (by congener sum) =	**9.04**		**10.59**		**21.50**		**15.73**		**18.62**		**14.32**		**20.32**		**28.52**		**24.13**		**17.03**		**25.80**		**11.47**	
Total Congeners Analyzed (Susp) =	**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**	
Total Congeners Detected (Susp) =	**85**		**83**		**83**		**84**		**83**		**84**		**86**		**86**		**82**		**78**		**85**		**81**	
Reported TPCBs (Susp) =																								

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener

ZERO VALUES indicate result was non-detect

All PCB and congener data reported in this database were obtained from the 1998-99 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI01		89GH5RI02		89GH5RI03		89GH5RI04		89GH5RI05		89GH5RI06		89GH5RI07		89GH5RI08		89GH5RI09		89GH5RI10		89GH5RI11		89GH5RI12		89GH5RI13	
Sample Date	1/19/89		4/14/89		4/20/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/6/89		6/13/89		6/21/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.5416		0.1117		0.2241		0.0855		0.1271		0.0239		0.0439		0	U	0.0828		0.1172		0.0724		0.0708		0.0312	
PCB 003	1.4249		0.31		0.3197		0.2659		0.2431		0.0754		0.1136		0.2185		0.0679		0.2366		0	U	0.0525		0	U
PCB 004/010	0.097		0.0668		0.1848		0.1583		0.2675		0.1376		0.2554		0.2456		0.1402		0.1478		0.1233		0.2197		0.1479	
PCB 005/008	0.8535		0.5562		1.5681		1.2696		2.0839		1.2018		1.3987		1.2485		0.9898		1.1525		1.0079		1.3774		0.7695	
PCB 006	0.1144		0.1451		0.394		0.3145		0.5455		0.2416		0.3535		0.3108		0.2255		0.3369		0.2556		0.3278		0.1744	
PCB 007	0.0073		0.0052		0.0329		0.0316		0.0482		0.0224		0.0271		0.0366		0.036		0.031		0.0236		0.0308		0.014	
PCB 012/013	0.0527		0.0221		0.0362		0.038		0.0373		0.0144		0.0261		0.0414		0.0666		0.0095		0.0086		0.011		0	U
PCB 016/032	0.1614		0.3984		1.2318		1.1428		1.7446		1.0553		1.5537		1.4921		0.9399		1.0805		1.0843		1.6709		1.1884	
PCB 017	0.1585		0.2631		0.7566		0.7341		1.1718		0.5982		0.9169		0.9195		0.5733		0.6441		0.6133		0.9385		0.759	
PCB 018	0.0944		0.4288		1.3961		1.2269		2.0099		1.321		2.3956		1.9708		1.1486		1.1653		1.1117		1.8474		1.2367	
PCB 019	0.0215		0.0382		0.1071		0.0897		0.1605		0.0661		0.1108		0.1327		0.107		0.1237		0.0921		0.1424		0.1349	
PCB 021	0.0081		0	U	0.0021		0	U	0.0009		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022	0.0395		0.2366		0.5775		0.6106		0.8358		0.5126		0.6833		0.6607		0.4404		0.5274		0.505		0.6997		0.555	
PCB 024/027	0.0206		0.0545		0.1312		0.1267		0.179		0.0915		0.1237		0.136		0.1143		0.1212		0.1176		0.1671		0.159	
PCB 025	0.0223		0.144		0.3042		0.3026		0.4232		0.2518		0.3252		0.3649		0.2925		0.2617		0.2398		0.3178		0.2412	
PCB 026	0.1225		0.1928		0.5813		0.5602		0.8598		0.4797		0.7376		0.7416		0.4268		0.4528		0.4373		0.6787		0.4291	
PCB 028/031	0.2927		1.1027		2.652		2.7137		3.6606		2.2463		3.3075		3.2551		2.0997		2.4459		2.3306		3.0724		2.3363	
PCB 029	0.0102		0	U	0.0044		0.0031		0.0176		0.0025		0.0049		0	U	0.0198		0.0044		0.0112		0.0073		0.0112	
PCB 033	0.0958		0.2344		0.5619		0.5201		0.7913		0.8252		1.1191		1.0517		1.1425		0.5068		0.4928		0.6459		0.4358	
PCB 037/042	0.0366		0.1469		0.2874		0.3269		0.4527		0.316		0.4249		0.3663		0.2329		0.2964		0.2919		0.3715		0.3156	
PCB 040	0.0159		0.0624		0.1474		0.1669		0.2244		0.1602		0.1884		0.1976		0.1394		0.1679		0.1684		0.2182		0.1809	
PCB 041/064/071	0.0568		0.2452		0.5056		0.5661		0.7719		0.5259		0.6472		0.6939		0.4716		0.5643		0.547		0.6801		0.5482	
PCB 043	0.0229		0.0369		0.0528		0.0554		0.0783		0.0955		0.1156		0.1408		0.0794		0.0871		0.1116		0.1635		0.0698	
PCB 044	0.0685		0.3		0.6286		0.6814		0.943		0.6461		0.8237		0.8336		0.5821		0.6585		0.6331		0.8201		0.647	
PCB 045	0.0338		0.0721		0.1553		0.1592		0.2336		0.1496		0.1995		0.1905		0.1203		0.1451		0.1263		0.196		0.1651	
PCB 046	0.0039		0.0263		0.0885		0.0808		0.1243		0.0777		0.1069		0.1167		0.0781		0.0825		0.0832		0.1303		0.0843	
PCB 047/048	0.0746		0.1639		0.3519		0.3906		0.5365		0.3638		0.4514		0.4701		0.3498		0.3956		0.3823		0.4841		0.3881	
PCB 049	0.0736		0.2283		0.2307		0.2486		0.3586		0.489		0.6122		0.6171		0.4435		0.5113		0.4863		0.6083		0.4719	
PCB 051	0.0081		0.0202		0.0321		0.0375		0.0512		0.0369		0.0498		0.048		0.0388		0.0453		0.0446		0.0576		0.0408	
PCB 052	0.1143		0.3883		0.6167		0.6814		0.8795		0.6644		0.8311		0.8037		0.59		0.6179		0.6039		0.759		0.5595	
PCB 053	0	U	0.066		0.1294		0.1402		0.1853		0.0979		0.1148		0.1078		0.091		0.1611		0.1388		0.2014		0.1518	
PCB 056/060	0.0839		0.1198		0.2301		0.2933		0.3615		0.2537		0.2727		0.295		0.1935		0.2439		0.2338		0.2959		0.2388	
PCB 063	0	U	0.0138		0.0293		0.0343		0.0461		0.0276		0.0473		0.0413		0.0317		0.0353		0.039		0.0311		0.0378	
PCB 066/095	0	U	0.2935		0.4469		0.5565		0.6991		0.528		0.5691		0.5786		0.4218		0.5153		0.5235		0.6131		0.4739	
PCB 070/076	0.0929		0.2095		0.3813		0.4439		0.596		0.408		0.4459		0.4587		0.3308		0.4106		0.4036		0.4746		0.3666	
PCB 074	0.0528		0.0839		0.1457		0.1622		0.2241		0.151		0.1756		0.1774		0.1358		0.1664		0.1631		0.1911		0.1608	
PCB 077/110	0.0394		0.087		0.1163		0.1597		0.1935		0.1393		0.1269		0.1526		0.1138		0.1284		0.1233		0.1588		0.1185	
PCB 081	0.0114		0.0172		0.0043		0.0061		0.0064		0.0035		0.0031		0.0041		0.0039		0.0059		0.0049		0.0047		0.005	
PCB 082	0.005		0.0087		0.0183		0.0147		0.0243		0.0168		0.0191		0.0313		0.0218		0.0204		0.0331		0.0294		0.0184	
PCB 083	0	U	0	U	0.0053		0.0069		0.0098		0.0094		0.0084		0.0077		0.0027		0.0114		0.0061		0.0083		0.007	
PCB 084/092	0.0299		0.0591		0.0964		0.1197		0.1566		0.1278		0.1381		0.1433		0.1125		0.1255		0.1169		0.1627		0.1012	
PCB 085	0.0162		0.0147		0.0198		0.0303		0.0335		0.0251		0.024		0.0272		0.0191		0.0248		0.0223		0.0273		0.0224	
PCB 087	0.0189		0.036		0.0374		0.0492		0.06		0.0254		0.0305		0.0467		0.0366		0.0456		0.0427		0.0482		0.0398	
PCB 089	0.0074		0.0096		0.0068		0.0113		0.0095		0.009		0.0097		0.0181		0.0082		0.0032		0.0058		0.0053		0.0042	
PCB 091	0	U	0.01		0.0312		0.0361		0.0497		0.0398		0.0436		0.0395		0.0398		0.034		0.0439		0.0517		0.0256	
PCB 097	0.0196		0.0264		0.0373		0.0416		0.0577		0.0356		0.0371		0.0434		0.0331		0.04		0.0394		0.0427		0.0347	
PCB 099	0.0128		0.0228		0.0339		0.0481		0.0589		0.0488		0.0453		0.0506		0.0372		0.0469		0.0423		0.0465		0.0365	
PCB 100	0.0054		0.0074		0.0179		0.0212		0.0283		0.0197		0.0187		0.0212		0.016		0.0168		0.0157		0.0218		0.0213	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI01		89GH5RI02		89GH5RI03		89GH5RI04		89GH5RI05		89GH5RI06		89GH5RI07		89GH5RI08		89GH5RI09		89GH5RI10		89GH5RI11		89GH5RI12		89GH5RI13	
Sample Date	1/19/89		4/14/89		4/20/89		4/26/89		5/3/89		5/11/89		5/17/89		5/24/89		6/1/89		6/6/89		6/6/89		6/13/89		6/21/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.0296		0.0653		0.0665		0.086		0.1075		0.0877		0.0871		0.0857		0.0756		0.0853		0.0788		0.0882		0.0739	
PCB 105/132/153	0.0366		0.0482		0.0547		0.0625		0.0767		0.0796		0.0743		0.086		0.1016		0.0917		0.0716		0.0791		0.0636	
PCB 107	0.0103		0.0065		0.0057		0.0088		0.0093		0.0091		0.0109		0.0145		0.0119		0.0108		0.0098		0.0108		0.0096	
PCB 114/134	0.0327		0	U	0.0111		0.0062		0.0098		0.0121		0.012		0.0155		0.014		0.0097		0.0135		0.0134		0.0057	
PCB 118	0.0208		0.0217		0.0298		0.0396		0.0493		0.0453		0.0445		0.0503		0.0369		0.0515		0.0482		0.0474		0.0458	
PCB 119	0.0058		0	U	0.006		0.0133		0.0099		0.0185		0.0129		0.0079		0.0067		0.009		0.0062		0.0063		0.0058	
PCB 124/135/144/147	0.0084		0.0081		0.0064		0.0092		0.01		0.0027		0.0086		0.0148		0.0168		0.0193		0.0198		0.0201		0.0093	
PCB 128	0.0003		0.0031		0.0025		0.0107		0.0084		0.0078		0.0038		0.0042		0.0049		0.0112		0.0049		0.0039		0.0043	
PCB 129/178	0.0016		0	U	0.0022		0.0021		0.0025		0.0033		0.003		0.0018		0.0074		0.0034		0.0041		0.0033		0.0028	
PCB 130	0.0395		0	U	0.0027		0.0043		0.005		0.0046		0.0091		0.0024		0.0046		0.0101		0.0081		0.0074		0.007	
PCB 131	0.0057		0.0016		0.0047		0.002		0.0022		0.0021		0.005		0.0038		0.0055		0.0018		0.0039		0.0059		0.0104	
PCB 136	0	U	0.0177		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137/176	0	U	0.0016		0.0016		0.0014		0.0018		0.0008		0.0031		0.0013		0.0039		0.0013		0.0016		0.002		0.0011	
PCB 138/158/163	0	U	0	U	0.0652		0.0424		0.05		0.0576		0.0656		0.0479		0.0706		0.056		0.0847		0.4141		0.0562	
PCB 141	0.0111		0.0135		0.0041		0	U	0.0073		0.0061		0.0058		0	U	0.0242		0.0081		0.0099		0.0099		0.0056	
PCB 146	0.0142		0.0113		0.0125		0.0158		0.0212		0.0143		0.0211		0.0185		0.0194		0.0252		0.0209		0.0211		0.0089	
PCB 149	0.0223		0.0292		0.025		0.0242		0.0321		0.0341		0.0346		0.0383		0.0604		0.0381		0.0392		0.0392		0.0305	
PCB 151	0.0114		0.0147		0.0101		0.0092		0.0124		0.0122		0.0133		0.014		0.026		0.0139		0.0174		0.0187		0.0116	
PCB 156/171/202	0.0049		0	U	0.0037		0.0049		0.0056		0.0068		0.0041		0.0046		0.0065		0.0067		0.0025		0.008		0.0014	
PCB 157/200	0	U	0	U	0	U	0	U	0	U	0	U	0.0023		0.0019		0	U	0	U	0	U	0	U	0	U
PCB 167	0.0005		0.0015		0.0018		0.0024		0.0012		0.0016		0.0018		0.0008		0.0026		0.0038		0.0013		0	U	0.0006	
PCB 169																										
PCB 170/190	0.0686		0.202		0	U	0.0098		0.0109		0	U	0	U	0	U	0	U	0.0097		0	U	0	U	0.0005	
PCB 172/197	0.0017		0	U	0.0011		0.0008		0.0017		0.0009		0.0015		0	U	0.0026		0.0021		0	U	0.0014		0	U
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0113		0	U	0.0048		0.0051		0.0066		0.003		0.0007		0.0036		0.0202		0.0076		0.0079		0.0093		0.0074	
PCB 175	0	U	0	U	0	U	0	U	0.0051		0.0037		0	U	0	U	0.0046		0	U	0	U	0	U	0	U
PCB 177	0.0044		0	U	0.0017		0.0018		0.0023		0.0053		0.0033		0.0039		0.0108		0.0051		0.0046		0.0033		0.0041	
PCB 180	0.012		0.0148		0.0098		0.0128		0.0132		0.0183		0.016		0.0126		0.0267		0.0363		0.0421		0.0411		0.0134	
PCB 182/187	0.0126		0	U	0.01		0.0118		0.0118		0.0122		0.0173		0.0147		0.0275		0.0157		0.0148		0.0143		0.0105	
PCB 183	0.0048		0.0061		0.0038		0.0059		0.0053		0.0084		0.0071		0.0066		0.0137		0.0072		0.0067		0.0077		0.0093	
PCB 185	0	U	0	U	0	U	0	U	0	U	0.0034		0.0057		0.0018		0.0039		0	U	0	U	0.0044		0.0021	
PCB 189	0.0005		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0113		0	U
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0005	
PCB 193	0.0004		0	U	0.0004		0.0004		0.0006		0.0042		0.0041		0	U	0.0023		0	U	0	U	0.004		0.0004	
PCB 194	0.0044		0	U	0.0004		0.0006		0.0006		0.0016		0.0012		0	U	0.0021		0.0017		0.0019		0.003		0.0017	
PCB 195/208	0.0145		0.0123		0.0016		0.0029		0.003		0.0039		0.0023		0.0019		0.0043		0.0033		0.0043		0.0149		0.0034	
PCB 196/203	0.0027		0	U	0.0034		0.0046		0.0038		0.0046		0.006		0.0001		0.005		0.0041		0	U	0.057		0.0053	
PCB 198	0	U	0	U	0	U	0	U	0	U	0.0007		0.0002		0	U	0	U	0	U	0	U	0	U	0	U
PCB 199	0	U	0	U	0.0014		0.0013		0.0019		0.0016		0.0024		0	U	0.0023		0.0011		0	U	0	U	0	U
PCB 201	0.0032		0	U	0.0009		0.0011		0.0014		0.0049		0.0062		0	U	0.0038		0.0047		0.0042		0.0074		0.005	
PCB 205	0	U	0	U	0.0001		0	U	0	U	0.0007		0.0003		0	U	0	U	0.0001		0.0013		0	U	0	U
PCB 206	0.001		0.0047		0.0013		0.0017		0.0015		0.0035		0.0086		0.0019		0.0029		0.0016		0	U	0.0024		0.0022	
PCB 207	0.0204		0.0182		0.0002		0.0001		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.005		0	U
PCB 209	0.3512		0.0202		0.0001		0.0002		0.0002		0.0012		0	U	0.0028		0.0012		0.0004		0.0008		0	U	0.0113	
Total Dissolved PCBs (by congener sum) =	5.81		7.61		16.31		16.17		23.15		15.15		20.58		20.01		14.32		15.53		14.54		20.17		14.38	
Total Congeners Analyzed (Diss) =	92		92		92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Diss) =	76		66		83		81		83		84		83		74		82		81		75		80		79	
Reported TPCBs (Diss) =																										

NOTE no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI14		89GH5RI15		89GH5RI16		89GH5RI17		89GH5RI18		89GH5RI19		89GH5RI20		89GH5RI21		89GH5RI22		89GH5RI23		89GH5RI24		89GH5RI25	
Sample Date	6/28/89		7/6/89		7/12/89		7/17/89		7/17/89		7/18/89		7/18/89		7/19/89		7/19/89		7/20/89		7/20/89		7/21/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.0456		0 0279		0.0858		0.067		0.0676		0.0661		0.0703		0.1004		0.0837		0.0699		0 0456		0.0418	
PCB 003	0.0566		0	U	0.0834		0 0922		0.1056		0.0848		0 0799		0.1554		0.1193		0.0395		0.132		0	U
PCB 004/010	0.2108		0.1772		0.2399		0.3043		0.272		0.2647		0.2898		0.2824		0.3071		0.2551		0.368		0 2684	
PCB 005/008	0.964		0.6466		1.0937		1 5434		1.3396		1.4988		1 3824		1 5266		1.5447		1.5144		1 6561		1.5037	
PCB 006	0.232		0 2061		0.3146		0.5463		0.463		0.5472		0.5297		0.4986		0.513		0.4805		0.6211		0.5639	
PCB 007	0.0209		0.017		0.024		0.032		0.0304		0 0303		0 0291		0.035		0.0327		0.0708		0.0366		0.0342	
PCB 012/013	0.0013		0	U	0.021		0 0194		0.0195		0 016		0.015		0.0233		0.0194		0.0143		0.0223		0.039	
PCB 016/032	1.2672		1.2118		1.6622		2 1035		1.8474		1.8462		1.6779		1.7746		1.7621		1.7055		2.0766		1.9071	
PCB 017	0.7556		0 8096		1 0618		1 1849		1.2535		1 3316		1.2249		1.1941		1.2637		1.0225		1.4691		1.4504	
PCB 018	1.5498		1 6574		2.7233		2.2354		2.909		2.0754		2.0064		2.0965		2.0602		2.3521		2.3734		2.1851	
PCB 019	0.1614		0 1295		0.188		0 2091		0.3007		0 1914		0.1919		0.2844		0.3114		0.2084		0.2551		0.2221	
PCB 021	0.0004		0	U	0.0021		0 0007		0	U	0	U	0	U	0.0007		0.0006		0	U	0	U	0	U
PCB 022	0.5063		0.5893		0.6526		0.931		0.8324		0.8053		0 7408		0 8082		0.745		0.7727		0.937		0.8505	
PCB 024/027	0.1457		0.1364		0.1729		0.2139		0.2302		0.2065		0.195		0 2088		0.1964		0.1893		0.2821		0.2641	
PCB 025	0.2857		0.282		0.4202		0.441		0.5556		0 5411		0.5257		0.5319		0.4933		0.4892		0.6553		0.6174	
PCB 026	0.4542		0 5471		0 6938		0.6657		0.8363		0.8692		0.7956		0.8656		0.7869		0.782		0.777		0.7585	
PCB 028/031	2.2387		2.6844		2.9483		4 4443		3.6771		3 7097		3 3611		3.623		3.3055		3.3975		4 3159		4.2339	
PCB 029	0.0296		0	U	0.0024		0.0466		0.0474		0 0403		0 0032		0.046		0.0459		0.003		0.0394		0.0221	
PCB 033	0.4315		0.4429		0 5509		0 8232		0.7266		0 7376		0 6546		0.7019		0.6555		0.6814		0 8346		0.7581	
PCB 037/042	0.2778		0 3507		0.3746		0 4914		0 428		0 4241		0.3723		0.4269		0.3864		0.3987		0.4823		0.4772	
PCB 040	0.1645		0.1994		0.2132		0.2733		0.2469		0.239		0.2125		0.2419		0.2202		0.2236		0.292		0.2828	
PCB 041/064/071	0.5428		0.6434		0.7139		0.9424		0.8485		0.8263		0.7009		0.8138		0.7344		0.7693		0.9051		0.8827	
PCB 043	0 0559		0 0728		0 1047		0.1455		0.1192		0.1243		0.1104		0.1363		0.1176		0.1132		0.1158		0.1176	
PCB 044	0.6803		0 7871		0 8934		1.1492		1.0217		1 0118		0.894		1.0071		0.9165		0.9564		1 1102		1.0481	
PCB 045	0.1858		0.1932		0.2388		0.2996		0.2708		0.2729		0 2401		0 2645		0.2488		0.2541		0.2807		0 2637	
PCB 046	0.1008		0 1008		0 1301		0.1635		0.1448		0.1418		0.1306		0.1446		0.1368		0.1363		0.1531		0.1382	
PCB 047/048	0.3232		0 4489		0.465		0.6221		0.5448		0 5407		0.4613		0.5412		0.4783		0.4956		0 5372		0.5242	
PCB 049	0.4362		0.5579		0.6112		0.8379		0.7191		0.7176		0.6318		0.7157		0.6353		0.662		0.7315		0.7194	
PCB 051	0.0472		0.053		0.0678		0.0713		0 0681		0.062		0.0633		0.063		0.0581		0 0585		0.0696		0.0583	
PCB 052	0 5887		0.6793		0.7561		0.9928		0.8606		0.8921		0.7715		0.8739		0.7761		0.8135		0.9426		0.911	
PCB 053	0.1782		0.1561		0.2284		0.2776		0.2453		0.224		0.217		0.2457		0.2365		0.2265		0.2365		0.2179	
PCB 056/060	0.2266		0 3593		0.3055		0 4194		0.3705		0 3543		0.2991		0.3508		0.3037		0.3299		0.3996		0.3987	
PCB 063	0.0302		0 0334		0 0468		0.0512		0.0435		0 0454		0.0395		0.0459		0.0414		0.0458		0 0491		0.0468	
PCB 066/095	0 4643		0.6039		0.6072		0.8209		0.7697		0.7127		0.6343		0.7017		0.6136		0.6933		0.7964		0.7489	
PCB 070/076	0.3526		0.473		0.4693		0.6371		0.5824		0.5503		0.4832		0.5459		0.4834		0.5264		0.6229		0.615	
PCB 074	0.1385		0.1803		0.1832		0.2352		0.2182		0.2177		0.182		0.2132		0 1883		0 2094		0.217		0.2762	
PCB 077/110	0 1029		0.1546		0.1525		0.203		0.1847		0.1716		0.1422		0.1723		0.1507		0.1683		0.2283		0.2184	
PCB 081	0 0038		0.0055		0.006		0.0062		0 0063		0.0068		0.0043		0.006		0 0048		0 0061		0.0058		0.0079	
PCB 082	0.014		0.0236		0.0259		0.0288		0.0253		0.0224		0.0191		0.0232		0.0199		0.0305		0.0229		0 0215	
PCB 083	0.0059		0.0076		0.0093		0.016		0.0151		0.0102		0.0083		0.0118		0 0111		0.0109		0.0087		0.012	
PCB 084/092	0.121		0 1686		0 1614		0.1999		0 1838		0.1664		0.1421		0.1665		0.1553		0 1654		0.1608		0.166	
PCB 085	0.0209		0.0304		0.0316		0.0424		0.0398		0.0356		0.0285		0.0345		0.0302		0.033		0.0381		0 0388	
PCB 087	0.0396		0.0529		0.0553		0.0711		0.0677		0.0633		0.0505		0.0599		0 0534		0.0594		0.0687		0 0666	
PCB 089	0.0064		0 0158		0.0061		0.0101		0.0091		0.0069		0.0072		0.0096		0.0075		0.0081		0.0113		0.0062	
PCB 091	0.0353		0.0341		0.0416		0 044		0 0687		0.0573		0.0473		0.0421		0 0357		0 0578		0.0433		0.0426	
PCB 097	0.0345		0.0422		0.0459		0.0615		0.058		0.0523		0.0426		0.0504		0.0453		0.0493		0.0578		0 0538	
PCB 099	0.0333		0.0464		0.0475		0.0676		0.0594		0.0545		0 0457		0.0552		0.0483		0.0528		0.0504		0 0603	
PCB 100	0 0156		0.0259		0.0213		0.0279		0.0273		0.0268		0.0226		0.027		0.0241		0.0234		0.0284		0 0291	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI14		89GH5RI15		89GH5RI16		89GH5RI17		89GH5RI18		89GH5RI19		89GH5RI20		89GH5RI21		89GH5RI22		89GH5RI23		89GH5RI24		89GH5RI25	
Sample Date	6/28/89		7/6/89		7/12/89		7/17/89		7/17/89		7/18/89		7/18/89		7/19/89		7/19/89		7/20/89		7/20/89		7/21/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.0679		0.1073		0.0895		0.1227		0.109		0.1028		0.0866		0.1023		0.0911		0.1017		0.119		0.106	
PCB 105/132/153	0.05		0.0774		0.072		0.1084		0.1022		0.0923		0.066		0.0911		0.0738		0.0807		0.0807		0.0676	
PCB 107	0.0058		0.009		0.0156		0.0167		0.0158		0.0081		0.0084		0.0131		0.0054		0.0084		0.0157		0.0113	
PCB 114/134	0.0041		0.0249		0.0118		0.0124		0.0166		0.0703		0	U	0.0742		0.0828		0	U	0.014		0	U
PCB 118	0.0322		0.0542		0.0494		0.0749		0.0621		0.059		0.047		0.059		0.0482		0.0511		0.0596		0.0581	
PCB 119	0.0089		0.0088		0.0109		0.0156		0.0149		0.0132		0.0124		0.0135		0.0134		0.0141		0.0047		0.0178	
PCB 124/135/144/147	0.0068		0.0117		0.0097		0.0127		0.0127		0.0108		0.009		0.0117		0.0091		0.0121		0.0109		0.0087	
PCB 128	0.0016		0.0047		0.0053		0.0073		0.0057		0.0059		0.0028		0.0042		0.004		0.0043		0.005		0.0043	
PCB 129/178	0.0037		0.0042		0.0034		0.0045		0.0045		0.0034		0.0028		0.003		0.003		0.0039		0.0038		0.0029	
PCB 130	0.0049		0.0061		0.0081		0.0145		0.0111		0.0078		0.0079		0.0097		0.008		0.0083		0.0075		0.0081	
PCB 131	0.0012		0	U	0.0045		0.0029		0.006		0.0223		0.0461		0.0228		0.0276		0.0659		0	U	0	U
PCB 136	0	U	0.0274		0	U	0.0063		0.0069		0	U	0	U	0	U	0.0064		0.0066		0	U	0.0274	
PCB 137/176	0.0013		0.0013		0.0014		0	U	0.0021		0.0018		0.0013		0.0014		0.0015		0.0018		0.0017		0.0015	
PCB 138/158/163	0.0743		0.0579		0.4579		0.0798		0.0727		0.0712		0.0824		0.0739		0.0541		0.0796		0.058		0	U
PCB 141	0.0052		0.0084		0.0062		0.01		0.0081		0.0079		0.0073		0.0077		0.0062		0.0083		0	U	0	U
PCB 146	0.013		0.0035		0.0201		0.0283		0.0262		0.0664		0.0363		0.0483		0.0376		0.0512		0.0535		0.0575	
PCB 149	0.0264		0.0391		0.0357		0.0483		0.0456		0.0427		0.0313		0.041		0.0334		0.0388		0.0376		0.032	
PCB 151	0.0105		0.0166		0.0138		0.0166		0.0167		0.0177		0.0133		0.014		0.0138		0.0187		0.0135		0.0106	
PCB 156/171/202	0.0023		0.0018		0.0061		0.0096		0.0084		0.0065		0.0067		0.0066		0.0059		0.0076		0.0054		0.0011	
PCB 157/200	0.0029		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 167	0	U	0	U	0.0015		0.0014		0.0013		0.0024		0.0004		0.0015		0.001		0.0007		0.0007		0.0004	
PCB 169																								
PCB 170/190	0	U	0	U	0	U	0.0146		0.0127		0	U	0	U	0.0912		0.1113		0	U	0.0127		0.0065	
PCB 172/197	0.0015		0.0007		0.0016		0	U	0.0013		0.0014		0.0008		0.0015		0.0013		0.0013		0.0012		0.0012	
PCB 173	0.0021		0	U	0	U	0	U	0	U	0	U	0	U	0.0003		0	U	0	U	0	U	0	U
PCB 174	0.0078		0.0102		0.0076		0.011		0.0098		0.0087		0.0075		0.0089		0.0085		0.0102		0.0133		0.0115	
PCB 175	0.0008		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0069		0	U
PCB 177	0.003		0.0076		0.0049		0.0075		0.0063		0.006		0.0046		0.0057		0.0054		0.0055		0.005		0.0042	
PCB 180	0.019		0.0176		0.0171		0.0233		0.0303		0.0291		0.0291		0.0246		0.0232		0.0213		0.0267		0.0165	
PCB 182/187	0.0105		0.015		0.0125		0.0182		0.0162		0.0134		0.0121		0.0143		0.0136		0.0144		0.0123		0.0081	
PCB 183	0.0068		0.006		0.0058		0.0087		0.0081		0.0078		0.0057		0.0064		0.0067		0.0076		0.0096		0.0074	
PCB 185	0.0006		0.0028		0	U	0.0032		0.004		0.0019		0.0023		0.0082		0.0034		0.0017		0.0011		0	U
PCB 189	0	U	0	U	0	U	0.0003		0.0002		0	U	0.0001		0.0003		0.0003		0.0004		0.001		0.0028	
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0008		0.0007		0.0021		0.0008		0.0007		0	U	0.0006		0.0011		0.0008		0.0009		0.0013		0.0004	
PCB 194	0.0027		0.0019		0.0022		0.0046		0.003		0.0027		0.0019		0.0022		0.0023		0.0026		0.0025		0.0011	
PCB 195/208	0.0056		0.0034		0.0034		0.0052		0.0079		0.0061		0.0039		0.0054		0.0038		0.0048		0.0044		0.0037	
PCB 196/203	0.0115		0.0128		0.0067		0.0099		0.0091		0.0076		0.0061		0.0076		0.0073		0.0085		0.013		0.0059	
PCB 198	0	U	0	U	0	U	0.0007		0.001		0.0174		0.0279		0.0226		0.0322		0.0526		0	U	0	U
PCB 199	0.0015		0.0008		0.0019		0.0022		0.0028		0.002		0.0015		0.0018		0.0016		0.001		0.0017		0.0016	
PCB 201	0.0101		0.0321		0.005		0.0086		0.0074		0.014		0.0105		0.0092		0.0119		0	U	0.0225		0.0186	
PCB 205	0	U	0	U	0.0007		0	U	0	U	0	U	0	U	0.0002		0	U	0	U	0.0008		0.0011	
PCB 206	0.0036		0.0014		0.0031		0.0037		0.0027		0	U	0.0054		0.0023		0.0024		0.0018		0.0033		0.0018	
PCB 207	0.0008		0	U	0	U	0.0006		0.0002		0	U	0	U	0	U	0.0002		0	U	0	U	0	U
PCB 209	0.0014		0	U	0.0055		0.0011		0.0033		0.0053		0	U	0.0003		0.0051		0	U	0	U	0	U
Total Dissolved PCBs (by congener sum) =	**15.01**		**16.64**		**20.86**		**25.83**		**24.44**		**23.63**		**21.37**		**23.56**		**22.18**		**22.32**		**26.20**		**24.68**	
Total Congeners Analyzed (Diss) =	**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**	
Total Congeners Detected (Diss) =	**85**		**76**		**82**		**85**		**86**		**80**		**81**		**87**		**87**		**81**		**82**		**78**	
Reported TPCBs (Diss) =																								

NOTE no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect -
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI26		89GH5RI27		89GH5RI28		89GH5RI29		89GH5RI30		89GH5RI31		89GH5RI32		89GH5RI33		89GH5RI34		89GH5RI35		89GH5RI36		89GH5RI37	
Sample Date	7/21/89		7/22/89		7/22/89		7/23/89		7/23/89		7/24/89		7/24/89		7/24/89		7/25/89		7/25/89		7/26/89		7/26/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001			0.0263		0.027		0.0458		0.102		0.0374		0.021		0.0292		0.0396		0.0481		0.0546		0.046	
PCB 003			0	U	0	U	0	U	0.1011		0	U	0	U	0	U	0	U	0.0504		0.0389		0	U
PCB 004/010			0.198		0.2599		0.3113		0.2724		0.1812		0.1076		0.1461		0.1728		0.1434		0.1523		0.1399	
PCB 005/008			1.1001		1.1822		1.2145		1.1523		0.8674		0.745		0.8725		0.9518		0.7803		0.9066		0.8178	
PCB 006			0.3697		0.4436		0.459		0.4491		0.2641		0.2197		0.2676		0.2883		0.2277		0.2725		0.2231	
PCB 007			0.025		0.0268		0.0262		0.0253		0.0182		0.0153		0.019		0.019		0.0162		0.0188		0.0153	
PCB 012/013			0.0365		0.0387		0.0374		0.0388		0.0117		0.0072		0.0061		0.0088		0.0142		0.0149		0.0028	
PCB 016/032			1.4951		1.7349		1.9901		1.829		1.2935		1.0994		1.134		1.1667		0.9817		1.1		0.9697	
PCB 017			0.9939		1.3151		1.7667		1.4328		0.8629		0.6851		0.7662		0.7763		0.6479		0.744		0.6176	
PCB 018			2.316		2.0514		2.3241		2.0566		1.8071		1.253		1.4132		1.566		1.3202		1.531		1.2123	
PCB 019			0.1783		0.2224		0.267		0.2447		0.1597		0.1388		0.2001		0.1439		0.133		0.1329		0.1102	
PCB 021			0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022			0.6787		0.8464		0.9144		0.8021		0.6902		0.6625		0.6753		0.6323		0.5431		0.6036		0.5476	
PCB 024/027			0.1974		0.237		0.2989		0.2509		0.1592		0.1509		0.1692		0.1448		0.1224		0.1364		0.118	
PCB 025			0.4421		0.4542		0.688		0.579		0.3919		0.4433		0.4304		0.3512		0.2927		0.3407		0.2822	
PCB 026			0.5862		0.6562		0.7922		0.7004		0.6222		0.5525		0.5645		0.5298		0.4468		0.5168		0.4322	
PCB 028/031			3.2335		3.7339		4.5408		3.9006		3.039		2.7502		2.7897		2.7085		2.4027		2.7241		2.3888	
PCB 029			0.0169		0.0183		0.0243		0.0203		0.0032		0.004		0	U	0.0162		0.0024		0.0075		0.0108	
PCB 033			0.5952		0.7016		0.7447		0.6486		0.5756		0.5556		0.5725		0.5356		0.4828		0.5165		0.4848	
PCB 037/042			0.3886		0.4552		0.5193		0.4326		0.3639		0.3697		0.3701		0.3391		0.2949		0.3241		0.3121	
PCB 040			0.2292		0.2662		0.2996		0.2398		0.214		0.2043		0.2048		0.1899		0.1754		0.1816		0.1785	
PCB 041/064/071			0.7281		0.8186		0.9164		0.7937		0.7048		0.7177		0.7039		0.6475		0.5974		0.6404		0.6163	
PCB 043			0.0828		0.1029		0.1375		0.1131		0.1121		0.1078		0.0768		0.0895		0.0735		0.0918		0.0739	
PCB 044			0.8673		1.0136		1.1419		0.9785		0.8774		0.8175		0.814		0.7862		0.7179		0.7728		0.7388	
PCB 045			0.2134		0.248		0.2901		0.2558		0.2194		0.1882		0.1768		0.1978		0.177		0.1912		0.1613	
PCB 046			0.1116		0.1322		0.1669		0.1372		0.1181		0.1026		0.1047		0.1036		0.093		0.1004		0.0926	
PCB 047/048			0.4316		0.4829		0.5482		0.4771		0.4667		0.4595		0.4022		0.4196		0.381		0.4286		0.3941	
PCB 049			0.5703		0.646		0.7652		0.6525		0.6092		0.5493		0.521		0.5365		0.4916		0.5548		0.505	
PCB 051			0.0446		0.0593		0.0674		0.0572		0.0443		0.0453		0.038		0.0413		0.0383		0.0398		0.0345	
PCB 052			0.7426		0.8413		0.9741		0.8236		0.7411		0.6462		0.6407		0.6394		0.582		0.6469		0.5952	
PCB 053			0.1448		0.1772		0.2525		0.1758		0.2108		0.1739		0.1917		0.1982		0.1663		0.1803		0.1556	
PCB 056/060			0.3389		0.3811		0.3954		0.3509		0.3381		0.3772		0.3702		0.3165		0.2945		0.3171		0.3248	
PCB 063			0.0524		0.0322		0.0534		0.0343		0.0527		0.0404		0.0637		0.0404		0.0344		0.0291		0.0332	
PCB 066/095			0.6463		0.7316		0.7823		0.6797		0.6771		0.6966		0.6547		0.6106		0.5987		0.6185		0.6187	
PCB 070/076			0.4947		0.5669		0.6123		0.5527		0.5268		0.539		0.52		0.4741		0.4535		0.4692		0.4821	
PCB 074			0.1738		0.2283		0.2537		0.2548		0.204		0.2012		0.22		0.1848		0.1685		0.1654		0.1821	
PCB 077/110			0.1848		0.2172		0.2164		0.1918		0.1656		0.1752		0.1699		0.1473		0.1397		0.1465		0.1537	
PCB 081			0.0068		0.0075		0.008		0.0072		0.004		0.0053		0.0067		0.0054		0.0043		0.0054		0.0048	
PCB 082			0.02		0.0219		0.022		0.0207		0.0231		0.0214		0.0242		0.0177		0.0178		0.0183		0.0182	
PCB 083			0.0108		0.0121		0.0123		0.0111		0.0099		0.0093		0.0083		0.0096		0.0082		0.0095		0.0086	
PCB 084/092			0.1332		0.1585		0.1653		0.1533		0.1547		0.151		0.1443		0.1483		0.1345		0.1384		0.1469	
PCB 085			0.0338		0.0384		0.0371		0.0336		0.0363		0.0364		0.0344		0.0309		0.0292		0.0329		0.0338	
PCB 087			0.058		0.0673		0.064		0.059		0.0629		0.0616		0.0592		0.0543		0.0507		0.0541		0.0566	
PCB 089			0.0064		0.0068		0.0117		0.0154		0.0048		0.0107		0.0168		0.0071		0.0079		0.007		0.0064	
PCB 091			0.0361		0.0412		0.0426		0.0358		0.0518		0.0434		0.0269		0.0414		0.0449		0.0409		0.0415	
PCB 097			0.047		0.0537		0.0528		0.048		0.0507		0.0504		0.0481		0.0439		0.0419		0.0444		0.0468	
PCB 099			0.0513		0.0575		0.0575		0.0519		0.0543		0.0522		0.051		0.0476		0.0444		0.0511		0.0509	
PCB 100			0.0238		0.0278		0.0278		0.0281		0.0232		0.0233		0.0288		0.02		0.0189		0.0164		0.0189	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI26		89GH5RI27		89GH5RI28		89GH5RI29		89GH5RI30		89GH5RI31		89GH5RI32		89GH5RI33		89GH5RI34		89GH5RI35		89GH5RI36		89GH5RI37	
Sample Date	7/21/89		7/22/89		7/22/89		7/23/89		7/23/89		7/24/89		7/24/89		7/24/89		7/25/89		7/25/89		7/26/89		7/26/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101			0.0921		0.1079		0.1066		0.1057		0.1029		0.0964		0.0937		0.091		0.0829		0.0908		0.0948	
PCB 105/132/153			*0.0728*		*0.0748*		*0.0662*		*0.0654*		*0.0903*		*0.0694*		*0.065*		*0.0756*		*0.0661*		*0.0721*		*0.0828*	
PCB 107			0.0101		0.0122		0.0084		0.0113		0.0065		0.0092		0.0075		0.009		0.0071		0.0069		0.0061	
PCB 114/134			0.0056		0.0055		0.0057		0.0053		0.0107		0.0137		0.0067		0.0527		0	U	0.0553		0	U
PCB 118			0.0547		0.0588		0.0535		0.0552		0.0531		0.0485		0.0467		0.0482		0.0447		0.0487		0.0454	
PCB 119			0.0161		0.0174		0.0191		0.0188		0.0072		0.0139		0.0078		0.0117		0.0123		0.0134		0.0099	
PCB 124/135/144/147			0.0059		0.0105		0.0055		0.0088		0.0127		0.0077		0.0042		0.01		0.0075		0.0051		0.0078	
PCB 128			0.0041		0.0046		0.0041		0.004		0.0057		0.0049		0.0045		0.003		0.0045		0.0049		0.0031	
PCB 129/178			0.0029		0.0032		0.0028		0.0031		0.0055		0.0028		0.0018		0.0037		0.0034		0.0028		0.0031	
PCB 130			0.0064		0.0075		0.0075		0.0068		0.0077		0.0083		0.007		0.0071		0.0075		0.0073		0.0081	
PCB 131			0.0006		0.0009		0.0006		0.0009		0.0039		0.005		0.0029		0.0133		0.0071		0.0161		0.0274	
PCB 136			0.0251		0	U	0	U	0	U	0.0076		0	U	0.0051		0.0063		0.0052		0.0055		0.0054	
PCB 137/176			0.0018		0.0016		0.0012		0.0014		0.0026		0.0015		0.0011		0.0016		0.0013		0.001		0.0015	
PCB 138/158/163			0.0553		0.053		0.0524		0.0596		0.0882		0.0461		0.1759		0.0576		0.0681		0.0642		0.0615	
PCB 141			0.0056		0.0056		0	U	0	U	0.011		0.0065		0.0056		0.0081		0.0067		0.0066		0.0077	
PCB 146			0.0165		0.0191		0.0182		0.0234		0.0199		0.018		0.017		0.0316		0.0373		0.0459		0.0337	
PCB 149			0.0346		0.0382		0.0267		0.0319		0.0491		0.0315		0.0268		0.0377		0.0294		0.0303		0.0333	
PCB 151			0.012		0.0132		0.0103		0.0108		0.0221		0.0114		0.0113		0.0155		0.0116		0.0117		0.0129	
PCB 156/171/202			0.0047		0.0056		0.004		0.0014		0.0082		0.0061		0.0045		0.0067		0.0065		0.006		0.0061	
PCB 157/200			0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 167			0	U	0.0006		0.0004		0.0003		0.0006		0.0032		0.0009		0.0017		0.0009		0.0012		0.0014	
PCB 169																								
PCB 170/190			0.0048		0.0088		0.0059		0.0158		0.0104		0	U	0	U	0.0628		0	U	0.0222		0	U
PCB 172/197			0.0007		0.0013		0.0015		0.001		0.0021		0.0013		0.0012		0.0013		0.001		0.0009		0.0015	
PCB 173			0	U	0	U	0	U	0	U	0	U	0	U	0.0011		0	U	0	U	0	U	0	U
PCB 174			0.013		0.0108		0.0107		0.0107		0.0133		0.0086		0.0063		0.0092		0.0079		0.0074		0.0088	
PCB 175			0.0013		0.0039		0.0063		0.0043		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177			0.004		0.0051		0.0039		0.0067		0.0046		0.0053		0.0043		0.0053		0.005		0.0049		0.0055	
PCB 180			0.0173		0.0189		0.0155		0.0178		0.0241		0.0218		0.0165		0.0164		0.0204		0.0182		0.0184	
PCB 182/187			0.0113		0.0107		0.0086		0.0095		0.0182		0.0136		0.0104		0.0134		0.0114		0.0111		0.0122	
PCB 183			0.0052		0.0084		0.0039		0.0074		0.0102		0.0062		0.0045		0.0068		0.006		0.006		0.0061	
PCB 185			0.0025		0.0008		0	U	0.0023		0.0012		0.0045		0.0077		0.0023		0.002		0.0017		0.0071	
PCB 189			0	U	0	U	0.0009		0.0015		0	U	0.0003		0	U	0.0002		0	U	0	U	0	U
PCB 191			0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193			0	U	0.0004		0	U	0.0007		0.0012		0.0013		0.0005		0.0008		0.0006		0.0007		0.0006	
PCB 194			0.0013		0.0011		0.0008		0.0014		0.003		0.0016		0.0007		0.0029		0.002		0.002		0.0028	
PCB 195/208			0.0029		0.0062		0.0032		0.0038		0.0058		0.0039		0.004		0.0039		0.0046		0.0039		0.004	
PCB 196/203			0.0026		0.0022		0.0018		0.0128		0.013		0.0068		0.0077		0.0061		0.0065		0.0059		0.0072	
PCB 198			0	U	0	U	0	U	0	U	0	U	0.0035		0	U	0.0172		0.0419		0.021		0.0322	
PCB 199			0	U	0.0014		0.0003		0.0015		0.0015		0.0005		0.0011		0.0016		0.0012		0.0013		0.001	
PCB 201			0.0107		0.0149		0.0036		0.0224		0.0101		0.0057		0.0064		0.0145		0.0153		0.015		0.0204	
PCB 205			0.0001		0.0001		0.0002		0.0004		0.0001		0	U	0	U	0.0007		0	U	0	U	0.0011	
PCB 206			0.0048		0.0039		0.0019		0.0049		0.0027		0.0018		0.0029		0.0018		0.0028		0.002		0.0021	
PCB 207			0	U	0	U	0	U	0	U	0	U	0	U	0.0001		0.0003		0.0002		0.0002		0	U
PCB 209			0	U	0	U	0	U	0	U	0.001		0.0002		0.01		0	U	0	U	0	U	0.0037	
Total Dissolved PCBs (by congener sum) =	0.00		19.87		22.38		25.80		22.81		18.74		16.78		17.33		17.10		15.12		16.75		15.09	
Total Congeners Analyzed (Diss) =	0		92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Diss) =	0		80		82		80		83		83		82		82		85		82		84		82	
Reported TPCBs (Diss) =																								

NOTE. no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI38		89GH5RI39		89GH5RI40		89GH5RI41		89GH5RI42		89GH5RI43		89GH5RI44		89GH5RI45		89GH5RI46		89GH5RI47		89GH5RI48	
Sample Date	7/27/89		7/27/89		7/28/89		7/28/89		7/29/89		7/29/89		7/30/89		7/30/89		7/31/89		8/9/89		8/14/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.038		0.0544		0.04		0.0559		0.0507		0.0403		0.0548		0.0265		0.0161		0.0346		0.0252	
PCB 003	0	U	0	U	0	U	0	U	0	U	0.0476		0	U	0	U	0	U	0	U	0	U
PCB 004/010	0.2894		0.2266		0.1954		0.3096		0.2611		0.319		0.2485		0.1833		0.1958		0.2628		0.1808	
PCB 005/008	1.6296		1.4509		1.1357		1.638		1.4464		1.6271		1.2812		1.1871		1.1715		1.5103		1.273	
PCB 006	0.6396		0.5346		0.3878		0.5891		0.4368		0.5526		0.4763		0.4214		0.4037		0.5666		0.3921	
PCB 007	0.0338		0.0314		0.0252		0.0357		0.0332		0.0372		0.0269		0.022		0.0229		0.0303		0.0244	
PCB 012/013	0.039		0.0381		0.0386		0.0167		0.0333		0.0271		0.01		0.0261		0.0148		0.0252		0.0212	
PCB 016/032	2.1458		1.9839		1.5498		2.068		1.8085		2.1951		1.8385		1.9266		1.8923		1.971		1.5741	
PCB 017	1.8592		1.3784		1.0702		1.6726		1.353		1.3129		1.4031		1.3624		1.2767		1.7247		1.0707	
PCB 018	2.4905		2.1806		2.1182		2.3795		2.7965		2.2957		2.1662		2.1329		2.0501		2.1175		2.2485	
PCB 019	0.2704		0.2253		0.184		0.2031		0.1831		0.1996		0.1853		0.2147		0.2105		0.2545		0.1651	
PCB 021	0.0043		0.0026		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022	0.9024		0.8979		0.668		0.877		0.8304		0.877		0.7992		0.8716		0.8086		0.7931		0.8476	
PCB 024/027	0.3272		0.2477		0.2151		0.2559		0.2214		0.2762		0.2414		0.2696		0.2341		0.2935		0.2101	
PCB 025	0.6415		0.6356		0.3907		0.5539		0.4772		0.6682		0.5054		0.5597		0.5237		0.5753		0.4704	
PCB 026	0.7927		0.7781		0.7482		0.6982		0.8471		0.0878		0.7078		0.7433		0.6989		0.6767		0.62	
PCB 028/031	4.4951		4.2932		3.0261		4.2619		3.8742		4.5113		3.7136		4.0511		3.8593		3.7683		3.561	
PCB 029	0.0417		0.0429		0.0281		0.0603		0.0391		0.0613		0.0132		0.0135		0.0168		0.0133		0.038	
PCB 033	0.8347		0.8242		0.608		0.8074		0.7325		0.779		0.7041		0.7806		0.6946		0.7522		0.7601	
PCB 037/042	0.539		0.5373		0.3857		0.4667		0.448		0.4682		0.4628		0.5045		0.4888		0.4139		0.4468	
PCB 040	0.3099		0.3116		0.2421		0.2469		0.2355		0.2486		0.2698		0.2993		0.2862		0.2593		0.2602	
PCB 041/064/071	0.9185		0.9409		0.7112		0.8496		0.8152		0.8483		0.812		0.8928		0.8599		0.771		0.7644	
PCB 043	0.103		0.1065		0.0696		0.0818		0.0851		0.1005		0.0973		0.1205		0.1125		0.0929		0.0942	
PCB 044	1.1701		1.1541		0.8809		1.1048		1.0291		1.1007		1.0067		1.1103		1.0642		0.9649		0.9591	
PCB 045	0.3002		0.2871		0.2282		0.2818		0.257		0.2852		0.2571		0.2761		0.2679		0.2568		0.2329	
PCB 046	0.1643		0.1619		0.1205		0.1536		0.1406		0.1585		0.1397		0.1501		0.1438		0.1376		0.1309	
PCB 047/048	0.5693		0.5476		0.4045		0.5402		0.5159		0.5628		0.5226		0.5703		0.516		0.4974		0.5193	
PCB 049	0.7877		0.7438		0.5587		0.7372		0.6705		0.7515		0.6716		0.7418		0.7105		0.6619		0.622	
PCB 051	0.0637		0.0655		0.049		0.0667		0.0593		0.068		0.0584		0.0592		0.057		0.0651		0.0731	
PCB 052	1.0232		0.9838		0.7577		1.0004		0.8974		1.0041		0.866		0.9473		0.8866		0.8404		0.7947	
PCB 053	0.2692		0.2603		0.1989		0.2933		0.2809		0.3246		0.231		0.2331		0.2364		0.2204		0.2173	
PCB 056/060	0.3722		0.4096		0.3051		0.3544		0.3498		0.3776		0.3464		0.3685		0.3693		0.3062		0.3694	
PCB 063	0.0495		0.0527		0.0384		0.041		0.0396		0.0427		0.0414		0.0475		0.0457		0.0418		0.0397	
PCB 066/095	0.7619		0.8304		0.6171		0.7514		0.724		0.7174		0.6795		0.7545		0.728		0.6257		0.6896	
PCB 070/076	0.5831		0.6371		0.4651		0.5704		0.553		0.5473		0.5326		0.6053		0.5657		0.4981		0.5512	
PCB 074	0.2222		0.2396		0.1791		0.1966		0.1922		0.1976		0.1922		0.2162		0.2121		0.1793		0.1843	
PCB 077/110	0.1884		0.2241		0.1609		0.1815		0.1713		0.1694		0.1712		0.1914		0.1805		0.1447		0.1739	
PCB 081	0.0056		0.0099		0.0068		0.0051		0.0057		0.0057		0.0066		0.0067		0.007		0.0036		0.0056	
PCB 082	0.0254		0.0222		0.0186		0.0258		0.0244		0.0253		0.024		0.0247		0.0223		0.0211		0.0227	
PCB 083	0.009		0.0103		0.0071		0.0089		0.0052		0.0052		0.0087		0.0097		0.0089		0.0067		0.0068	
PCB 084/092	0.167		0.1808		0.1368		0.1818		0.167		0.176		0.149		0.158		0.1618		0.136		0.1572	
PCB 085	0.0349		0.0393		0.0302		0.0343		0.0324		0.0305		0.032		0.0347		0.0351		0.0273		0.0313	
PCB 087	0.0596		0.0756		0.0569		0.0636		0.0578		0.0548		0.0563		0.061		0.0595		0.0473		0.0587	
PCB 089	0.0056		0.0083		0.004		0.0129		0.0131		0.0128		0.0034		0.0082		0.008		0.0046		0.0074	
PCB 091	0.0416		0.0466		0.0376		0.0456		0.0363		0.0565		0.0377		0.0422		0.04		0.0343		0.0372	
PCB 097	0.0525		0.0605		0.0472		0.0493		0.046		0.0455		0.0452		0.0503		0.0491		0.0409		0.0464	
PCB 099	0.0549		0.0623		0.0488		0.0553		0.0509		0.0506		0.0499		0.0548		0.0541		0.0435		0.0476	
PCB 100	0.0267		0.0296		0.0253		0.0245		0.024		0.0247		0.0237		0.0318		0.0269		0.0232		0.0261	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI38		89GH5RI39		89GH5RI40		89GH5RI41		89GH5RI42		89GH5RI43		89GH5RI44		89GH5RI45		89GH5RI46		89GH5RI47		89GH5RI48	
Sample Date	7/27/89		7/27/89		7/28/89		7/28/89		7/29/89		7/29/89		7/30/89		7/30/89		7/31/89		8/9/89		8/14/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0 1275		0.1265		0.0948		0 1159		0 1051		0.1029		0.1017		0.1156		0.1078		0.0808		0.1033	
PCB 105/132/153	0 0925		0.1028		0.0764		0.0936		0.0823		0.0898		0 076		0.08		0 0801		0.0575		0 069	
PCB 107	0 0078		0.01		0.007		0.0093		0 0079		0.0088		0.0093		0.0089		0.0064		0.0104		0.0097	
PCB 114/134	0	U	0 0079		0.013		0	U	0	U	0	U	0.0065		0.0068		0.0063		0.0063		0.007	
PCB 118	0 0571		0.0558		0.0436		0.0579		0 0523		0.0605		0.054		0.0554		0.0514		0.0465		0.0471	
PCB 119	0.009		0 0168		0.0075		0.0085		0.0076		0.0076		0.0099		0.0111		0.01		0 0088		0 0097	
PCB 124/135/144/147	0.0073		0.0133		0.01		0 015		0 0078		0.0081		0.0074		0.0111		0.0064		0.0094		0 011	
PCB 128	0 004		0 0051		0.0037		0.0062		0.0053		0 0054		0.0039		0 004		0.0037		0 0032		0 0037	
PCB 129/178	0 0027		0 0042		0 0025		0 003		0.0027		0.0031		0.0035		0.0022		0 0023		0	U	0 0021	
PCB 130	0	U	0.005		0.0056		0.0056		0.0049		0.006		0.0069		0.0068		0 0046		0	U	0 0069	
PCB 131	0	U	0	U	0	U	0	U	0	U	0	U	0.0006		0 0005		0 0008		0 0006		0 0006	
PCB 136	0.0259		0 0326		0.0248		0	U	0	U	0	U	0.0226		0.0243		0.0241		0.0186		0 023	
PCB 137/176	0	U	0 0017		0.0011		0.0022		0.0018		0 0018		0.0013		0.0012		0	U	0	U	0 0011	
PCB 138/158/163	0	U	0	U	0	U	0.0636		0.0656		0.0537		0.0451		0.0475		0.0443		0 0365		0 0421	
PCB 141	0.0073		0.0106		0 0073		0 01		0 0083		0 008		0.007		0.0065		0.0059		0.0051		0.0068	
PCB 146	0.0385		0 0178		0 0388		0 0286		0.0232		0.0245		0.0133		0.014		0.0145		0.0127		0.0134	
PCB 149	0.0373		0 0494		0.0367		0.0516		0 043		0 0466		0 0394		0 0377		0.0315		0.0319		0 039	
PCB 151	0.0152		0.0204		0 0152		0 0211		0.0172		0 018		0.0149		0.0147		0.0127		0.0122		0.0165	
PCB 156/171/202	0.0024		0.0077		0 0059		0 0057		0.0049		0 0049		0.0051		0.0019		0.0013		0.004		0.0047	
PCB 157/200	0	U	0	U	0	U	0.0007		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 167	0	U	0	U	0	U	0.001		0.0011		0 0008		0	U	0	U	0	U	0	U	0 0005	
PCB 169																						
PCB 170/190	0	U	0	U	0	U	0	U	0.0324		0	U	0.0029		0.0078		0.0039		0.0044		0.0018	
PCB 172/197	0	U	0.0016		0 0016		0 0012		0 001		0 001		0	U	0	U	0	U	0	U	0.0013	
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0097		0 0162		0.0088		0.0102		0.0089		0 0084		0 0087		0 0088		0.0081		0.0069		0 0084	
PCB 175	0.0063		0 014		0 0022		0	U	0	U	0 0008		0 0022		0 0019		0	U	0	U	0 0047	
PCB 177	0.0047		0.0121		0 007		0 0057		0.0052		0 0048		0.0048		0.0046		0.0046		0.0038		0.0041	
PCB 180	0.0219		0.0278		0.0189		0 0226		0 0197		0 0171		0.0153		0 0148		0.0126		0.0134		0.016	
PCB 182/187	0.011		0 0192		0 0109		0 0146		0.0124		0.0109		0 0106		0 0097		0.0095		0.0076		0 0109	
PCB 183	0.0054		0.0075		0.0059		0 0075		0.0064		0.0061		0 0088		0 0049		0.0048		0.0039		0 0069	
PCB 185	0	U	0.0029		0 0037		0 0014		0.0073		0.0012		0	U	0	U	0	U	0	U	0.0008	
PCB 189	0	U	0	U	0.0335		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0	U	0.0014		0.0022		0 0006		0.0004		0	U	0	U	0	U	0	U	0	U	0.0007	
PCB 194	0.0026		0 0057		0.0023		0	U	0	U	0	U	0.002		0 0008		0.0028		0 001		0.002	
PCB 195/208	0	U	0.0041		0 0019		0.0041		0.0031		0.0028		0 0024		0.0018		0 0022		0	U	0.0025	
PCB 196/203	0	U	0 022		0 0068		0.0052		0.0041		0.0038		0 0017		0.0012		0 0015		0.0023		0 0037	
PCB 198	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 199	0	U	0.0015		0 0017		0.0009		0.001		0.0011		0	U	0	U	0	U	0	U	0.0003	
PCB 201	0	U	0	U	0	U	0.0056		0.0054		0.0038		0 005		0 0093		0 0052		0.0037		0.0039	
PCB 205	0.0082		0	U	0.001		0	U	0	U	0	U	0.0004		0.0003		0.0003		0	U	0.0033	
PCB 206	0	U	0.0052		0 0011		0.0016		0 0007		0.0004		0.0015		0.0023		0.0017		0	U	0.0023	
PCB 207	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209	0.0001		0.0013		0	U	0.0005		0.0004		0.0002		0 0007		0.0005		0 0017		0	U	0.009	
Total Dissolved PCBs (by congener sum) =	26.87		25.50		19.72		25.49		23.90		24.89		22.67		23.88		22.77		23.13		21.55	
Total Congeners Analyzed (Diss) =	92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Diss) =	70		79		79		78		78		78		79		79		77		71		84	
Reported TPCBs (Diss) =																						

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI49		89GH5RI50		89GH5RI51		89GH5RI52		89GH5RI53		89GH5RI54		89GH5RI55	
Sample Date	*8/23/89*		*8/29/89*		*9/7/89*		*9/13/89*		*9/20/89*		*9/27/89*		*10/4/89*	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0	U	0.0314		0	U	0	U	0.0215		0.0101	
PCB 003	0	U	0	U	0	U	0	U	0	U	0	U	0.0097	
PCB 004/010	0.2703		0.2919		0.1908		0.3396		0.18		0.2956		0.1911	
PCB 005/008	1.7237		1.7121		1.4847		1.9682		1.272		2.2998		1.5291	
PCB 006	0.4792		0.5475		0.4216		0.6402		0.3137		0.6189		0.3873	
PCB 007	0.0341		0.0333		0.0307		0.0403		0.0248		0.0417		0.0283	
PCB 012/013	0.0102		0.016		0.009		0.0226		0.0097		0.0077		0.008	
PCB 016/032	1.8002		1.6497		1.5239		2.023		1.1665		1.8969		1.3256	
PCB 017	1.5137		1.6406		1.0913		2.0768		0.8426		1.8468		0.8664	
PCB 018	2.5337		2.6981		2.1526		3.7419		1.5747		2.1992		1.7294	
PCB 019	0.2361		0.2444		0.1736		0.2745		0.157		0.2731		0.1334	
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022	0.8241		0.8558		0.8243		0.8895		0.5966		0.8683		0.6118	
PCB 024/027	0.2714		0.2795		0.1817		0.3733		0.1555		0.2156		0.1516	
PCB 025	0.3766		0.4231		0.457		0.4416		0.3291		0.552		0.337	
PCB 026	0.628		0.6761		0.7744		0.7497		0.5343		0.6904		0.5614	
PCB 028/031	3.7277		4.0984		3.626		4.327		2.6453		4.0914		2.76	
PCB 029	0.0041		0.0135		0.0103		0	U	0.0035		0.0067		0.0055	
PCB 033	0.7717		0.7852		0.7445		0.8312		0.5948		0.8585		0.6052	
PCB 037/042	0.4528		0.4922		0.4424		0.5328		0.3648		0.4226		0.3291	
PCB 040	0.2436		0.2565		0.2535		0.2711		0.184		0.2431		0.1821	
PCB 041/064/071	0.808		0.8669		0.8537		0.9207		0.6375		0.7807		0.6355	
PCB 043	0.1007		0.1161		0.096		0.1203		0.0737		0.1028		0.0751	
PCB 044	1.0372		1.1025		1.0376		1.1656		0.7961		1.0203		0.7861	
PCB 045	0.256		0.2705		0.256		0.2835		0.184		0.2548		0.1859	
PCB 046	0.1449		0.1539		0.1301		0.1603		0.1031		0.1358		0.0971	
PCB 047/048	0.5226		0.5634		0.5426		0.5971		0.4502		0.5305		0.4297	
PCB 049	0.6766		0.7518		0.7003		0.8088		0.5294		0.7082		0.5394	
PCB 051	0.0689		0.0661		0.0591		0.0692		0.0516		0.0599		0.048	
PCB 052	0.9621		1.0006		0.897		1.0755		0.7077		0.9489		0.7031	
PCB 053	0.2772		0.2896		0.2139		0.3153		0.1793		0.2231		0.1732	
PCB 056/060	0.3655		0.3809		0.3953		0.4056		0.3268		0.3384		0.2911	
PCB 063	0.0393		0.0467		0.0436		0.0492		0.0274		0.0412		0.029	
PCB 066/095	0.7421		0.7983		0.8156		0.8404		0.6552		0.7398		0.6211	
PCB 070/076	0.5619		0.6011		0.6089		0.642		0.4845		0.5667		0.4693	
PCB 074	0.1914		0.2243		0.2217		0.2409		0.1679		0.2		0.1605	
PCB 077/110	0.1897		0.1949		0.1945		0.2107		0.1668		0.1689		0.1466	
PCB 081	0.0052		0.0068		0.0071		0.0055		0.0065		0.0051		0.0059	
PCB 082	0.0221		0.0237		0.0212		0.0269		0.0207		0.0177		0.0152	
PCB 083	0.0052		0.007		0.0029		0.0069		0.0046		0.0037		0.0032	
PCB 084/092	0.1656		0.1899		0.1727		0.1932		0.1413		0.1408		0.1236	
PCB 085	0.0341		0.0358		0.0391		0.0369		0.0324		0.0304		0.0269	
PCB 087	0.063		0.0612		0.0676		0.0633		0.0588		0.0575		0.052	
PCB 089	0.0157		0.0138		0.0054		0.0224		0.0142		0.0019		0.002	
PCB 091	0.0573		0.0513		0.0481		0.0562		0.0402		0.0406		0.0351	
PCB 097	0.0512		0.0521		0.054		0.0537		0.0464		0.0489		0.0413	
PCB 099	0.0544		0.0563		0.0567		0.0602		0.0483		0.0487		0.0423	
PCB 100	0.0211		0.0244		0.031		0.0243		0.0158		0.0261		0.0206	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI49		89GH5RI50		89GH5RI51		89GH5RI52		89GH5RI53		89GH5RI54		89GH5RI55	
Sample Date	8/23/89		8/29/89		9/7/89		9/13/89		9/20/89		9/27/89		10/4/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.12		0.1104		0.114		0.1246		0.1039		0.1021		0.0886	
PCB 105/132/153	0.1017		0.0951		0.08		0.1025		0.0963		0.0868		0.0748	
PCB 107	0.0077		0.0144		0.0045		0.0099		0.0067		0.0037		0.0027	
PCB 114/134	0	U	0	U	0	U	0	U	0.0114		0.0087		0.0183	
PCB 118	0.0457		0.0539		0.0524		0.0616		0.048		0.051		0.0441	
PCB 119	0.0058		0.0029		0.0075		0.004		0.0012		0.0035		0.003	
PCB 124/135/144/147	0.0113		0.0098		0.0082		0.0093		0.0094		0.0072		0.0057	
PCB 128	0	U	0	U	0.0044		0	U	0	U	0.0078		0.0026	
PCB 129/178	0.0025		0.0023		0.0026		0.0022		0.0027		0.0031		0.0022	
PCB 130	0.0042		0.0043		0.0029		0.0051		0.0037		0.0016		0.0023	
PCB 131	0	U	0	U	0	U	0	U	0	U	0.0007		0.0027	
PCB 136	0	U	0	U	0	U	0	U	0	U	0.0081		0.0074	
PCB 137/176	0.0012		0.001		0.0008		0.001		0.0014		0.0007		0.001	
PCB 138/158/163	0.0655		0.0658		0.0536		0.1103		0.1192		0.0497		0.046	
PCB 141	0.0088		0	U	0	U	0.0075		0	U	0.0094		0.0067	
PCB 146	0.0244		0.0256		0	U	0.0239		0.017		0.0175		0.0141	
PCB 149	0.0519		0.0391		0.035		0.0414		0.0449		0.0431		0.0366	
PCB 151	0.0206		0.0137		0.0144		0.015		0.0172		0.0174		0.0148	
PCB 156/171/202	0.0043		0.0049		0	U	0.0041		0.006		0.004		0.0041	
PCB 157/200	0	U	0	U	0	U	0	U	0	U	0.0007		0.0006	
PCB 167	0	U	0	U	0.0002		0	U	0	U	0.0007		0.0012	
PCB 169														
PCB 170/190	0	U	0	U	0	U	0.0069		0	U	0.005		0.0036	
PCB 172/197	0.0011		0.0011		0.0008		0.001		0.0014		0.0009		0.0006	
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0114		0.0098		0.0063		0.0087		0.0102		0.0103		0.0068	
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177	0.0044		0.0051		0	U	0.0034		0.0058		0.0053		0.0045	
PCB 180	0.0316		0.018		0.0128		0.0168		0.0203		0.0161		0.0131	
PCB 182/187	0.0133		0.012		0.0091		0.0128		0.0132		0.0121		0.0088	
PCB 183	0.0066		0.0061		0.0076		0.0062		0.0069		0.0088		0.0052	
PCB 185	0.0015		0.0012		0.0005		0.0016		0	U	0.0013		0.0005	
PCB 189	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0006		0.0008		0.0002		0.0007		0.0008		0.0004		0	U
PCB 194	0	U	0.0005		0	U	0	U	0	U	0	U	0	U
PCB 195/208	0.0027		0.0036		0	U	0.0038		0.0037		0.001		0	U
PCB 196/203	0.004		0.0039		0.0048		0	U	0.0031		0.0044		0.0039	
PCB 198	0	U	0	U	0.0006		0.0004		0	U	0	U	0	U
PCB 199	0.0005		0.0006		0.0008		0.0005		0.0006		0.0005		0	U
PCB 201	0.0028		0.0031		0.0023		0	U	0.0017		0.0033		0.0009	
PCB 205	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 206	0.001		0.0018		0.0016		0.0011		0.0017		0	U	0	U
PCB 207	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209	0.0007		0.0006		0	U	0.0005		0.0005		0	U	0	U
Total Dissolved PCBs (by congener sum) =	23.92		25.18		22.42		28.58		17.48		25.19		17.95	
Total Congeners Analyzed (Diss) =	92		92		92		92		92		92		92	
Total Congeners Detected (Diss) =	74		74		72		73		73		80		78	
Reported TPCBs (Diss) =														

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI56		89GH5RI57		89GH5RI58		89GH5RI59		89GH5RI60		89GH5RI61		89GH5RI63		89GH5RI64		89GH5RI65		89GH5RI66		89GH5RI67	
Sample Date	10/12/89		10/18/89		10/24/89		10/30/89		10/31/89		10/31/89		11/1/89		11/2/89		11/2/89		11/3/89		11/3/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0.047		0.0826		0.0195		0.0327		0.1438		0.073				0.1194		0.1013		0.1064	
PCB 003	0	U	0	U	0	U	0	U	0	U	0	U	0.0816				0	U	0	U	0.0595	
PCB 004/010	0.2075		0.2372		0.2042		0.1687		0.2146		0.3578		0.2755				0.1727		0.1077		0.1532	
PCB 005/008	1.6852		1.7393		1.3782		1.352		1.6014		2.5225		1.6984				1.4798		0.9637		1.0626	
PCB 006	0.4488		0.4969		0.316		0.2777		0.3903		0.6767		0.3912				0.3303		0.1865		0.2334	
PCB 007	0.0359		0.0354		0.0301		0.0286		0.0318		0.0506		0.0391				0.0306		0.0223		0.0279	
PCB 012/013	0.0151		0.0069		0.0019		0	U	0	U	0	U	0.0221				0.0119		0.0041		0	U
PCB 016/032	1.4764		1.4144		1.0631		1.1396		1.4189		2.2382		1.5559				1.2252		0.8005		0.9458	
PCB 017	1.0304		0.9238		0.8065		0.7501		1.0048		1.3022		1.1025				0.9394		0.5828		0.6357	
PCB 018	1.9404		1.8878		1.2743		1.3919		1.7152		2.2392		1.8446				1.5038		0.8965		1.0211	
PCB 019	0.1471		0.1548		0.1347		0.1047		0.1421		0.2839		0.1373				0.1548		0.0934		0.0823	
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U
PCB 022	0.735		0.5844		0.5131		0.5194		0.6875		0.7995		0.7239				0.5484		0.3753		0.4552	
PCB 024/027	0.1634		0.1454		0.1407		0.1265		0.149		0.2868		0.1674				0.1523		0.1028		0.1081	
PCB 025	0.3769		0.3561		0.2635		0.2634		0.3703		0.4392		0.3894				0.2737		0.2589		0.2285	
PCB 026	0.7048		0.6181		0.5574		0.4455		0.6288		0.6961		0.6724				0.4396		0.3487		0.3821	
PCB 028/031	3.2848		2.6629		2.5056		2.3463		2.9289		4.1216		3.3438				2.7661		1.9341		2.0777	
PCB 029	0.0066		0.0074		0.0014		0.0058		0.0099		0.01		0.016				0.058		0.0041		0.0031	
PCB 033	0.7061		0.5673		0.5147		0.4944		0.6922		0.815		0.732				0.5811		0.402		0.4518	
PCB 037/042	0.3603		0.2853		0.2682		0.301		0.3482		0.4424		0.3704				0.3146		0.2238		0.2178	
PCB 040	0.1982		0.1612		0.1287		0.156		0.1932		0.2198		0.2065				0.1516		0.1059		0.1256	
PCB 041/064/071	0.701		0.5307		0.4885		0.5237		0.652		0.8075		0.6996				0.5652		0.4072		0.4184	
PCB 043	0.09		0.0547		0.0465		0.071		0.076		0.0988		0.0898				0.0761		0.0474		0.0456	
PCB 044	0.8598		0.6979		0.5912		0.6853		0.8177		1.0018		0.8783				0.6819		0.4876		0.5246	
PCB 045	0.1844		0.1781		0.1497		0.1438		0.1975		0.2587		0.1923				0.165		0.1213		0.1123	
PCB 046	0.1082		0.0879		0.0761		0.0846		0.1034		0.1398		0.1131				0.0858		0.0604		0.0669	
PCB 047/048	0.4852		0.333		0.3577		0.3653		2.171		0.5585		0.5164				0.4765		0.2905		0.3181	
PCB 049	0.6145		0.4469		0.4427		0.4715		0.5897		0.7323		0.6687				0.5314		0.3798		0.4073	
PCB 051	0.0519		0.0422		0.0388		0.0405		0.3119		0.0685		0.0556				0.0546		0.0303		0.0355	
PCB 052	0.7963		0.7062		0.5839		0.6225		0.8451		1.0677		0.7887				0.7017		0.4779		0.4963	
PCB 053	0.1873		0.1634		0.1279		0.1483		0.1704		0.2762		0.1819				0.1737		0.1176		0.1215	
PCB 056/060	0.3283		0.2419		0.24		0.2596		0.3258		0.3566		0.3677				0.2862		0.2016		0.2116	
PCB 063	0.037		0.0269		0.026		0.0282		0.0363		0.0447		0.0447				0.0355		0.0226		0.0281	
PCB 066/095	0.7809		0.5182		0.5337		0.5185		0.8051		0.7675		0.7925				0.6764		0.4561		0.4844	
PCB 070/076	0.657		0.4009		0.378		0.3879		0.5432		0.5729		0.6042				0.5022		0.3324		0.3497	
PCB 074	0.238		0.1439		0.1349		0.1546		0.1816		0.2142		0.217				0.1621		0.125		0.1379	
PCB 077/110	0.1767		0.1132		0.1383		0.1301		0.2042		0.1911		0.202				0.1654		0.1236		0.1291	
PCB 081	0.008		0.0061		0.0039		0.0077		0.0066		0.0044		0.0121				0.0039		0.0032		0.0077	
PCB 082	0.0219		0.0125		0.0173		0.0155		0.0191		0.0225		0.0214				0.0213		0.0129		0.0108	
PCB 083	0.0082		0.0044		0.0027		0.005		0.0094		0.0061		0.0105				0.0049		0		0.0054	
PCB 084/092	0.1417		0.1097		0.1135		0.1185		0.1886		0.1695		0.1736				0.1248		0.0952		0.1089	
PCB 085	0.0339		0.023		0.0243		0.025		0.0371		0.0364		0.0375				0.0296		0.0218		0.0219	
PCB 087	0.0616		0.044		0.045		0.0495		0.0817		0.062		0.067				0.0516		0.0376		0.0437	
PCB 089	0.0031		0.0027		0.0073		0.004		0.0038		0.0108		0.0065				0.0091		0.0078		0.0036	
PCB 091	0.0489		0.0359		0.0271		0.0354		0.053		0.0397		0.035				0.0239		0.0177		0.0234	
PCB 097	0.0495		0.0357		0.0372		0.0343		0.0535		0.0545		0.0614				0.0483		0.0338		0.0335	
PCB 099	0.0547		0.0363		0.0424		0.0426		0.0676		0.0599		0.0656				0.0573		0.0382		0.0427	
PCB 100	0.0272		0.0208		0.0157		0.0211		0.0256		0.0194		0.0302				0.0272		0.013		0.0206	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI56		89GH5RI57		89GH5RI58		89GH5RI59		89GH5RI60		89GH5RI61		89GH5RI63		89GH5RI64		89GH5RI65		89GH5RI66		89GH5RI67	
Sample Date	10/12/89		10/18/89		10/24/89		10/30/89		10/31/89		10/31/89		11/1/89		11/2/89		11/2/89		11/3/89		11/3/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.1077		0.0733		0.0917		0.0831		0.1487		0.1193		0.1208				0.1069		0.0763		0.0802	
PCB 105/132/153	0.0905		0.0508		0.0889		0.0705		0.1078		0.1089		0.0969				0.1138		0.076		0.0531	
PCB 107	0.005		0.0024		0.006		0.0052		0.0032		0.009		0.0094				0.0112		0.0073		0.0037	
PCB 114/134	0.0303		0.0055		0.0115		0.0197		0	U	0.0129		0.0463				0.0278		0.0066		0.0205	
PCB 118	0.0622		0.0335		0.0458		0.0457		0.0531		0.07		0.0723				0.0692		0.0446		0.0411	
PCB 119	0.0097		0.006		0.0077		0.0057		0.0049		0.0099		0.0122				0.009		0.0057		0.0085	
PCB 124/135/144/147	0.0095		0.0041		0.01		0.0077		0.0141		0.0133		0.008				0.0154		0.0094		0.0067	
PCB 128	0.0119		0.0098		0.0076		0.0124		0.0073		0.0112		0.0056				0.0102		0.0079		0.0082	
PCB 129/178	0.0036		0.0018		0.0032		0.0024		0.005		0.0041		0.0034				0.0044		0.0029		0.0022	
PCB 130	0.0049		0.0014		0.0087		0.0044		0.005		0.009		0.0038				0.0114		0.0086		0.003	
PCB 131	0.0034		0.0006		0.0014		0.0017		0	U	0.002		0.0054				0	U	0.0009		0.0024	
PCB 136	0.0089		0.0053		0	U	0.0068		0.0175		0	U	0.0083				0	U	0	U	0.0063	
PCB 137/176	0.0022		0.0003		0.0021		0.0015		0.0032		0.0018		0	U			0.0029		0.0017		0.0014	
PCB 138/158/163	0.0655		0.0335		0.0575		0.0444		0.0614		0.0744		0.0651				0.073		0.085		0.0405	
PCB 141	0	U	0	U	0.0088		0.0074		0.0139		0	U	0	U			0	U	0.007		0	U
PCB 146	0.0258		0.0102		0.0222		0.016		0.0132		0.034		0.0351				0.039		0.0216		0.0167	
PCB 149	0.0485		0.0259		0.0447		0.0356		0.0656		0.046		0.0426				0.0549		0.0341		0.0293	
PCB 151	0.0192		0.0108		0.0175		0.0144		0.0307		0.0172		0.0153				0.0181		0.0134		0.0116	
PCB 156/171/202	0	U	0	U	0.0057		0	U	0.0064		0.0069		0	U			0.0082		0.0047		0	U
PCB 157/200	0	U	0	U	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U
PCB 167	0.0014		0	U	0.0011		0	U	0	U	0.002		0.0014				0.002		0.0009		0	U
PCB 169																						
PCB 170/190	0.0114		0.0018		0.0331		0.0062		0	U	0.0293		0.0094				0.0787		0.0797		0.0042	
PCB 172/197	0.0011		0	U	0.0015		0.0008		0.0012		0.0022		0.0011				0.0035		0.0015		0.0008	
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U
PCB 174	0.0104		0.005		0.0099		0.0078		0.0149		0.0115		0.0118				0.0143		0.0086		0.0066	
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U
PCB 177	0.0048		0.0016		0.0058		0.0023		0.0071		0.0075		0.0045				0.0081		0.0052		0.002	
PCB 180	0.0181		0.0082		0.0202		0.0128		0.0341		0.0229		0.0203				0.0258		0.0158		0.0098	
PCB 182/187	0.0122		0.0064		0.0127		0.009		0.0248		0.0159		0.0129				0.0194		0.0112		0.0098	
PCB 183	0.0109		0.004		0.006		0.0069		0.0111		0.0082		0.0066				0.0087		0.0055		0.0076	
PCB 185	0.0008		0.0005		0.001		0	U	0.0056		0.0015		0.0011				0.0012		0.0009		0.0006	
PCB 189	0	U	0	U	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U
PCB 193	0.0005		0	U	0.0007		0	U	0.0007		0.0009		0.0016				0.0011		0	U	0	U
PCB 194	0.0007		0	U	0.0012		0	U	0.0012		0.0021		0.0017				0.0025		0.0011		0.0003	
PCB 195/208	0.0026		0	U	0.0031		0.0011		0.0026		0.0054		0.0014				0.0052		0.0029		0	U
PCB 196/203	0.002		0.0006		0.0048		0.0048		0.0064		0.0081		0.0077				0.0078		0.0049		0.0036	
PCB 198	0	U	0	U	0	U	0	U	0	U	0	U	0	U			0	U	0	U	0	U
PCB 199	0.0011		0.0003		0.0004		0.0014		0.0015		0.0005		0.0018				0.0007		0.0004		0.0013	
PCB 201	0.001		0	U	0.0049		0.0015		0.0044		0.0084		0.0062				0.0081		0.0048		0.0027	
PCB 205	0.0007		0	U	0	U	0	U	0	U	0	U	0.0017				0	U	0	U	0	U
PCB 206	0.0041		0	U	0.0013		0	U	0.001		0.0026		0.0019				0.0024		0.0012		0	U
PCB 207	0.0002		0	U	0.0004		0	U	0	U	0.0003		0.0008				0	U	0	U	0	U
PCB 209	0.0053		0.003		0	U	0	U	0	U	0.0008		0	U			0.0015		0.0005		0	U
Total Dissolved PCBs (by congener sum) =	**20.88**		**17.66**		**15.42**		**15.32**		**21.81**		**25.97**		**21.42**		**0.00**		**17.76**		**12.04**		**12.95**	
Total Congeners Analyzed (Diss) =	**92**		**92**		**92**		**92**		**92**		**92**		**92**		**0**		**92**		**92**		**92**	
Total Congeners Detected (Diss) =	**81**		**73**		**81**		**74**		**76**		**80**		**81**		**0**		**79**		**79**		**75**	
Reported TPCBs (Diss) =																						

NOTE. no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI68		89GH5RI69		89GH5RI70		89GH5RI71		89GH5RI72		89GH5RI73		89GH5RI74		89GH5RI75		89GH5RI76		89GH5RI77		89GH5RI78	
Sample Date	11/4/89		11/6/89		11/7/89		11/7/89		11/8/89		11/8/89		11/9/89		11/9/89		11/10/89		11/10/89		11/11/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.0932		0.0982		0.1222		0.0669		0.0893		0.1313		0.1092		0.0936		0.0679		0	U	0.0756	
PCB 003	0.3616		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 004/010	0.1082		0.1296		0.1265		0.1367		0.1367		0.1289		0.1282		0.1572		0.1449		0.1104		0.1136	
PCB 005/008	0.8456		0.9491		1.2313		1.0664		1.2364		1.0843		1.0265		1.1245		1.1095		0.8708		0.8087	
PCB 006	0.1639		0.2238		0.2254		0.2377		0.2308		0.2095		0.2176		0.2379		0.2433		0.1923		0.177	
PCB 007	0.0192		0.0237		0.0301		0.0259		0.0276		0.0272		0.0207		0.0268		0.0246		0.0193		0.0184	
PCB 012/013	0.0184		0	U	0.0142		0	U	0.0058		0	U	0.015		0	U	0.0143		0.0086		0	U
PCB 016/032	0.6194		0.8205		0.8159		0.8728		0.8736		0.7786		0.7925		0.9236		0.8948		0.7672		0.7222	
PCB 017	0.4292		0.5644		0.5894		0.5734		0.6117		0.5137		0.5223		0.5902		0.5856		0.5145		0.4462	
PCB 018	0.6792		0.9376		0.9189		0.9768		0.9591		0.8648		0.8719		1.0252		1.0305		0.8941		0.8226	
PCB 019	0.0754		0.0703		0.0977		0.0753		0.1127		0.0672		0.0668		0.0826		0.0761		0.0636		0.055	
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022	0.2964		0.3909		0.471		0.4163		0.394		0.3836		0.3784		0.4214		0.3883		0.3507		0.3548	
PCB 024/027	0.0802		0.0897		0.1112		0.0955		0.1063		0.0869		0.0877		0.0999		0.0983		0.0845		0.0793	
PCB 025	0.1979		0.213		0.3344		0.2185		0.2727		0.1808		0.1739		0.2122		0.2086		0.1841		0.1652	
PCB 026	0.2947		0.3445		0.4007		0.3498		0.3695		0.31		0.304		0.3529		0.3553		0.3084		0.2823	
PCB 028/031	1.5977		1.8242		2.1181		1.9073		1.9854		1.7008		1.7291		1.9174		1.9078		1.6981		1.6046	
PCB 029	0.0012		0.0032		0.0818		0.0065		0.0014		0.0035		0.0039		0.0042		0.0032		0.0047		0.0022	
PCB 033	0.3023		0.3693		0.4548		0.4089		0.4026		0.3675		0.3694		0.4058		0.4135		0.3744		0.3487	
PCB 037/042	0.1743		0.1959		0.205		0.1955		0.1979		0.172		0.1768		0.2052		0.1955		0.1945		0.1974	
PCB 040	0.0893		0.1078		0.1014		0.1065		0.0945		0.1028		0.1002		0.112		0.1031		0.0999		0.1037	
PCB 041/064/071	0.3277		0.3674		0.3748		0.3883		0.3567		0.3358		0.3344		0.411		0.366		0.3571		0.3596	
PCB 043	0.0454		0.0498		0.046		0.0515		0.0343		0.0508		0.0381		0.0558		0.0531		0.0454		0.0491	
PCB 044	0.3912		0.4607		0.4694		0.4679		0.4383		0.4262		0.4318		0.4888		0.4648		0.4539		0.4616	
PCB 045	0.0983		0.099		0.1187		0.1242		0.1124		0.0943		0.1169		0.1319		0.1057		0.095		0.0918	
PCB 046	0.0569		0.0594		0.0482		0.0599		0.0565		0.0553		0.0552		0.0627		0.0573		0.0531		0.0511	
PCB 047/048	0.2492		0.2716		0.3258		0.323		0.2766		0.2624		0.2889		0.3369		0.3052		0.438		0.2951	
PCB 049	0.3317		0.3578		0.3627		0.351		0.3277		0.3265		0.324		0.3686		0.3538		0.3406		0.3335	
PCB 051	0.027		0.0335		0.0431		0.0455		0.04		0.0325		0.0424		0.0492		0.041		0.074		0.0355	
PCB 052	0.398		0.4456		0.4557		0.4491		0.4526		0.4118		0.4257		0.4749		0.4677		0.4383		0.434	
PCB 053	0.1044		0.117		0.111		0.1123		0.1127		0.1072		0.1096		0.1193		0.1072		0.107		0.1025	
PCB 056/060	0.1635		0.1662		0.1932		0.1739		0.1651		0.1571		0.1511		0.1678		0.1589		0.1624		0.1808	
PCB 063	0.0217		0.0211		0.0238		0.0205		0.0189		0.0191		0.0208		0.0212		0.0181		0.019		0.0182	
PCB 066/095	0.4153		0.392		0.4682		0.3801		0.3655		0.3645		0.3681		0.4089		0.3755		0.3953		0.3988	
PCB 070/076	0.3043		0.3		0.36		0.2913		0.2715		0.2748		0.2897		0.3144		0.2906		0.2903		0.3034	
PCB 074	0.1041		0.1091		0.1224		0.1082		0.1035		0.0968		0.0956		0.118		0.1039		0.1053		0.1056	
PCB 077/110	0.1147		0.1011		0.1192		0.0934		0.091		0.0966		0.085		0.0966		0.0958		0.1016		0.101	
PCB 081	0.0021		0.0062		0.0032		0.0053		0.0028		0.0071		0.0065		0.0062		0.0055		0.0043		0.005	
PCB 082	0.0112		0.0088		0.0092		0.0084		0.009		0.0085		0.0082		0.0101		0.0074		0.008		0.0091	
PCB 083	0.0018		0.004		0.002		0.0015		0.0015		0.0055		0.0033		0.0044		0.0016		0.0026		0.002	
PCB 084/092	0.083		0.0824		0.0867		0.0778		0.0741		0.0671		0.0798		0.0727		0.0796		0.0714		0.0673	
PCB 085	0.02		0.0176		0.0198		0.0159		0.0151		0.0161		0.0142		0.0163		0.015		0.0165		0.0163	
PCB 087	0.0337		0.0356		0.0387		0.0333		0.0294		0.0349		0.0328		0.0359		0.0356		0.037		0.0353	
PCB 089	0.0065		0.003		0.0074		0.0018		0.0066		0.0019		0.0019		0.0021		0.001		0.0007		0.001	
PCB 091	0.0299		0.0167		0.0159		0.0168		0.0133		0.0192		0.0171		0.0125		0.0142		0.0185		0.0171	
PCB 097	0.0305		0.0246		0.0313		0.0239		0.0266		0.0347		0.0187		0.0284		0.023		0.0256		0.0262	
PCB 099	0.0395		0.0305		0.04		0.0289		0.0279		0.0292		0.028		0.0309		0.0279		0.0316		0.0287	
PCB 100	0.0142		0.0159		0.0181		0.0162		0.0109		0.0153		0.0149		0.0157		0.0126		0.0136		0.014	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI68		89GH5RI69		89GH5RI70		89GH5RI71		89GH5RI72		89GH5RI73		89GH5RI74		89GH5RI75		89GH5RI76		89GH5RI77		89GH5RI78	
Sample Date	11/4/89		11/6/89		11/7/89		11/7/89		11/8/89		11/8/89		11/9/89		11/9/89		11/10/89		11/10/89		11/11/89	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.0739		0.0624		0.0836		0.0602		0.0589		0.0604		0.0582		0.0648		0.065		0.0696		0.0615	
PCB 105/132/153	0.0711		0.0507		0.0668		0.0462		0.0502		0.04		0.0392		0.0533		0.0632		0.0606		0.0481	
PCB 107	0.0097		0.0022		0.0039		0.0014		0.0051		0.0024		0.0024		0.0022		0.0018		0.0018		0.002	
PCB 114/134	0.0056		0.0126		0.0088		0	U	0.0152		0	U	0.0174		0.0214		0.0136		0.0057		0.0152	
PCB 118	0.0417		0.0334		0.0376		0.0307		0.0305		0.0301		0.0278		0.0333		0.0314		0.0336		0.0321	
PCB 119	0.0054		0.002		0.0098		0.0025		0.0028		0.0055		0.0044		0.0051		0.0018		0.0019		0.0021	
PCB 124/135/144/147	*0.0104*		*0.0037*		*0.0105*		*0.0046*		*0.0072*		*0.005*		*0.0041*		*0.0051*		*0.0056*		*0.0054*		*0.004*	
PCB 128	0.0058		0.0017		0.0032		0.0141		0.0049		0.0119		0.0069		0.0086		0	U	0.0021		0.0024	
PCB 129/178	0.003		0.0017		0.0026		0.0014		0.0017		0.0017		0.0016		0.0019		0.0021		0.0021		0.0016	
PCB 130	0.0086		0.0013		0.0046		0.002		0.0047		0.0039		0.0038		0.0041		0.0014		0.0019		0.0016	
PCB 131	0.0006		0.0014		0	U	0	U	0	U	0	U	0.0021		0.0024		0.0015		0.0005		0.0025	
PCB 136	0	U	0.0049		0.0079		0.0049		0	U	0.0053		0.0043		0.0056		0.0063		0.0062		0.004	
PCB 137/176	0.002		0	U	0.0017		0	U	0.0013		0	U	0	U	0.0012		0.0013		0.0012		0.0007	
PCB 138/158/163	0.0638		0.0347		0.0584		0.0305		0.0528		0.0477		0.0322		0.0403		0.0438		0.0378		0.0373	
PCB 141	0	U	0.0042		0	U	0.0049		0.0047		0.005		0.0045		0.0057		0.0077		0.0069		0.0047	
PCB 146	0.0209		0.013		0.0179		0.0091		0.0187		0.0116		0.0113		0.0136		0.0114		0.0137		0.0101	
PCB 149	0.0368		0.0242		0.0348		0.0224		0.0241		0.0237		0.0222		0.0278		0.035		0.0342		0.0239	
PCB 151	0.0136		0.0097		0.0134		0.0075		0.008		0.0098		0.0092		0.0125		0.0145		0.0139		0.0088	
PCB 156/171/202	0.0029		0	U	0.0042		0	U	0.0031		0	U	0	U	0	U	0	U	0	U	0	U
PCB 157/200	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 167	0.0022		0	U	0.0017		0	U	0.0007		0	U	0	U	0	U	0	U	0.0009		0.0005	
PCB 169																						
PCB 170/190	0.0525		0.0028		0.1116		0.0044		0.0459		0.0019		0.0038		0.0068		0.0025		0.0042		0.0019	
PCB 172/197	0.0025		0	U	0.0012		0	U	0.0008		0	U	0.0004		0.0004		0	U	0.0006		0	U
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0088		0.0053		0.0073		0.0048		0.0055		0.0051		0.0051		0.006		0.0071		0.007		0.0045	
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177	0.0053		0.0032		0.0042		0.0026		0.0036		0.0051		0.0035		0.0015		0.004		0.0045		0.0032	
PCB 180	0.0141		0.0081		0.0179		0.0086		0.0116		0.0087		0.0089		0.0078		0.0117		0.0116		0.0079	
PCB 182/187	0.013		0.0061		0.0102		0.005		0.0073		0.0064		0.0064		0.0071		0.0102		0.0095		0.006	
PCB 183	0.0058		0.0043		0.0049		0.0034		0.0033		0.0092		0.0046		0.0077		0.0058		0.0051		0.0036	
PCB 185	0.0013		0	U	0.0007		0	U	0.0006		0	U	0.0003		0.0012		0.0003		0.0004		0.0002	
PCB 189	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.0008		0	U	0.0006		0	U	0	U	0	U	0.0004		0	U	0	U	0	U	0	U
PCB 194	0.0014		0	U	0	U	0	U	0.0002		0	U	0.0007		0	U	0	U	0	U	0	U
PCB 195/208	0.0033		0	U	0.0027		0	U	0.0021		0.0011		0	U	0	U	0	U	0	U	0	U
PCB 196/203	0.005		0	U	0.0029		0	U	0.003		0.0044		0.0025		0	U	0	U	0.0036		0.0029	
PCB 198	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 199	0.0011		0	U	0.0008		0	U	0.0001		0.0016		0	U	0.0029		0.0003		0.0005		0	U
PCB 201	0.0053		0	U	0.0034		0	U	0.0041		0.0012		0.0026		0	U	0	U	0.0028		0.0014	
PCB 205	0	U	0	U	0.0013		0	U	0	U	0	U	0.0011		0	U	0	U	0	U	0	U
PCB 206	0.0036		0	U	0.0004		0	U	0.0008		0	U	0	U	0	U	0	U	0	U	0	U
PCB 207	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209	0.0006		0	U	0	U	0	U	0.0005		0.008		0	U	0.0034		0	U	0	U	0	U
Total Dissolved PCBs (by congener sum) =	10.38		11.25		12.91		11.68		11.93		10.78		10.79		12.21		11.80		10.80		10.22	
Total Congeners Analyzed (Diss) =	92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Diss) =	81		68		79		66		79		71		76		73		71		75		73	
Reported TPCBs (Diss) =																						

NOTE no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI79		89GH5RI80		89GH5RI81		89GH5RI82		89GH5RI83		89GH5RI84		90GH5RI100		90GH5RI101		90GH5RI102		90GH5RI103		90GH5RI104	
Sample Date	11/11/89		11/12/89		11/12/89		11/13/89		11/30/89		12/13/89		3/24/90		3/25/90		3/25/90		3/26/90		3/26/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.1617		0.089		0.0947		0	U	0.1984		0.0725		0.1244		0.1131		0.1159		0.0554			
PCB 003	0	U	0.0799		0	U	0.0126		0.1818		0	U	0	U	0	U	0	U	0.1065			
PCB 004/010	0.1267		0.1239		0.1477		0.1448		0.1201		0.0618		0.0579		0.0583		0.0509		0.0555			
PCB 005/008	0.7986		0.9898		1.3143		1.0221		0.7978		0.2372		0.3488		0.3603		0.3225		0.3653			
PCB 006	0.1781		0.2139		0.2881		0.2138		0.1442		0.0482		0.0563		0.0716		0.0638		0.0714			
PCB 007	0.0231		0.0222		0.0282		0.0252		0.0244		0.0133		0.009		0.0082		0.0075		0.0081			
PCB 012/013	0	U	0.0147		0	U	0.0276		0.027		0.0103		0.0204		0.0108		0.0094		0.0108			
PCB 016/032	0.7465		0.8368		1.053		0.817		0.5431		0.1934		0.2868		0.2968		0.2748		0.333			
PCB 017	0.4756		0.5369		0.7213		0.543		0.368		0.1486		0.2119		0.2218		0.2009		0.2409			
PCB 018	0.8261		0.9456		1.1509		0.8998		0.5897		0.2116		0.3132		0.3239		0.2963		0.3714			
PCB 019	0.0603		0.0669		0.0809		0.0627		0.0504		0.02		0.0348		0.037		0.0332		0.0286			
PCB 021	0	U	0	U	0	U	0	U	0.0034		0	U	0	U	0	U	0	U	0	U		
PCB 022	0.3709		0.3751		0.5718		0.4366		0.3054		0.103		0.1357		0.1463		0.1252		0.1422			
PCB 024/027	0.0826		0.0918		0.1221		0.091		0.0926		0.023		0.0322		0.0285		0.0327		0.0361			
PCB 025	0.1853		0.1934		0.3571		0.1967		0.1524		0.0495		0.0748		0.0804		0.0763		0.0891			
PCB 026	0.2992		0.3296		0.5135		0.3372		0.2416		0.081		0.1156		0.1192		0.113		0.1347			
PCB 028/031	1.6465		1.7807		2.471		1.8632		1.2925		0.4684		0.6688		0.6713		0.6589		0.7577			
PCB 029	0.0037		0.0031		0.0095		0.0055		0.0059		0.0052		0.005		0.0044		0.0063		0.001			
PCB 033	0.3549		0.4038		0.5737		0.4236		0.2881		0.0997		0.13		0.136		0.1301		0.1464			
PCB 037/042	0.1773		0.199		0.2968		0.1972		0.1525		0.0607		0.081		0.0759		0.0771		0.0957			
PCB 040	0.0998		0.1107		0.1455		0.1013		0.0749		0.0242		0.0344		0.0361		0.0389		0.0467			
PCB 041/064/071	0.334		0.3657		0.531		0.3588		0.2927		0.0881		0.1365		0.1326		0.138		0.1666			
PCB 043	0.0318		0.0557		0.048		0.0527		0.0175		0.008		0.0152		0.0138		0.0137		0.0161			
PCB 044	0.4261		0.4773		0.6319		0.4524		0.338		0.1184		0.1697		0.1666		0.1681		0.2066			
PCB 045	0.0923		0.0943		0.1504		0.1056		0.0768		0.0271		0.0381		0.0389		0.0368		0.0465			
PCB 046	0.0531		0.0549		0.0857		0.0601		0.0782		0.0447		0.0178		0.0187		0.0188		0.0241			
PCB 047/048	0.9116		0.3601		1.1179		0.7127		0.2094		0.4001		0.1051		0.1164		0.1024		0.1216			
PCB 049	0.3177		0.3642		0.4482		0.365		0.2329		0.0944		0.131		0.128		0.1288		0.1574			
PCB 051	0.3739		0.0494		0.3725		0.1942		0.039		0.1221		0.0138		0.0233		0.0142		0.0176			
PCB 052	0.4161		0.4628		0.5762		0.4398		0.3171		0.1269		0.2076		0.2072		0.2169		0.2709			
PCB 053	0.096		0.1035		0.1265		0.0982		0.0586		0.0222		0.0378		0.0386		0.0378		0.0493			
PCB 056/060	0.1633		0.1786		0.3089		0.1925		0.1641		0.0506		0.0598		0.06		0.0589		0.0745			
PCB 063	0.0202		0.018		0.0335		0.0222		0.0198		0.012		0.0047		0.0061		0.01		0.0092			
PCB 066/095	0.3878		0.4076		0.5976		0.4102		0.3484		0.1187		0.1505		0.1447		0.1471		0.1706			
PCB 070/076	0.3026		0.3037		0.5619		0.3621		0.2517		0.0712		0.0945		0.0973		0.1		0.1165			
PCB 074	0.1109		0.1105		0.1817		0.1211		0.1126		0.0386		0.0366		0.0383		0.0387		0.0472			
PCB 077/110	0.091		0.1051		0.1467		0.1217		0.095		0.0424		0.0365		0.039		0.0434		0.047			
PCB 081	0.0054		0.0044		0.0115		0.0052		0.0037		0.0003		0	U	0.0019		0.002		0.0027			
PCB 082	0.0084		0.0083		0.0178		0.0086		0.01		0	U	0.0027		0.0029		0.003		0.0038			
PCB 083	0.0025		0.0012		0.0058		0.0042		0.0027		0	U	0	U	0	U	0	U	0	U		
PCB 084/092	0.083		0.0814		0.1377		0.1011		0.0717		0.0421		0.0424		0.0356		0.033		0.0423			
PCB 085	0.0173		0	U	0.0269		0	U	0.0172		0.0039		0.0047		0.0053		0.0053		0.0069			
PCB 087	0.0352		0.0363		0.0668		0.0458		0.0285		0.0109		0.0146		0.0131		0.0138		0.0152			
PCB 089	0.0012		0.0016		0.0035		0.0064		0.0114		0.0108		0.0105		0.0109		0.0052		0.0049			
PCB 091	0.0226		0.0189		0.0274		0.0153		0.0131		0.0049		0.0074		0.0064		0.0058		0.0072			
PCB 097	0.024		0.0269		0.0389		0.0312		0.0272		0.0127		0.008		0.0102		0.0104		0.0123			
PCB 099	0.0307		0.0293		0.0481		0.034		0.0263		0.0117		0.0108		0.0114		0.0119		0.0133			
PCB 100	0.0152		0.0138		0.0197		0.0112		0.0091		0.0017		0.0036		0.0033		0.0026		0.0044			

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	89GH5RI79		89GH5RI80		89GH5RI81		89GH5RI82		89GH5RI83		89GH5RI84		90GH5RI100		90GH5RI101		90GH5RI102		90GH5RI103		90GH5RI104	
Sample Date	11/11/89		11/12/89		11/12/89		11/13/89		11/30/89		12/13/89		3/24/90		3/25/90		3/25/90		3/26/90		3/26/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.064		0.0663		0.0981		0.0793		0.0582		0.0332		0.0278		0.0293		0.0275		0.0299			
PCB 105/132/153	0.0401		0.0572		0.0643		0.0744		0.039		0.019		0.0367		0.0297		0.0241		0.026			
PCB 107	0.0021		0.002		0.0103		0.0047		0.0017		0.0008		0.0016		0.0017		0	U	0.0021			
PCB 114/134	0.0124		0.0062		0.0187		0.0163		0	U	0	U	0.003		0.0021		0	U	0	U		
PCB 118	0.03		0.0346		0.0513		0.0438		0.0218		0.0103		0.0144		0.0145		0.0127		0.0149			
PCB 119	0.0038		0.0024		0	U	0.0045		0.002		0.001		0.0015		0.0012		0	U	0.0012			
PCB 124/135/144/147	0.0042		0.0057		0.0112		0.0047		0.0055		0.0046		0.0061		0.0039		0.0037		0.004			
PCB 128	0.0024		0.0024		0.0107		0.0025		0.0013		0.0002		0	U	0	U	0	U	0	U		
PCB 129/178	0.0016		0.0014		0.0021		0.0016		0.0006		0.0009		0.0019		0.0012		0	U	0	U		
PCB 130	0.0023		0.0017		0.0018		0.0021		0.0025		0	U	0	U	0	U	0	U	0	U		
PCB 131	0.0016		0.0004		0.0023		0.0017		0	U	0	U	0.0006		0.0003		0	U	0	U		
PCB 135	0.0048		0	U	0.005		0	U	0.0049		0.0033		0.0023		0.0017		0.002		0.0018			
PCB 137/176	0.0012		0.0009		0	U	0.0005		0.0022		0.0005		0.0013		0	U	0	U	0	U		
PCB 138/158/163	0.0361		0.0375		0.056		0.0446		0.0243		0.0125		0.0277		0.0193		0.0259		0.023			
PCB 141	0.0048		0.0056		0	U	0	U	0.0045		0.0032		0.0054		0.0045		0.0031		0.0032			
PCB 146	*0.0103*		*0.0127*		*0.021*		*0.0133*		*0.0078*		*0.0039*		*0.0031*		*0.0046*		*0.0045*		*0.0054*			
PCB 149	0.0233		0.0293		0.0356		0.031		0.0168		0.0127		0.0207		0.0186		0.0155		0.0163			
PCB 151	0.009		0.0105		0.0239		0.0136		0.0071		0	U	0.0111		0.0079		0.007		0.0069			
PCB 156/171/202	0.0001		0	U	0	U	0	U	0.0035		0.001		0.0014		0.0026		0	U	0	U		
PCB 157/200	0	U	0	U	0	U	0	U	0.0003		0.0006		0	U	0	U	0	U	0	U		
PCB 167	0.0007		0.0001		0.0006		0	U	0.0111		0	U	0.0006		0	U	0	U	0	U		
PCB 169																						
PCB 170/190	0.0031		0.0034		0.0045		0.0048		0.0113		0.0093		0	U	0	U	0	U	0	U		
PCB 172/197	0	U	0.0006		0.0011		0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 174	0.0056		0.0055		0.0098		0.006		0.0045		0.0032		0.0049		0.0032		0.003		0.0031			
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 177	0.0023		0.0035		0.0016		0	U	0.0033		0.0028		0.0027		0.0026		0.0019		0.0015			
PCB 180	0.0079		0.0094		0.0224		0.0162		0.0082		0.0065		0.0074		0.0061		0.0051		0.0061			
PCB 182/187	0.0063		0.0076		0.01		0.0076		0.0056		0.0036		0.0091		0.0062		0.0047		0.0052			
PCB 183	0.0033		0.0044		0.0102		0.0059		0.003		0.0021		0.0036		0.0027		0.0021		0.0019			
PCB 185	0.0009		0.0004		0.0041		0.0011		0	U	0.0007		0.0015		0.0002		0.0009		0.0009			
PCB 189	0	U	0	U	0	U	0	U	0	U	0.001		0	U	0	U	0	U	0	U		
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 193	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 194	0.0005		0	U	0.0011		0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 195/208	0	U	0	U	0	U	0	U	0.0013		0	U	0	U	0	U	0	U	0	U		
PCB 196/203	0.0023		0	U	0.0045		0.002		0.0018		0.0018		0.0007		0.0007		0.0006		0	U		
PCB 198	0	U	0	U	0	U	0	U	0.0002		0	U	0.0005		0	U	0	U	0	U		
PCB 199	0.0005		0	U	0.0008		0.0008		0.0003		0	U	0	U	0	U	0	U	0	U		
PCB 201	0.0026		0	U	0.0038		0	U	0.0005		0.0004		0.0007		0.0006		0.0044		0.0011			
PCB 205	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 206	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 207	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U		
PCB 209	0.0023		0	U	0.0049		0	U	0	U	0	U	0	U	0	U	0	U	0	U		
Total Dissolved PCBs (by congener sum) =	11.28		11.45		16.76		12.14		8.78		3.56		4.30		4.34		4.15		4.91		0.00	
Total Congeners Analyzed (Diss) =	92		92		92		92		92		92		92		92		92		92		0	
Total Congeners Detected (Diss) =	77		72		74		69		78		70		71		69		63		65		0	
Reported TPCBs (Diss) =																						

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5RI105		90GH5RI106		90GH5RI107		90GH5RI108		90GH5RI109		90GH5RI110		90GH5RI111		90GH5RI112		90GH5RI113		90GH5RI114		90GH5RI115	
Sample Date	3/27/90		3/27/90		3/28/90		3/28/90		3/29/90		3/30/90		3/30/90		3/31/90		4/1/90		4/1/90		4/3/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0 063		0 0564		0.0569		0.0647		0.0728		0.062		0.0784		0.0861		0	U	0.0875	
PCB 003	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 004/010	0.0507		0.0501		0.0512		0 054		0.065		0.0749		0.0636		0.0806		0.0844		0.0923		0.134	
PCB 005/008	0 2995		0.3336		0.3216		0.3605		0.5439		0.5178		0.3953		0.6471		0.5733		0.7024		1.0073	
PCB 006	0.0557		0.0663		0.0643		0.0684		0 1103		0.102		0.0853		0.1418		0 1291		0.1617		0.2314	
PCB 007	0.0073		0.0096		0 0066		0.0084		0.0114		0.0131		0.0099		0.0152		0.0135		0.0147		0.0244	
PCB 012/013	0	U	0.0097		0.0064		0.0043		0.0136		0.0062		0.0098		0.0058		0 0056		0.0095		0.0154	
PCB 016/032	0.2554		0.2703		0.2978		0.3181		0	U	0.4618		0.3761		0.5112		0.5105		0.5675		0.8122	
PCB 017	0.1973		0.1901		0.2186		0.2381		0 3286		0.2976		0.2824		0.3762		0.3671		0.4139		0.5911	
PCB 018	0 2905		0.3036		0.3138		0.346		0 4236		0.5015		0.4018		0.5308		0 5536		0.6068		0.9212	
PCB 019	0 0257		0 0343		0.0256		0.0275		0 0452		0.0542		0.0434		0.0784		0 0502		0 0693		0.1044	
PCB 021	0	U	0	U	0	U	0	U	0.0016		0.0065		0	U	0	U	0	U	0	U	0	U
PCB 022	0.1162		0.1218		0.1362		0.1681		0 1868		0.2083		0.1737		0.2384		0 2411		0.2687		0.3518	
PCB 024/027	0.0317		0.0308		0.0395		0.0391		0 0396		0.0497		0.0436		0.0578		0.0559		0.0632		0.0909	
PCB 025	0.0713		0 0793		0.0819		0.0913		0.1267		0.1333		0.1036		0.1392		0 1471		0 1698		0.2208	
PCB 026	0.1053		0.1059		0.1224		0 14		0.1737		0.1897		0.159		0.2195		0.2347		0.2665		0.3487	
PCB 028/031	0 6141		0 6131		0 6819		0.7851		1.059		1.0246		0.8795		1.1763		1.199		1 3489		1 6713	
PCB 029	0	U	0	U	0	U	0	U	0.0016		0.001		0	U	0	U	0.009		0.0041		0.0007	
PCB 033	0 1224		0.124		0.1295		0.1497		0	U	0.2045		0.1638		0.2263		0.2278		0 2624		0 3437	
PCB 037/042	0 072		0 0704		0.0801		0.0926		0.1177		0.1333		0.1097		0.1388		0.1365		0.1723		0.1886	
PCB 040	0.0348		0.0361		0 0387		0.0475		0.0538		0.0668		0.0562		0.0719		0.0715		0.0849		0.0996	
PCB 041/064/071	0 1234		0 1303		0 1471		0.1626		0.2018		0.2347		0.1879		0.2556		0.2544		0.3051		0.3448	
PCB 043	0 0093		0.0131		0.0126		0.0152		0.0207		0.022		0.0156		0.0221		0.0253		0 0286		0.0352	
PCB 044	0 1586		0 1599		0 1763		0.2108		0.2379		0.2849		0.2393		0.3099		0.308		0.3658		0.4295	
PCB 045	0 0368		0.0352		0.0441		0.05		0.0485		0.0629		0 0519		0.07		0.0749		0.0805		0.1107	
PCB 046	0.0185		0.0212		0.0282		0.0235		0.0276		0 0371		0.0287		0.0428		0.0425		0.0494		0.066	
PCB 047/048	0.0888		0 1045		0 1012		0.1324		0.1517		0.1625		0.1347		0.1687		0.1713		0.2053		0.2365	
PCB 049	0 119		0.1202		0.135		0.1601		0.1903		0 2102		0 1739		0 2325		0.2326		0.2699		0.3162	
PCB 051	0.0124		0.0158		0 0139		0 0166		0 018		0.0235		0.0195		0.025		0.0242		0.0259		0.0336	
PCB 052	0.2		0.2183		0.1972		0.2246		0.2671		0.2979		0.2379		0.3044		0.3076		0.3543		0.4212	
PCB 053	0 037		0 0351		0.0405		0.0487		0.1416		0.0635		0.0555		0.0674		0.0729		0 0801		0.0989	
PCB 056/060	0 0569		0.0575		0.066		0.0794		0.1041		0 1097		0.0929		0.1118		0.1157		0.1432		0.1725	
PCB 063	0 0071		0.0078		0 0064		0.01		0.0129		0 0132		0.012		0.0144		0.0121		0 0247		0 0215	
PCB 065/095	0 142		0.1397		0.1568		0.1905		0.2363		0 2449		0.2128		0.2667		0.2672		0.3255		0.3366	
PCB 070/076	0 0965		0.0949		0.1092		0 1316		0.1695		0 1608		0.1472		0 1869		0.1907		0.2293		0.2378	
PCB 074	0 0379		0 0362		0.0411		0.0519		0.0658		0 0651		0 0576		0.0732		0.074		0.1001		0.0944	
PCB 077/110	0 0379		0 0376		0.0396		0 0526		0.0599		0 0656		0 0562		0.0698		0.0732		0.0876		0.0864	
PCB 081	0 0019		0.004		0.0029		0.0028		0.0029		0.0048		0 0025		0 0037		0.0035		0.004		0.0049	
PCB 082	0 0033		0 0029		0.0049		0 0049		0.0045		0 0064		0 0045		0 0073		0.006		0.0069		0 0092	
PCB 083	0	U	0	U	0	U	0	U	0.0007		0.0011		0	U	0	U	0	U	0	U	0.0007	
PCB 084/092	0.0347		0.0342		0.0407		0 0485		0.0461		0.0582		0.0562		0.064		0.0741		0.0802		0.0806	
PCB 085	0 0066		0 0055		0.0073		0.0089		0.0103		0 0108		0 0105		0 0122		0.0132		0.0177		0 0156	
PCB 087	0.0129		0.0133		0.0149		0.0189		0.0203		0 0239		0 0196		0.023		0.0238		0.0316		0.029	
PCB 089	0	U	0.0012		0 0028		0.0026		0.0032		0.0041		0 0053		0 0027		0	U	0 006		0.0074	
PCB 091	0.0063		0.0068		0.0067		0 0097		0.0117		0 0118		0.0102		0.0135		0.0125		0.0143		0.0154	
PCB 097	0.01		0.009		0.0117		0 0135		0.0163		0.0188		0.016		0.0184		0.0231		0.0243		0.0249	
PCB 099	0 0114		0 0107		0.0118		0.0158		0.018		0.0199		0.0173		0.0199		0.0203		0.025		0.0253	
PCB 100	0.0032		0 0032		0.004		0.0038		0.0056		0.006		0 0047		0 0055		0.0055		0.0081		0.0131	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5RI105		90GH5RI106		90GH5RI107		90GH5RI108		90GH5RI109		90GH5RI110		90GH5RI111		90GH5RI112		90GH5RI113		90GH5RI114		90GH5RI115	
Sample Date	3/27/90		3/27/90		3/28/90		3/28/90		3/29/90		3/30/90		3/30/90		3/31/90		4/1/90		4/1/90		4/3/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.0276		0.0239		0.0295		0.0381		0.0385		0.0439		0.0389		0.0443		0.0483		0.0562		0.053	
PCB 105/132/153	0.0243		0.0215		0.0274		0.0319		0.0289		0.0408		0.026		0.0388		0.0383		0.0403		0.0453	
PCB 107	0.0014		0.0016		0.0015		0.002		0.0018		0.0039		0.0027		0.0033		0.0031		0.0046		0.0041	
PCB 114/134	0	U	0	U	0.0031		0.0035		0.0037		0.0055		0.0029		0.0046		0.0047		0.0077		0.0033	
PCB 118	0.0113		0.0112		0.0124		0.0155		0.0194		0.0216		0.0146		0.0195		0.0195		0.023		0.0291	
PCB 119	0.002		0	U	0.002		0.0026		0.0023		0.0037		0.0015		0.004		0.0039		0.0051		0.004	
PCB 124/135/144/147	0.004		0.0036		0.0043		0.0044		0.0038		0.0065		0.004		0.0052		0.0059		0.0059		0.0051	
PCB 128	0	U	0	U	0.0017		0.0025		0	U	0.0013		0.0014		0.0022		0.0031		0.003		0	U
PCB 129/178	0.0012		0	U	0.0019		0	U	0	U	0	U	0.0013		0.0019		0.0008		0.0015		0.001	
PCB 130	0	U	0	U	0	U	0	U	0	U	0.0025		0.0016		0.0004		0.0016		0.0022		0.0029	
PCB 131	0	U	0	U	0.0004		0.0004		0.0007		0.0006		0.0004		0.0005		0.0005		0.0013		0.0006	
PCB 136	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 137/176	0	U	0	U	0.0006		0.0005		0.0003		0.0019		0.0009		0.0005		0.0014		0.0013		0.0013	
PCB 138/158/163	0	U	0.02		0	U	0	U	0.0284		0.0304		0	U	0	U	0	U	0.0373		0.0339	
PCB 141	*0.004*		*0.0027*		*0.004*		*0.0039*		*0.0028*		*0.0051*		*0.0033*		*0.0047*		*0.0065*		*0.0043*		*0.0046*	
PCB 146	0.0053		0.0033		0.0047		0.0059		0.0052		0.0079		0.0061		0.0069		0.0087		0.0097		0.0125	
PCB 149	0.0159		0.0132		0.0174		0.0187		0.0143		0.0245		0.0147		0.0201		0.0222		0.0202		0.0227	
PCB 151	0.0074		0.0059		0.0079		0.008		0.0057		0.0104		0.0061		0.0086		0.0087		0.008		0.0088	
PCB 156/171/202	0.0013		0.0007		0.0012		0.0012		0.0015		0.0024		0.0015		0.002		0.0023		0.0015		0.0029	
PCB 157/200	0	U	0	U	0	U	0	U	0.0004		0	U	0	U	0	U	0	U	0	U	0	U
PCB 167	0.001		0	U	0.0002		0.0048		0	U	0	U	0	U	0	U	0.002		0.0022		0	U
PCB 169																						
PCB 170/190	0.0244		0	U	0.0308		0.0361		0	U	0	U	0.0079		0.0108		0.0255		0.009		0.0034	
PCB 172/197	0.0004		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0033	
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0014		0	U	0	U
PCB 174	0.0032		0.0027		0.0038		0.0035		0.0031		0.0046		0.0037		0.0043		0.0097		0.0046		0.0055	
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177	0.0017		0.001		0.0021		0.0023		0.0014		0.003		0.0019		0.0025		0.0024		0.0025		0.0031	
PCB 180	*0.0068*		*0.0031*		*0.0063*		*0.0053*		*0.0046*		*0.0067*		*0.0057*		*0.0085*		*0.0092*		*0.0077*		*0.009*	
PCB 182/187	0.004		0.0036		0.0047		0.004		0.0051		0.0078		0.0045		0.005		0.0049		0.0051		0.0065	
PCB 183	0.002		0.0013		0.0025		0.0024		0.002		0.0034		0.0023		0.0028		0.0027		0.0028		0.0035	
PCB 185	0	U	0	U	0	U	0	U	0.0004		0.0012		0	U	0.0005		0	U	0	U	0	U
PCB 189	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 194	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 195/208	0	U	0	U	0	U	0	U	0.0007		0.0013		0	U	0	U	0	U	0.0011		0	U
PCB 196/203	0	U	0.0002		0.0011		0.0001		0.0011		0.0012		0.0006		0.0001		0.0021		0.0012		0.0021	
PCB 198	0	U	0.0004		0	U	0	U	0	U	0	U	0.0002		0	U	0	U	0	U	0	U
PCB 199	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0002		0.0001		0	U
PCB 201	0	U	0	U	0.0015		0.0006		0.0004		0.0006		0.001		0.0009		0.0117		0.0022		0.0008	
PCB 205	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 206	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0088		0	U	0	U
PCB 207	0	U	0	U	0	U	0.0009		0	U	0	U	0	U	0.0002		0	U	0	U	0	U
PCB 209	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
Total Dissolved PCBs (by congener sum) =	**3.77**		**3.95**		**4.27**		**4.88**		**5.64**		**6.59**		**5.44**		**7.33**		**7.38**		**8.44**		**10.79**	
Total Congeners Analyzed (Diss) =	**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**		**92**	
Total Congeners Detected (Diss) =	**61**		**62**		**69**		**69**		**70**		**73**		**70**		**71**		**73**		**73**		**72**	
Reported TPCBs (Diss) =																						

NOTE no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5RI116		90GH5RI117		90GH5RI118		90GH5RI119		90GH5RI85		90GH5RI86		90GH5RI87		90GH5RI88		90GH5RI89		90GH5RI90		90GH5RI91	
Sample Date	4/11/90		4/18/90		4/24/90		5/1/90		1/11/90		1/29/90		2/6/90		2/21/90		3/6/90		3/19/90		3/20/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0	U	0	U	0	U	0	U	0.158		0	U	0.075		0.1583		0.0854		0	U	0.0549	
PCB 003	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.211		0	U	0	U
PCB 004/010	0.2002		0.2958		0.2535		0.2309		0.0552		0.0395		0.0496		0.0879		0.0801		0.0801		0.0691	
PCB 005/008	1.0809		1.3146		1.4771		1.1311		0.4874		0.2501		0.316		0.4715		0.4948		0.5176		0.4693	
PCB 006	1.0885		0.3133		0.3591		0.268		0.0489		0.0484		0.0431		0.0855		0.1043		0.1082		0.1006	
PCB 007	0.0349		0.0334		0.0405		0.0235		0.0219		0.017		0.0128		0.0142		0.016		0.0118		0.0105	
PCB 012/013	0	U	0.011		0.0221		0.0246		0.0201		0.0165		0.0091		0.0147		0.0124		0.0086		0.0088	
PCB 016/032	0.6889		1.1663		1.1358		1.2446		0.1799		0.2173		0.214		0.3396		0.4094		0.4489		0.4105	
PCB 017	0.6212		0.8495		0.7725		0.8489		0.1223		0.1619		0.155		0.3013		0.3251		0.3134		0.2991	
PCB 018	1.1201		1.4784		1.3414		1.5661		0.2033		0.2314		0.2279		0.3353		0.4456		0.4895		0.4496	
PCB 019	0.1122		0.1581		0.145		0.1813		0.0258		0.0312		0.0256		0.0423		0.0509		0.0524		0.0481	
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0097		0	U	0	U	0	U
PCB 022	0.3111		0.4342		0.4494		0.5235		0.1032		0.13		0.107		0.1453		0.2007		0.2106		0.1866	
PCB 024/027	0.1378		0.159		0.1602		0.1732		0.0316		0.036		0.0319		0.0441		0.0498		0.0538		0.0456	
PCB 025	0.2015		0.2448		0	U	0.2651		0.0473		0.0731		0.0695		0.1001		0.1136		0.1233		0.1202	
PCB 026	0.3998		0.4236		0.5385		0.4515		0.0797		0.1185		0.0972		0.1486		0.1734		0.195		0.1773	
PCB 028/031	1.7886		2.1845		2.2051		2.5422		0.5168		0.6822		0.5881		0.7833		0.9421		1.089		1.0024	
PCB 029	0.0137		0.014		0.0256		0.0113		0.0058		0.0011		0.0023		0.0091		0.0056		0.0014		0.0012	
PCB 033	0.3423		0.4688		0.4834		0.5113		0.1026		0.1274		0.1087		0.1296		0.1793		0.2046		0.1887	
PCB 037/042	0.1675		0.2337		0.2635		0.3197		0.049		0.0774		0.0617		0.0757		0.1038		0.1305		0.1163	
PCB 040	0.0921		0.1243		0.1445		0.1744		0.0321		0.0398		0.0296		0.0429		0.0601		0.0603		0.0562	
PCB 041/064/071	0.3355		0.4495		0.5033		0.6116		0.0769		0.1409		0.1056		0.1403		0.1858		0.2209		0.1978	
PCB 043	0.0464		0.0586		0.061		0.0781		0.024		0.0282		0.0134		0.0146		0.0255		0.0232		0.021	
PCB 044	0.4213		0.5769		0.6286		0.7643		0.1074		0.172		0.1382		0.1689		0.2341		0.2802		0.2526	
PCB 045	0.1036		0.1484		0.1548		0.1876		0.0298		0.0474		0.0323		0.0426		0.0554		0.0602		0.0556	
PCB 046	0.0565		0.0735		0.0749		0.1076		0.0258		0.0223		0.0204		0.0533		0.0716		0.0359		0.0326	
PCB 047/048	0.2506		0.3176		0.3746		0.4329		0.152		0.1411		0.3955		0.1193		0.1604		0.1607		0.1549	
PCB 049	0.3341		0.4304		0.4507		0.5427		0.1036		0.1512		0.1155		0.1391		0.1881		0.2164		0.1968	
PCB 051	0.0225		0.0322		0.0477		0.0483		0.0387		0.0227		0.1069		0.025		0.0254		0.0212		0.0201	
PCB 052	0.4702		0.597		0.6544		0.7585		0.1645		0.2066		0.1822		0.1948		0.24		0.3163		0.2796	
PCB 053	0.0987		0.1145		0.1341		0.1573		0.012		0.0323		0.0258		0.0317		0.0508		0.0669		0.0609	
PCB 056/060	0.1344		0.1885		0.238		0.2981		0.0536		0.0849		0.0586		0.0579		0.0899		0.1049		0.0909	
PCB 063	0.0112		0.0234		0.0287		0.028		0.0088		0.0072		0.0057		0.0114		0.0157		0.0148		0.0132	
PCB 066/095	0.3007		0.413		0.4963		0.6069		0.1192		0.2021		0.164		0.1632		0.2093		0.2523		0.2245	
PCB 070/076	0.1866		0.2798		0.3255		0.399		0.0611		0.1269		0.1012		0.1029		0.1356		0.181		0.1583	
PCB 074	0.0808		0.1099		0.1259		0.1489		0.0401		0.0554		0.0391		0.0401		0.0561		0.0711		0.0613	
PCB 077/110	0.0667		0.101		0.1445		0.1585		0.0435		0.061		0.0437		0.0473		0.0608		0.0686		0.0565	
PCB 081	0	U	0	U	0.006		0.0024		0	U	0	U	0	U	0.0043		0.0039		0.0047		0.0044	
PCB 082	0.0092		0.0103		0.0262		0.018		0.008		0.0044		0.009		0.0047		0.0063		0.0061		0.005	
PCB 083	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 084/092	0.0707		0.0887		0.1186		0.1512		0.0326		0.037		0.0329		0.0447		0.0546		0.0611		0.0525	
PCB 085	0.0121		0.0186		0.0287		0.0294		0.0057		0.0077		0.0078		0.0026		0.0043		0.0109		0.0085	
PCB 087	0.0218		0.0311		0.0521		0.0516		0.0138		0.0176		0.0184		0.0135		0.0187		0.0229		0.0201	
PCB 089	0	U	0.0041		0.0006		0.0026		0.0107		0.0089		0.007		0.005		0.0098		0.0023		0.0039	
PCB 091	0.0132		0.0232		0.0339		0.0337		0	U	0.008		0.0057		0.0083		0.0111		0.0116		0.011	
PCB 097	0.0168		0.0258		0.0416		0.0417		0.0107		0.0164		0.0134		0.011		0.0137		0.0188		0.0163	
PCB 099	0.0224		0.0285		0.0424		0.0456		0.0123		0.0174		0.0141		0.0127		0.0167		0.0207		0.0187	
PCB 100	0.0081		0.0067		0.0096		0.015		0.0065		0.0085		0.0037		0.0051		0.008		0.0062		0.0055	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5RI116		90GH5RI117		90GH5RI118		90GH5RI119		90GH5RI85		90GH5RI86		90GH5RI87		90GH5RI88		90GH5RI89		90GH5RI90		90GH5RI91	
Sample Date	4/11/90		4/18/90		4/24/90		5/1/90		1/11/90		1/29/90		2/6/90		2/21/90		3/6/90		3/19/90		3/20/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.0473		0.0657		0.0871		0.0932		0.0347		0.0416		0.035		0.0289		0.0388		0.0453		0.0414	
PCB 105/132/153	0.0567		0.0586		0.0884		0.0827		0.0316		0.0325		0.0328		0.0316		0.0353		0.041		0.0335	
PCB 107	0.0049		0.0057		0.0087		0.0096		0.0024		0.002		0.0015		0.0018		0.0025		0.0025		0.0022	
PCB 114/134	0	U	0.01		0.0138		0.0105		0.0084		0.0038		0.0044		0.0033		0.002		0.004		0.0049	
PCB 118	0.0302		0.0352		0.0486		0.048		0.0143		0.0172		0.0155		0.016		0.0211		0.0199		0.0189	
PCB 119	0	U	0.0065		0.0062		0.0062		0	U	0.0023		0.0016		0	U	0.0016		0.0026		0.0039	
PCB 124/135/144/147	0.0048		0.0064		0.0132		0.0093		0.0032		0.0039		0.0044		0.0062		0.0048		0.005		0.0049	
PCB 128	0	U	0.0051		0.0084		0.0072		0.002		0.0031		0.0023		0	U	0	U	0.0018		0.002	
PCB 129/178	0	U	0.0025		0.0046		0.0032		0.0014		0.0016		0.0014		0.0014		0.0014		0	U	0	U
PCB 130	0	U	0.0026		0.0052		0.0043		0	U	0.0014		0.0016		0	U	0.0041		0.0021		0	U
PCB 131	0.001		0.001		0.0012		0.0012		0.0012		0.0004		0.0004		0	U	0.0004		0.0006		0.0006	
PCB 136	0	U	0	U	0	U	0	U	0.0024		0	U	0.0035		0.0029		0.0022		0	U	0	U
PCB 137/176	0.0045		0.0017		0.0034		0.0028		0.0007		0.0007		0.0009		0	U	0.0017		0.0015		0	U
PCB 138/158/163	0.0745		0.0382		0.1027		0.0548		0.0292		0.0273		0.0341		0.0201		0.0276		0.0375		0.029	
PCB 141	0.0066		0.0054		0.0085		0.0085		0	U	0	U	0.0039		0.0054		0.0042		0.0052		0.0045	
PCB 146	0.0088		0.011		0.0164		0.0124		0.0068		0.0066		0.0052		0.0046		0.0064		0.0095		0.0077	
PCB 149	0.0244		0.026		0.0438		0.0407		0.0183		0.018		0.0186		0.023		0.0198		0.0241		0.0216	
PCB 151	0.0095		0.0101		0.0163		0.0146		0.0084		0.0066		0.0119		0.0106		0.008		0.0101		0.0092	
PCB 156/171/202	0	U	0.0044		0.0056		0.0051		0.0034		0.0022		0.0022		0.003		0.0025		0.0022		0.0009	
PCB 157/200	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0011		0	U
PCB 167	0.0021		0.0034		0.0022		0.002		0.0013		0.0009		0.0009		0	U	0	U	0	U	0	U
PCB 169																						
PCB 170/190	0.0935		0	U	0.0532		0.0371		0.0282		0.0296		0.0273		0	U	0	U	0	U	0	U
PCB 172/197	0	U	0	U	0.002		0.0016		0	U	0	U	0	U	0	U	0	U	0.0011		0	U
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0074		0.0065		0.0099		0.0095		0.0045		0.0044		0.004		0.0039		0.0034		0.0047		0.0041	
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177	0	U	0.0037		0.0062		0.0046		0.0029		0.0033		0.0028		0.0033		0.0013		0.003		0.0026	
PCB 180	0.0061		0.0097		0.0162		0.0158		0.0094		0.0091		0.0102		0.0084		0.0067		0.0071		0.0064	
PCB 182/187	0.0055		0.0079		0.0133		0.0119		0.0059		0.0058		0.0057		0.0071		0.006		0.0085		0.0077	
PCB 183	0.0028		0.0043		0.007		0.0062		0.0026		0.003		0.0027		0.0031		0.003		0.0034		0.003	
PCB 185	0	U	0	U	0	U	0	U	0.0007		0.0004		0.0003		0	U	0.0015		0	U	0	U
PCB 189	0	U	0	U	0	U	0.0011		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 191	0.0059		0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0	U	0	U	0.001		0.0011		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 194	0	U	0	U	0.0008		0.0036		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 195/208	0	U	0	U	0.0042		0.0025		0.0012		0.0013		0.0009		0	U	0	U	0	U	0	U
PCB 196/203	0	U	0.0029		0.0056		0.003		0.0023		0.0016		0.0013		0.0029		0.0002		0.0019		0.0015	
PCB 198	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 199	0	U	0	U	0.0007		0.0005		0.0001		0.0003		0	U	0.001		0	U	0	U	0	U
PCB 201	0	U	0.0029		0.0053		0.0031		0	U	0.0015		0.0013		0.0007		0	U	0.0018		0.0015	
PCB 205	0.0031		0	U	0	U	0.0025		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 206	0	U	0.0011		0.0022		0.0025		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 207	0	U	0	U	0	U	0.0006		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209	0.0016		0.0004		0.0006		0.0003		0	U	0	U	0	U	0	U	0	U	0	U	0	U
Total Dissolved PCBs (by congener sum) =	12.10		14.40		15.23		16.74		3.68		4.16		4.12		4.99		6.22		6.61		6.05	
Total Congeners Analyzed (Diss) =	92		92		92		92		92		92		92		92		92		92		92	
Total Congeners Detected (Diss) =	62		71		77		81		70		72		74		68		71		70		67	
Reported TPCBs (Diss) =																						

NOTE: no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5RI92		90GH5RI93		90GH5RI94		90GH5RI95		90GH5RI96		90GH5RI97		90GH5RI98		90GH5RI99	
Sample Date	3/20/90		3/21/90		3/21/90		3/22/90		3/22/90		3/23/90		3/23/90		3/24/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 001	0.0625		0.0595		0.0622		0.0538		0.0639		0.0759		0.0515		0.0805	
PCB 003	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 004/010	0.0629		0.0687		0.0697		0.0652		0.0635		0.0865		0.0613		0.0566	
PCB 005/008	0.4412		0.4629		0.4625		0.4513		0.4188		0.5737		0.376		0.3494	
PCB 006	0.0898		0.0883		0.0944		0.0976		0.0897		0.1047		0.0912		0.0599	
PCB 007	0.0097		0.0111		0.0233		0.0116		0.0101		0.0123		0.0121		0.0094	
PCB 012/013	0.0094		0.0094		0.01		0.0098		0.0092		0.0144		0.0084		0.0105	
PCB 016/032	0.3865		0.3981		0.4168		0.4028		0.4084		0.4255		0.3688		0.2812	
PCB 017	0.2772		0.2845		0.3017		0.2812		0.3034		0.3121		0.2718		0.216	
PCB 018	0.4298		0.4327		0.4552		0.4477		0.4437		0.4636		0.4048		0.3035	
PCB 019	0.0454		0.0324		0.0484		0.042		0.0477		0.0548		0.0385		0.0317	
PCB 021	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 022	0.1787		0.1712		0.1981		0.1911		0.1956		0.1761		0.163		0.14	
PCB 024/027	0.0456		0.0433		0.046		0.0452		0.0438		0.0447		0.0408		0.0295	
PCB 025	0.1039		0.1106		0.1183		0.1168		0.1201		0.1216		0.1033		0.0926	
PCB 026	0.1625		0.1661		0.1751		0.1783		0.1747		0.1662		0.1539		0.1153	
PCB 028/031	0.9639		0.9323		1.0096		1.0033		1.0011		0.9549		0.8606		0.6854	
PCB 029	0	U	0.0061		0.0026		0.0008		0.0045		0.0087		0.0052		0.0024	
PCB 033	0.1753		0.1746		0.2046		0.1908		0.2031		0.1921		0.1674		0.1272	
PCB 037/042	0.1262		0.1042		0.122		0.1138		0.1137		0.1005		0.104		0.0768	
PCB 040	0.096		0.052		0.0556		0.058		0.0601		0.053		0.0519		0.0336	
PCB 041/064/071	0.2095		0.1887		0.2047		0.2099		0.2215		0.1861		0.182		0.1299	
PCB 043	0.0199		0.0157		0.018		0.0181		0.0198		0.0251		0.0184		0.0133	
PCB 044	0.2534		0.2335		0.2612		0.259		0.268		0.2396		0.2273		0.1635	
PCB 045	0.0504		0.0563		0.0574		0.0597		0.0565		0.0522		0.0475		0.0374	
PCB 046	0.0801		0.029		0.0342		0.0289		0.0313		0.0349		0.0276		0.0178	
PCB 047/048	0.1444		0.1322		0.2313		0.149		0.1565		0.1514		0.1365		0.4901	
PCB 049	0.1926		0.1766		0.1984		0.1987		0.2013		0.1928		0.173		0.1315	
PCB 051	0.0197		0.0164		0.0408		0.017		0.021		0.0206		0.0201		0.1288	
PCB 052	0.2817		0.2553		0.2872		0.3021		0.302		0.2822		0.2584		0.2019	
PCB 053	0.0562		0.0578		0.0626		0.0593		0.0602		0.0607		0.051		0.0337	
PCB 056/060	0.0898		0.0815		0.1002		0.0995		0.1051		0.0901		0.0815		0.0581	
PCB 063	0.0132		0.0119		0.0124		0.0125		0.0136		0.0149		0.0114		0.0057	
PCB 066/095	0.2215		0.1989		0.2412		0.2405		0.2497		0.2351		0.1877		0.1648	
PCB 070/076	0.1573		0.1402		0.2183		0.1694		0.1915		0.163		0.1347		0.1003	
PCB 074	0.0621		0.0533		0.066		0.0657		0.0694		0.0649		0.0521		0.0374	
PCB 077/110	0.0905		0.0543		0.0667		0.0656		0.0649		0.0595		0.0459		0.036	
PCB 081	0.0035		0.0022		0.0019		0.0038		0.0021		0.0019		0.0032		0.0018	
PCB 082	0.0045		0.0044		0.0045		0.0051		0.0047		0.0054		0.0033		0.0016	
PCB 083	0	U	0	U	0.003		0.0011		0.0026		0.0019		0	U	0.0012	
PCB 084/092	0	U	0.0469		0.0544		0.055		0.0515		0.0503		0.0446		0.042	
PCB 085	0.0089		0.0078		0.0111		0.011		0.0098		0.0091		0.006		0.0049	
PCB 087	0.02		0.0168		0.0212		0.0226		0.0209		0.0208		0.0154		0.0133	
PCB 089	0	U	0.0009		0	U	0	U	0	U	0	U	0.004		0	U
PCB 091	0.0122		0.0088		0.0128		0.0095		0.0145		0.0141		0.0072		0.0064	
PCB 097	0.0165		0.015		0.0165		0.0187		0.019		0.0154		0.0152		0.0088	
PCB 099	0.0182		0.0158		0.0194		0.0208		0.0198		0.0139		0.0138		0.0114	
PCB 100	0.0049		0.0049		0.0069		0.0059		0.0066		0.0047		0.0049		0.0066	

Table H-13. Lower Fox River Historic Water Column Congener Data for Mouth of Lower Fox River (Dissolved)
Lower Fox River Baseline Monitoring Plan

Sample Name	90GH5RI92		90GH5RI93		90GH5RI94		90GH5RI95		90GH5RI96		90GH5RI97		90GH5RI98		90GH5RI99	
Sample Date	3/20/90		3/21/90		3/21/90		3/22/90		3/22/90		3/23/90		3/23/90		3/24/90	
Fraction	Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved		Dissolved	
Congener (ng/l)	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark	Result	Remark
PCB 101	0.0418		0.0354		0.0431		0.0446		0.0436		0.0397		0.0311		0.028	
PCB 105/132/153	0.0377		0.0341		0.0394		0.0434		0.0388		0.0357		0.0252		0.034	
PCB 107	0.0091		0.0022		0.0036		0.0024		0.0029		0.0033		0.0017		0	U
PCB 114/134	0.0022		0.0044		0.0026		0.0055		0	U	0.0029		0.0038		0.0069	
PCB 118	0.0181		0.0174		0.0194		0.0206		0.0188		0.0189		0.0144		0.0173	
PCB 119	0	U	0	U	0.0041		0.0052		0.0048		0.0026		0.0016		0.0019	
PCB 124/135/144/147	0.0056		0.0046		0.0053		0.0064		0.0056		0.0055		0.004		0.0036	
PCB 128	0	U	0.0017		0	U	0.0008		0.0015		0.0014		0	U	0	U
PCB 129/178	0.0019		0	U	0.0023		0	U	0	U	0	U	0.0007		0.0019	
PCB 130	0	U	0.0007		0	U	0.0024		0.0019		0	U	0	U	0	U
PCB 131	0.0004		0.0008		0	U	0.0012		0	U	0.0003		0.001		0.0011	
PCB 136	0	U	0	U	0	U	0	U	0	U	0	U	0.0013		0	U
PCB 137/176	0	U	0.0006		0	U	0.0017		0.0009		0	U	0	U	0	U
PCB 138/158/163	0.0753		0.0304		0.0313		0.0394		0.0305		0.0594		0.0323		0.0233	
PCB 141	0.0052		0.0047		0.0047		0.0058		0.0047		0.0042		0.0027		0.0039	
PCB 146	0.0067		0.0072		0.0091		0.0095		0.0083		0.008		0.0044		0.0031	
PCB 149	0.0225		0.0204		0.0214		0.0262		0.0207		0.02		0.014		0.0216	
PCB 151	0.0099		0.009		0.0104		0.0112		0.0096		0.0085		0.0058		0.0083	
PCB 156/171/202	0.0011		0.002		0.0021		0.0034		0.0024		0.0026		0.0006		0	U
PCB 157/200	0.0015		0	U	0	U	0	U	0.0013		0	U	0	U	0	U
PCB 167	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0.0005	
PCB 169																
PCB 170/190	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 172/197	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 173	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 174	0.0053		0.0043		0.0047		0.0061		0.0048		0.0039		0.0021		0.0034	
PCB 175	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 177	0.0039		0.0028		0.0031		0.004		0.0031		0.003		0.0012		0.0029	
PCB 180	0.0092		0.0066		0.0092		0.0141		0.0097		0.0068		0.0044		0.0048	
PCB 182/187	0.0173		0.0076		0.0081		0.0087		0.0082		0.0087		0.0049		0.0052	
PCB 183	0.0044		0.0029		0.0038		0.004		0.0031		0.0024		0.0021		0.0021	
PCB 185	0	U	0	U	0.0024		0	U	0.0014		0.0146		0.0029		0	U
PCB 189	0	U	0	U	0	U	0	U	0	U	0	U	0.0004		0	U
PCB 191	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 193	0.01		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 194	0	U	0	U	0	U	0	U	0.0005		0	U	0	U	0	U
PCB 195/208	0	U	0	U	0	U	0.0011		0	U	0	U	0.0011		0	U
PCB 196/203	0	U	0.0014		0.0024		0.0022		0.002		0.0019		0.0007		0.0001	
PCB 198	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 199	0	U	0	U	0	U	0.0009		0	U	0	U	0	U	0	U
PCB 201	0.0031		0.0013		0.0022		0.002		0.0017		0.0014		0	U	0	U
PCB 205	0.0111		0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 206	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 207	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
PCB 209	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U
Total Dissolved PCBs (by congener sum) =	6.00		5.64		6.36		6.14		6.19		6.21		5.27		4.72	
Total Congeners Analyzed (Diss) =	92		92		92		92		92		92		92		92	
Total Congeners Detected (Diss) =	65		68		67		71		70		68		70		65	
Reported TPCBs (Diss) =																

NOTE. no replicates samples were reported for this dataset

BLANK CELLS indicate no analysis for this congener
ZERO VALUES indicate result was non-detect
All PCB and congener data reported in this database were obtained from the 1988-90 Green Bay Mass Balance Study Surface Water Surveys - EPA/GLNPO by Cook.

APPENDIX I

Appendix I –

Other Supporting Data

Document List

1. Cormorant Memo 1-05-06
2. Cormorant Memo 1-05-06 Attachment A
3. Cormorant Memo 1-05-06 Figure 1
4. Water Monthly Sampling Memo – 4-01-05

Memorandum

TO: Long-Term Monitoring Work Group **DATE:** January 5, 2006
PROJECT: FOXSH

FROM: Wendy Larson, John Wolfe (LTI), and Todd Thornburg (Anchor)

SUBJECT: Comparison of Cormorants and Forage Fish as Ecological Indicator Species for Baseline and Long-Term Monitoring in Green Bay

Summary

The Response Agencies for the Lower Fox River have suggested that measurements of PCB uptake rates in cormorants may provide a cost-effective ecological indicator of natural recovery in Green Bay during baseline and long-term monitoring. To further evaluate the pros and cons of this type of monitoring approach, PCB data for Green Bay cormorants and forage fish were reviewed to compare the inherent statistical variability, the sensitivity to chemical gradients, and the geographic representativeness of these two types of monitoring approaches.

Fish data generally exhibit lower statistical variability compared to cormorant uptake data, indicating fish data would likely provide better statistical power to detect post-remediation trends in Green Bay. Similarly, forage fish show a greater response to differences in exposures between more and less contaminated locations (i.e., along chemical gradients between Green Bay and Lake Michigan), indicating they would likely be a more sensitive indicator of recovery than cormorants, and better able to discriminate the effects of Lower Fox River inputs from ambient regional inputs of PCBs. Fish sampling also provides more spatial flexibility than cormorant sampling, which is limited to locations of nesting sites and the feeding range of cormorants. Finally, the addition of cormorant sampling to the monitoring program provides little opportunity to offset fish monitoring costs, because sport fish would still need to be sampled in Green Bay, and cormorant sampling would require a separate mobilization during a different season of the year. For these reasons, we do not recommend substituting cormorant sampling into the baseline monitoring program. Monitoring the protection of ecological receptors through the use of representative fish prey species, sorted in narrow size classes, is the recommended monitoring approach.

1. Variability of Cormorant PCB Uptake Rates and Fish Tissue Data

A comparison was made of the variability in cormorant PCB uptake and in forage fish tissue PCB concentrations (alewife, gizzard shad, and yellow perch) in Green Bay. For alewife, the available data control for the effects of fish length (and age), so individual fish samples of six inches or less were included in the summary statistics for this species, consistent with fish sizes commonly found near cormorant nesting sites (Custer et al., 2001). For the other two species, all available sizes, and both individuals and composite samples, were included in the summary statistics because these species were limited by

smaller data sets. Because narrower size ranges will likely be used in the baseline monitoring program (two-inch to three-inch size classes), the variability in fish tissue concentrations might be even further reduced.

Overall, the summary statistics indicate there is more variability in estimates of cormorant uptake rates as compared to the fish data. The coefficient of variability (CV) for cormorant uptake rates ranges from 0.51 to 0.57. By comparison, the CV for alewife specimens with a total length of 6 inches or less ranges from 0.13 to 0.37 within those zones of Green Bay for which data are available. The CV for gizzard shad ranges from 0.12 to 0.37 within the two zones of Green Bay for which data are available, and the CV for yellow perch in the Inner Bay is 0.38.

The higher variability in the cormorant data may reflect several factors, including different feeding ranges of individual cormorants nesting on the same island, and differences in the species, sizes, and ages of fish brought back to the nest. The variability in cormorant uptake rates primarily reflects variability between nests on each island. This is consistent with the findings of Dole and Stromberg (1993), who reported that 89% of the variance in cormorant egg PCB concentrations occurred between clutches, compared to only 11% within clutches.

Variability in Cormorant PCB Uptake Rates

The variability in cormorant uptake rates was determined by calculating coefficients of variation for PCB uptake from double-crested cormorant data collected by U.S. Fish and Wildlife Service in 1994-1995. Table 1 presents the results for Cat Island and Hat Island in Green Bay, and Spider Island in Lake Michigan.

Table 1. Variability in Cormorant Accumulation Data

Location	Number of Samples	Mean (µg/day)	Standard Deviation	Coefficient of Variation
Cat Island	10	77.9	39.9	0.51
Hat Island	10	41.4	23.6	0.57
Spider Island	10	38.5	20.6	0.53

Tables A-1 through A-3 in Attachment A provide the supporting calculations for the values in Table 1. Total PCB concentration data and weights of embryos and nestlings collected from nests on Cat Island, Hat Island, and Spider Island were obtained from the Fox River Database (LTI, 2005). Measurements were made of PCB concentrations in the tissue of eggs at pipping and in sibling 10-day-old chicks. Total PCBs were estimated based on Aroclor equivalents. Ten paired samples (i.e. pairings of pipping embryos and nestlings taken 10 days later from the same nest) from each island were included in the variability analysis. The study is described in detail in Custer, et al. (2001).

Accumulation rates of PCB mass per day were calculated by subtracting the mass of contaminant in the pipping embryo from that of the sibling chick and dividing by the age of the chick, according to Custer, et al. (2001). The PCB concentrations were not corrected for moisture loss as described in Custer, et al. because the necessary information was not available to make such a correction, and it could not be determined whether the concentrations may have already been corrected in the database. Means and coefficients of variation were then computed for these accumulation rates for each island.

Variability in Forage Fish Tissue PCB Concentrations

The variability in forage fish tissue data was determined by calculating coefficients of variation for total PCB concentrations for alewife (less than 6 inches total length), gizzard shad, and yellow perch whole body data. Alewife and gizzard shad data were collected from the Inner Bay in 1989 as part of the Green Bay Mass Balance Study (GBMBS), and yellow perch data were collected by the Fox River Group in 1998. Results are presented in Tables 2, 3, and 4.

Table 2. Variability in Alewife Data (Individuals Less Than 6 Inches)

Zone	Number of Samples	Mean (ug/kg)	Standard Deviation	Coefficient of Variation
Zone 2A	6	1260	305	0.24
Zone 2B	4	1550	208	0.13
Zone 3A	7	417	154	0.37

Table 3. Variability Gizzard Shad Data (All Lengths)

Zone	Number of Samples	Mean (ug/kg)	Standard Deviation	Coefficient of Variation
Zone 2A	8	1762	652	0.37
Zone 2B	6	1783	223	0.12

Table 4. Variability in Yellow Perch Data (All Lengths)

Zone	Number of samples	Mean (ug/kg)	Standard Deviation	Coefficient of Variation
2	5	604	230	0.38

Attachment A provides the supporting calculations for the values in Tables 2 through 4. Total PCB concentration data were obtained from the Fox River Database (LTI, 2005). Total PCBs for alewife and gizzard shad are expressed as the sum of homologs, with non-detects assumed to be equal to the detection limit (denoted "homolog max" in the GBMBS). For yellow perch, total PCBs are expressed as the sum of Aroclors. Homolog and Aroclor data were not combined within a particular species because bias between these two analytical methods could affect the resultant summary statistics.

2. Relative Sensitivities of Fish and Cormorants to Chemical Gradients

A comparison of cormorant and alewife data for the Inner Bay and nearby Lake Michigan locations shows that cormorant PCB uptake appears to be less sensitive to differences in PCB exposures along chemical gradients in Green Bay compared to PCB data for an important species of cormorant prey. Table 5 presents alewife tissue data and cormorant uptake data for these two areas. Cormorant and Green Bay alewife data were derived from data sources cited previously. Lake Michigan alewife data were derived from the 1994-95 Lake Michigan Mass Balance Study.

Table 5: Comparison of Alewife and Cormorant PCB Data for Inner Green Bay and Nearby Lake Michigan

Sample Medium	Inner Bay	Lake Michigan	Ratio
Alewife Tissue	2.17 mg/kg (Zone 2)	0.363 mg/kg (Sturgeon Bay)	6.0
Cormorant Uptake	77.9 μg/day (Cat Island)	38.5 μg/day (Spider Island)	2.0

As shown in Table 5, alewife concentrations measured in the Inner Bay averaged 6 times higher than those measured in Lake Michigan, reflecting the lower levels of PCB exposure in Lake Michigan. In contrast, average cormorant uptake rates in the Inner Bay were only 2 times higher than in Lake Michigan, consistent with the results of Custer et al. (2001). These data suggest that forage fish are likely more sensitive indicators of inputs from the Lower Fox River, and better able to discriminate these inputs from ambient regional background sources of PCBs and other chlorinated organic compounds.

Because cormorants are opportunistic feeders, this may reflect variability in prey between the two locations during the study period. Similar variations in foraging behavior over time at a single sampling location, and changes in the relative availability of prey species or sizes would complicate the use of cormorant data to interpret trends.

3. Fish versus Cormorants as Spatial Integrators

Potential exposure concentrations for biota in Green Bay vary among locations. Water column concentrations generally decline from the mouth of the Lower Fox River to the Outer Bay (Connelly et al., 1992), and sediment concentrations are generally lowest in the Outer Bay and highest in a broad depositional area near the eastern shore of the bay, peaking at greater than 1 ppm PCBs in surface sediments of Zone 3B (Figure 1; Manchester-Neesvig, 1996). Fish sampling locations are flexible and can be focused toward areas of particular interest, e.g., in and around the elevated concentrations in Zone 3B which represent a "worst-case" scenario for fish exposures to sediment PCB concentrations in the bay.

In contrast, sampling of cormorant nestlings to measure PCB uptake is limited to a small number of nesting locations such as Cat Island and Hat Island, neither of which provides representative coverage of the elevated surface sediment PCB deposits in Zone 3B. A study of cormorant flight behavior in Green Bay and Lake Michigan (Custer and Bunck, 1992) indicates cormorants forage relatively close to their colonies, i.e., within the range of a few kilometers around their nests. The approximate foraging radius for cormorants nesting on Cat Island is shown on Figure 1. Collecting fish samples can therefore provide greater flexibility and broader spatial coverage for monitoring trends in ecological exposures. This flexibility should translate into greater sensitivity (i.e., improved "signal to noise") for discerning recovery trends in the bay.

4. Effect of Cormorant Sampling on Baseline Monitoring Costs

In some circumstances, cormorant sampling may provide a potentially cost-effective means of obtaining ecological monitoring data in lieu of sampling for ecological fish species. However, the cost-effectiveness of bird sampling in this monitoring program is diminished by the fact that human health fish species must be sampled regardless of the ecological indicator species selected (i.e., birds or fish). Thus, we will in any case need to collect fish from Green Bay in the fall using electrofishing, fyke nets, set lines, or other techniques as appropriate. These are indiscriminate fishing techniques that will likely produce ecological fish species of interest at the same time we are collecting human health species.

While some additional sampling and processing time may be needed to collect and composite the ecological fish species, and additional analytical costs will be incurred, the level of effort is expected to be relatively minor once the field crew has mobilized to collect human health species in the bay. Bird sampling, on the other hand, would require a separate mobilization in the spring, several field days over a few weeks time, and a specialty subcontractor. The field effort would be compounded by the need to collect data from a background location, such as Lake Michigan, to be able to correct for exposures to ambient levels of chlorinated organic compounds in the region, due to the lower sensitivity of birds to the PCB gradient in Green Bay, as discussed in Section 2 of this memorandum. Because cormorants will likely provide data with lower statistical power and more limited spatial coverage than the fish tissue data, our recommendation is

to focus baseline and long-term monitoring efforts on collecting appropriate and representative fish species to monitor the recovery of Green Bay's ecological resources.

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Attachment A. Supporting Data for Variability Analyses

Table A-1. Total PCBs in Double-Crested Cormorants: Cat Island

Nest #	PCB Concentration		Weight of Embryos & Nestlings		Total PCB Mass		Accumulation Rate
	Pipping Embryo Total PCB Concentration (ug/kg)	10-day nestling Total PCB Concentration (ug/kg)	Weight of Pipping Embryo (grams)	Weight of 10-Day Nestling (grams)	Pipping Embryo (ug)	10-day Nestling (ug)	10-Day Nestling (ug/day)
842	12000	3500	35.2	288	422.4	1008	58.6
178	9800	3800	36.6	344	358.7	1307.2	94.9
256	12000	4200	33.3	291	399.6	1222.2	82.3
279	12000	3000	40.9	473	490.8	1419	92.8
289	11000	3200	36	345	396	1104	70.8
307	11000	3200	37.2	428	409.2	1369.6	96.0
151	17000	2700	35	237	595	639.9	4.5
2001	23000	5000	35.2	483	809.6	2415	160.5
673	23000	4000	33.1	316	761.3	1264	50.3
687	14000	2600	31.7	433	443.8	1125.8	68.2

Table A- 2. Total PCBs in Double-Crested Cormorants: Hat Island

Nest #	PCB Concentration		Weight of Embryos & Nestlings		PCB Mass		Accumulation Rate
	Pipping Embryo Total PCB Concentration (ug/kg)	10-day nestling Total PCB concentration (ug/kg)	Weight of pipping embryo (grams)	Weight of 10-day nestling (grams)	Pipping Embryo Total PCB Mass (ug)	10-day Nestling Total PCB Mass (ug)	10-day Nestling (ug/day)
461	15000	1600	37.9	377	568.5	603.2	3.5
493	9300	2000	40.3	334	374.79	668.0	29.3
541	14000	2400	34	292	476	700.8	22.5
598	8500	1800	35.8	364	304.3	655.2	35.1
609	8500	1800	34.6	388	294.1	698.4	40.4
342	10000	2000	35.1	538	351	1076.0	72.5
347	7300	1600	35.3	413	257.69	660.8	40.3
351	11000	1600	33.2	419	365.2	670.4	30.5
358	10000	2600	34.5	451	345	1172.6	82.8
367	0	1800	32.2	316	0	568.8	56.9

Table A-3. Total PCBs in Double-Crested Cormorants: Spider Island

Nest #	PCB Concentration		Weight of Embryos & Nestlings		PCB Mass		Accumulation Rate
	Pipping Embryo Total PCB Concentration (ug/kg)	10-day nestling Total PCB concentration (ug/kg)	Weight of pipping embryo (grams)	Weight of 10-day nestling (grams)	Pipping Embryo Total PCB Mass (ug)	10-day Nestling Total PCB Mass (ug)	10-day Nestling (ug/day)
2027	20000	1900	38.3	409	766	777.10	1.11
2054	11000	1700	36.8	583	404.8	991.10	58.63
2055	9100	1800	36.4	455	331.24	819.00	48.78
2016	14000	1600	34	535	476	856.00	38.00
850	16000	1700	32.9	671	526.4	1140.70	61.43
125	5400	1700	34.1	475	184.14	807.50	62.34
266	9300	2300	33.8	338	314.34	777.40	46.31
725	8700	1200	32.1	439	279.27	526.80	24.75
733	7300	1300	32.3	357	235.79	464.10	22.83
864	11000	1500	34.2	391	376.2	586.50	21.03

Table A-4. Total PCB concentration in Alewife collected in 1989 as part of GBMBS

Zone	Date	Sample ID	Length (in)	Total PCB (ug/kg)
2A	8/16/1989	A/2/2A/4/Y	2.36	1100
	8/16/1989	A/2/2A/3/Y	2.36	1100
	8/16/1989	A/2/2A/7/A	5.91	2000
	8/16/1989	A/2/2A/1/Y	2.36	1200
	8/16/1989	A/2/2A/5/Y	2.36	1100
	6/2/1989	A/2/2A/6/A	5.71	1800
2B	9/14/1989	A/2/2B/1/Y	1.34	1500
	9/18/1989	A/2/2B/4/Y	1.57	1300
	9/18/1989	A/2/2B/3/Y	3.54	1600
	9/18/1989	A/2/2B/2/Y	3.54	1800
3A	6/10/1989	A/1/3A/3/Y	4.13	530
	6/16/1989	A/1/3A/2/Y	3.15	320
	6/16/1989	A/1/3A/4/Y	3.94	450
	6/20/1989	A/1/3A/1/Y	3.35	680
	10/3/1989	A/3/3A/1/Y	1.57	280
	6/2/1989	RS/1/3A/1/A	4.92	420
	6/2/1989	RS/1/3A/4/Y	3.35	240

Zone	Count	Mean	SD	CV
2A	6	1260	305	0.24
2B	4	1550	208	0.13
3A	7	417	154	0.37

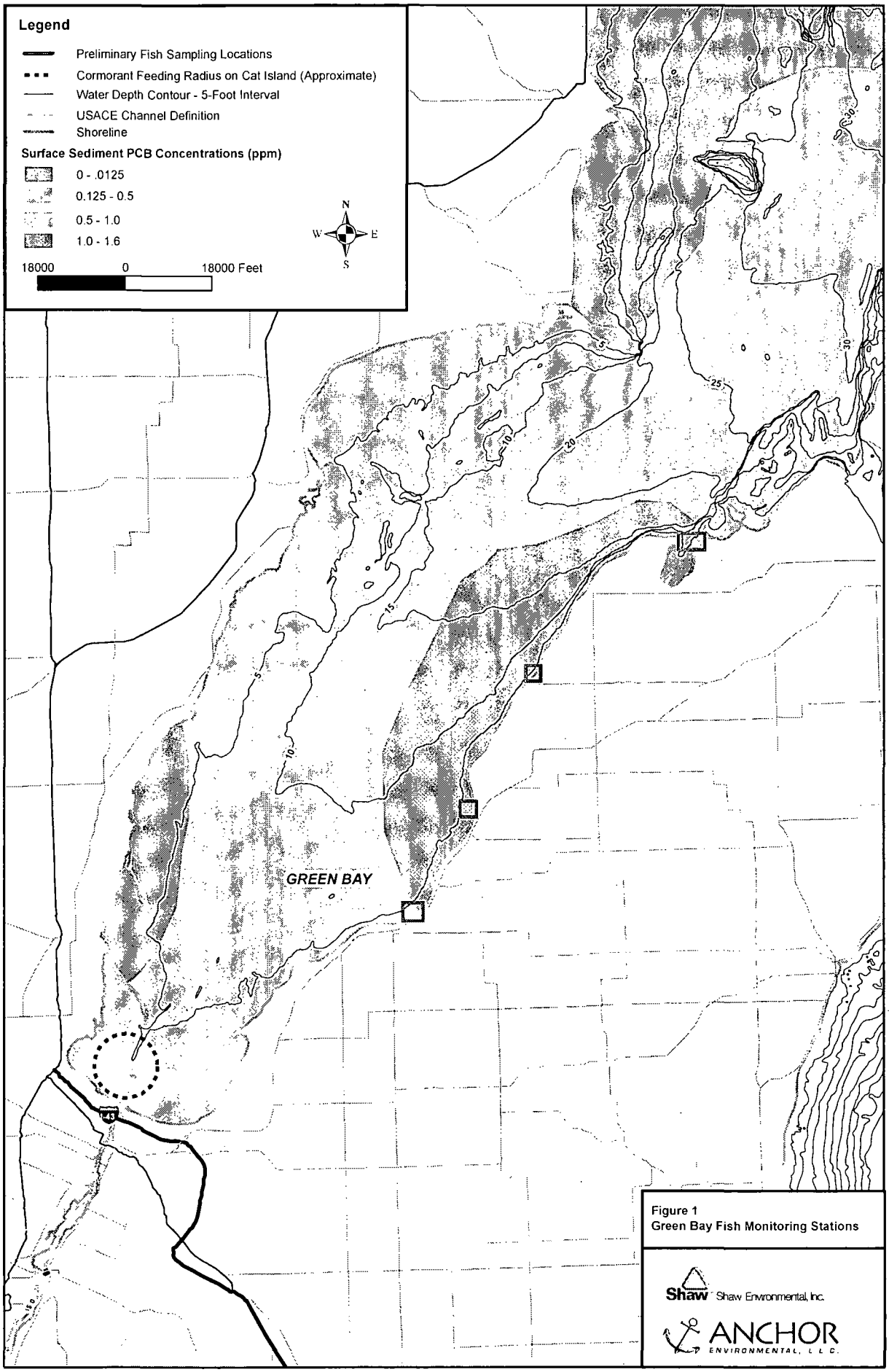
Table A-5. Total PCB concentration in Gizzard Shad collected in 1989 as part of GBMBS

Zone	Date	Sample ID	Length (inches)	Total PCB (ug/kg)
2A	6/5/1989	GS/1/2A/1/Y	7.6	3200
	9/28/1989	GS/3/2A/1/Y	3.94	1700
	6/5/1989	WDF059006BC1	composite	1700
	8/16/1989	WDH169013BC1	composite	1300
	8/16/1989	WDH169016BC1	composite	1200
	8/16/1989	WDH169017BC1	composite	1200
	9/26/1989	WDI269014BC1	composite	1800
	9/28/1989	WDI289003BC1	composite	2000
2B	8/21/1989	GS/2/2B/1/Y	2.76	1600
	10/12/1989	GS/3/2B/1/Y	2.56	1500
	8/21/1989	WDH219001BC1	composite	1900
	8/21/1989	WDH219002BC1	composite	2100
	10/12/1989	WDJ129002BC1	composite	1700
	10/12/1989	WDJ129006BC1	composite	1900

Zone	Count	Mean	SD	CV
2A	8	1762.50	652.33	0.37
2B	6	1783.33	222.86	0.12

Table A-6. Total PCB concentration in yellow perch collected in 1989 as part of FRG Studies

Date	Sample ID	Average Length (inches)	Number of Individuals in Sample	Total PCB (sum of Aroclors) ug/kg	Mean	SD	CV
7/15/1998	WB0059	8.11	2	760	604	230.2824	0.381262
7/15/1998	WB0064	8.07	2	570			
7/15/1998	WB0066	2.48	56	280			
7/16/1998	WB0087	7.44	2	530			
7/21/1998	WB0091	2.76	45	880			


Legend
Preliminary Fish Sampling Locations
Cormorant Feeding Radius on Cat Island (Approximate)
Water Depth Contour - 5-Foot Interval
USACE Channel Definition
Shoreline
Surface Sediment PCB Concentrations (ppm)
0 - .0125
0.125 - 0.5
0.5 - 1.0
1.0 - 1.6
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GREEN BAY
Figure 1
Green Bay Fish Monitoring Stations
Shaw Shaw Environmental, Inc.
ANCHOR ENVIRONMENTAL, L L C.

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Memorandum

DATE: April 1, 2005
PROJECT: **FOXSH**

TO:	**Subgroup on Sampling Frequency** Long Term Monitoring Plan Working Group, Fox & Green Bay	**FROM:**	**John Wolfe**
		CC:	
SUBJECT:	**Sufficiency of Monthly Water Column Samples for Data Analyses - Revised**		

Introduction

The objective of this memorandum is to support discussion of sampling frequencies for several data analysis methods that have been discussed by the Long Term Monitoring Work Group. The Proposed Supplemental Baseline Monitoring Plan, Lower Fox River (draft, March 8, 2005) proposes monthly water column sampling. Previous drafts of this document have evaluated proposed frequencies using an EPA minimum detectable difference methodology, with a target of detecting a minimum 50% reduction in PCB concentrations or loads. In working group meetings, there have also been questions about sample frequencies needed to support a multiple regression approach to time trend analysis, or to support the Beale's ratio estimator as a means of estimating PCB loads. This memo evaluates the sufficiency of monthly sampling to support these additional data analyses, should interested parties decide to undertake them in the future, in addition to the methods proposed in Section 7 of the Proposed Supplemental Baseline Monitoring Plan.

Summary of Results

With monthly sampling frequency and multiple regression methods, based on estimation of water column PCB trends at the mouth of the Lower Fox River:

- the estimated effect of remediation on post-remedial concentration would be subject to uncertainty (+/- one standard error) of about +/- 10 percentage points, based on a 50% reduction,;
- a finding of a reduction in concentration of 29% or greater, due to remediation, would be statistically significant at a 95% confidence level (in the sense of rejecting a "no effect" hypothesis); and
- the power of the test (i.e. chance of finding the effect of remediation to be significant if there truly is an effect) would be 0.97, assuming a true 50% reduction in concentration.

Uncertainty estimates for higher and lower sampling frequencies and for concentrations measured at DePere Dam are also presented in this memo.

With monthly sampling frequency and using the Beale's ratio estimator to estimate PCB load, the uncertainty of the load estimate would be about +/- 17% (root mean squared error), based on the 1994-95 Lake Michigan Mass Balance Study data. Comparable results for a range of sampling frequencies are presented below.

Multiple Regression Trend Analysis

a. *Form of the regression equation*: Multiple linear regression provides a way to estimate the effect of an independent variable on water-column PCB concentrations, such as the effect of sediment remediation, while controlling for the effects of other variables known to affect PCBs, such as flow and seasonal trends. To estimate the effects of remediation, the method would use baseline data and data from a post-remedial sampling round. These two rounds of data would be pooled to estimate the coefficients α, β, γ, etc. of an equation that would be structured similarly to:

$$\ln(PCB) = \alpha + \beta * R + \gamma * TSS + \delta * flow + \phi * Temp + u, \qquad (1)$$

where R is an indicator for post-remedial data, equal to 0 for the baseline and 1 for post-remedial data. An equation with a similar set of variables, and a time trend instead of the remediation indicator R, is estimated in LTI (2002, p 26). Variations in the specification of this equation can be made, depending what variables are known to affect PCB concentration and whether their effects are linear, nonlinear, or interactive. The inclusion of variables and their functional form should be dictated by scientific understanding of cause and effect relationships, supplemented by comparisons of goodness of fit of alternative forms of the equation, and variables should be retained in the regression equation if the hypothesis of "no effect" can be rejected at a high level of significance.

It is not necessary to use the log of PCB as a dependent variable, but a good fit has been obtained with this specification, and residuals were approximately normally distributed. The 2002 estimates are a useful prototype because they provide an estimate of the average prediction error (the standard error of the estimate, or SEE) for an equation of this type, to use in estimating the uncertainty bounds of estimates with varying sampling frequencies.

b. *Effect of monthly sampling frequency on uncertainty in estimated effect of remediation*: If the remediation reduces PCB concentrations, then β is negative. The regression equation can be rewritten as:

$$PCB = (e^{\beta * R}) * (e^{\alpha + \gamma * TSS + \delta * flow + \phi * Temp + u}), \qquad (2)$$

so that:

$$PCB_{(R=0)} = 1 * (e^{\alpha + \gamma * TSS + \delta * flow + \phi * Temp + u}), \text{ and} \qquad (3)$$

$$PCB_{(R=1)} = e^{\beta} * (e^{\alpha + \gamma * TSS + \delta * flow + \phi * Temp + u}). \qquad (4)$$

Thus, the proportional effect of the remediation (R =1 versus R = 0) on PCB concentrations is e^{β}. Using this relationship, Table 1 shows the correspondence between β and the proportional reductions in PCB concentration ($1 - e^{\beta}$), due to the remedy.

β	e^{β}	1- e^{β} = PCB Reduction
0.00	1.0	0%
-0.10	0.9	10%
-0.36	0.7	30%
-0.69	0.5	50%
-1.20	0.3	70%
-2.30	0.1	90%

Table 1: Correspondence Between β and Effects of Remediation on PCB Concentration

The regression estimate of β (call it b) can therefore be used to estimate the reduction in water column PCB concentrations. The number of samples to be collected each round depends on the desired level of confidence in this estimate. The uncertainty in b is measured by its standard error σ_b, which depends on the standard error of the estimate (SEE) of PCB and the standard deviation of R (σ_r) (Johnston, p 138):

$$\sigma_b = SEE * \sigma_R. \quad (5)$$

If the same number of samples is taken for the baseline as in each post-remedial round ($n_1 = n_2$), then

$$\sigma_b = SEE * 2 / sqrt (n_1 + n_2), \quad (6)$$

assuming that R is uncorrelated with the other explanatory variables. With monthly sampling, there would be $n_1 = 12$ samples prior to the remedy, and $n_2 = 12$ samples post-remedy. In LTI (2002), for the data obtained at the mouth, it is shown that SEE = 0.464. If similar results were obtained in the future, with monthly samples, then σ_b would equal 0.19. For comparison, estimates of σ_b for bimonthly and semi-monthly frequencies are also given in Table 2 below.

Sampling Frequency	$n_1 = n_2$	σ_b
Bimonthly	6	0.27
Monthly	12	0.19
Twice/month	24	0.13

Table 2: Standard Error of Regression Estimate (σ_b) Versus Sampling Frequency

Figure 1 shows the range of estimated reductions in PCB concentrations ($1 - e^{b +/- \sigma b}$), consistent with variation of $+/-\sigma_b$ around b, for selected sampling frequencies. For b = -0.69, corresponding to a 50% reduction in water-column PCBs, upper and lower bound estimates are (41%, 60%). Bounds would be slightly narrower with bimonthly sampling and would be wider with twice per month sampling, as Figure 1 shows. Any reductions in SEE due to improvements in the regression specification and goodness of fit, relative to LTI's estimates (2002), would reduce σ_b and narrow the bounds on the estimates.

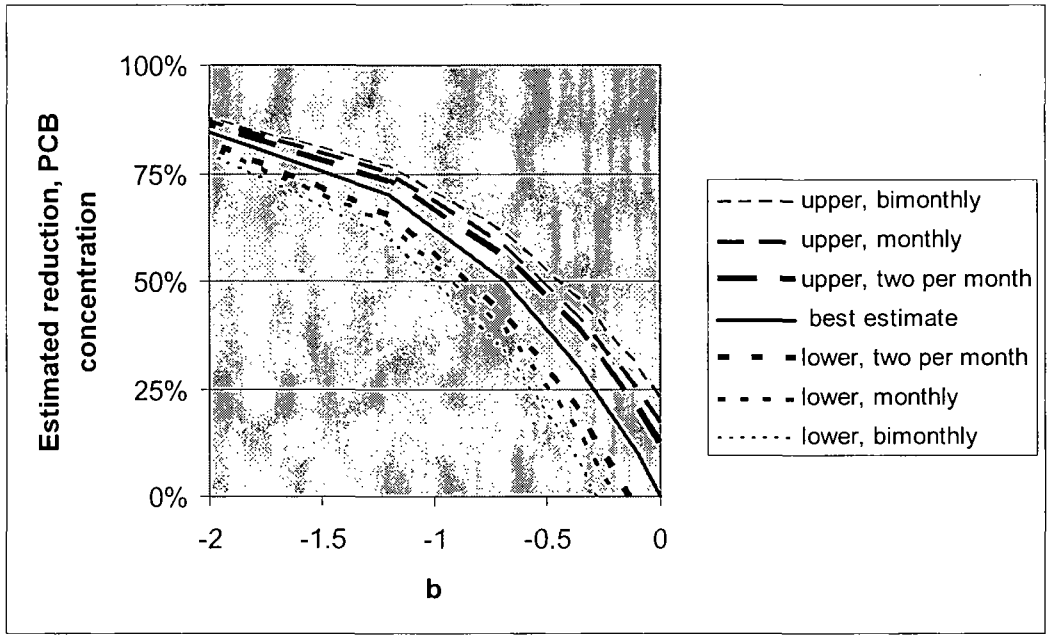


Figure 1: Best Estimate and Range of Estimated Reductions in PCBs (+/-One Standard Error), Versus Regression Coefficient Estimate b

c. *Effect of Sampling Frequency on Test of No Effect*: The estimate of σ_b also makes it possible to structure a statistical test of the significance of the effect of the remedy on water column concentrations. If the null hypothesis is that remediation has no effect

$$H_0: \beta = 0 \tag{7}$$

and the alternative hypothesis is the PCBs have been reduced

$$H_a: \beta < 0, \tag{8}$$

Then the following test statistic can be constructed:

$$t = (b - 0) / \sigma_b. \tag{9}$$

Using the critical t value of -1.725 (for 20 degrees of freedom, as in LTI's 2002 regression) for a one-tailed test at the 95% confidence level (P[rejection of H_0 if it is true] = Type I error = 5%), the acceptance criterion is:

$$\text{accept } H_0 \text{ if } t = b / \sigma_b > -1.725, \qquad (10)$$

and we obtain the acceptance regions shown in Table 3.

Sampling Frequency	$n_1 = n_2$	Acceptance Region, $b > -1.725\ \sigma_b$	Corresponding PCB reduction
Bimonthly	6	$b > -0.46$	< 37%
Monthly	12	$b > -0.33$	< 29%
Twice/month	24	$b > -0.23$	< 21%

Table 3: Acceptance Regions for H_0, for Selected Sampling Frequencies

Table 3 shows that the hypothesis of no effect would be rejected with monthly sampling if the regression estimate b is less than -0.33, corresponding to a 29% or greater reduction in PCB concentrations. Based on modeling for the RI/FS, reductions of this magnitude relative to baseline are likely after five years, and increasingly likely with the passage of time. A doubling of frequency to twice per month would narrow the acceptance region only slightly, rejecting the null hypothesis for a 21% or greater reduction in PCB concentrations.

d. *Effect of Sampling Frequency on Power of Test*: Larger sample sizes also reduce the likelihood of accepting H_0 if it is false (Type II error). If β is the true value of the regression coefficient, then

$$P(\text{Type II error}) = P(b > -1.725\ \sigma_b \mid E(b) = \beta < 0) \qquad (11)$$

$$= P(\ t > (-1.725\ \sigma_b - \beta)/\ \sigma_b\ ). \qquad (12)$$

Figure 2 shows how the power of the test of H_0 varies with the true value of β, for selected sampling frequencies. Figure 3 shows the same power function versus the reduction in PCB due to remediation, all else equal.

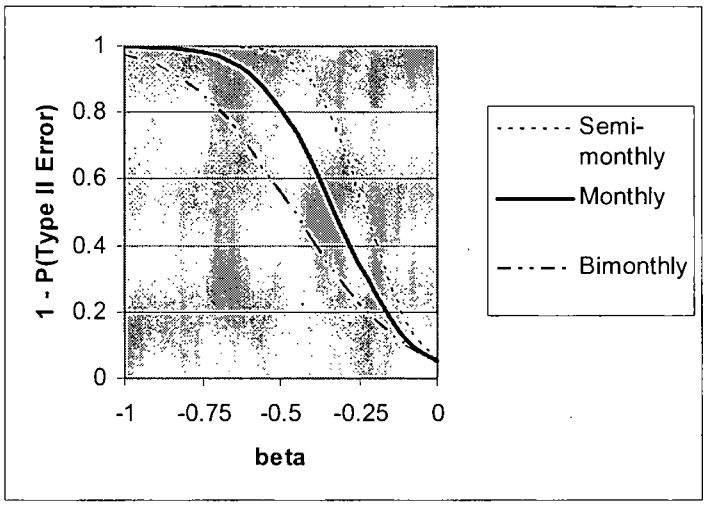


Figure 2: Power of Test of β = 0, for Selected Sampling Frequencies, as a Function of β

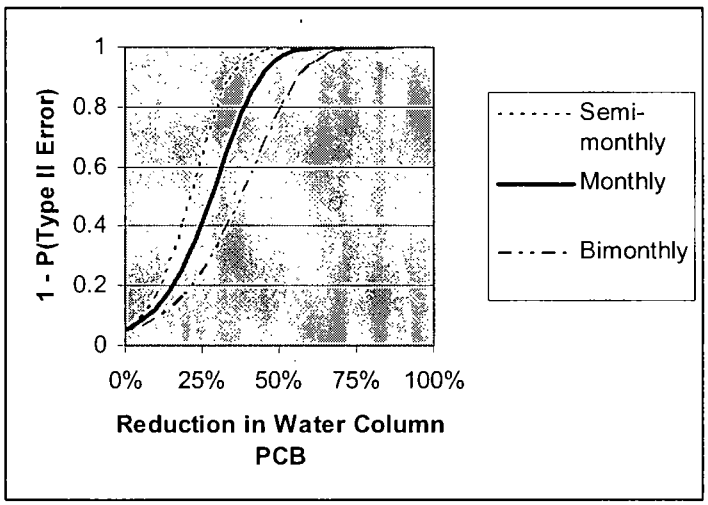


Figure 3: Power of Test of β = 0, for Selected Sampling Frequencies, as a Function of Reduction in Water Column PCB Concentration

Figures 2 and 3 show that the power of the test is greater, the greater the effect of the remedy. If PCBs decline by 50%, then Figure 3 shows that the likelihood of rejecting the null hypothesis of no effect is about 0.80 with semi-monthly sampling, 0.97 with monthly sampling, and very close to 1.00 with bimonthly sampling. Based on modeling for the RI/FS, reductions of this magnitude relative to baseline are likely after 5 years, and increasingly likely with the passage of time.

The same methods can be applied to analyze trends in PCB data at DePere Dam, assuming monthly sampling, and SEE = 0.579, as obtained for this location by LTI

(2002). Then $\sigma_b = 0.24$, and if $\beta = -0.69$, implying a PCB reduction of 50%, the range of the estimate of PCB reduction (+/- one standard error) would be 39% to 64%. An acceptance region for a test of no effect would be $b < -0.41$ (corresponding to a 34% reduction in PCB), and the power of the test would be 0.88.

The overall conclusion is that monthly sampling frequency would be sufficient to accurately estimate the effects of the remedy on water column concentration, given the magnitude of expected effects, and based on historical regression results for two locations on the river.

Beale's Ratio Estimator

The Beale's ratio estimator takes advantage of relationships between measured flows, which are inexpensive to measure on a daily basis, and concentration estimates, which are less frequent because of their greater cost to obtain. A guidance document written for EPA Region V by Richards (1999) provides formulas for the estimated average daily load and the mean squared error of that estimate. Equation (29) in that document provides a method to estimate the average daily load for a full year based on the average daily load during sampling events, including a bias correction. If flows are higher (or lower) than average on sampling days, which would also mean higher (or lower) than average concentrations, it uses the correlation between flows and concentrations to compensate accordingly and avoid bias.

The sufficiency of monthly sampling can be evaluated using an existing data set, and assuming that variability and correlations between flow and concentration would be similar to that data set. Using the Beale's method and the 1994-95 Lake Michigan Mass Balance Study (LMMBS) data for the mouth of the Fox River, we can compute the following:

- average daily load = 0.51 kg/day, and
- average annual load = 224 kg/yr.

A measure of the uncertainty of that estimate is the root mean squared error (RMSE) of the load, as shown in equation (30) in Richards (1999). The calculations assume that all sample means, variances, and covariances of flow and PCB flux would be equal to values estimated for the LMMBS, regardless of the assumed sample size.

The resulting relationship between RMSE and estimated load is shown in Figure 4.

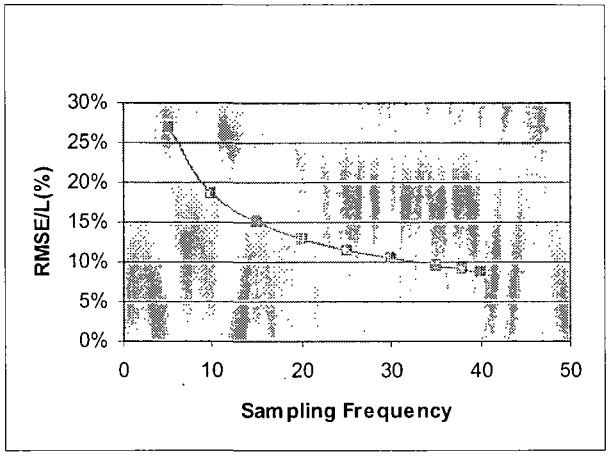


Figure 4: RMSE of Load, as % of Load, Versus Sampling Frequency

Figure 4 shows that there is a substantial reduction in the RMSE of the load estimate when sampling frequency increases from 5 to 10 per year, and that these expected gains diminish as sampling frequency increases further. For monthly monitoring (n = 12), the estimated RMSE is 17% of the load. This amount of uncertainty would be sufficient to recognize and accurately quantify reductions in loads over time, given the substantial decreases in loads that are expected over the course of the post-remedial monitoring period, based on the RI/FS modeling.

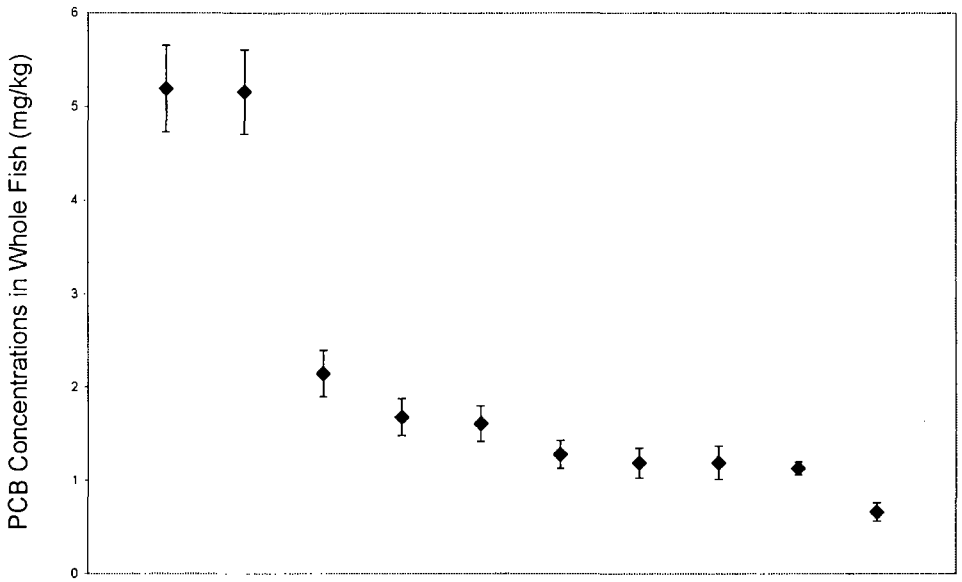
References

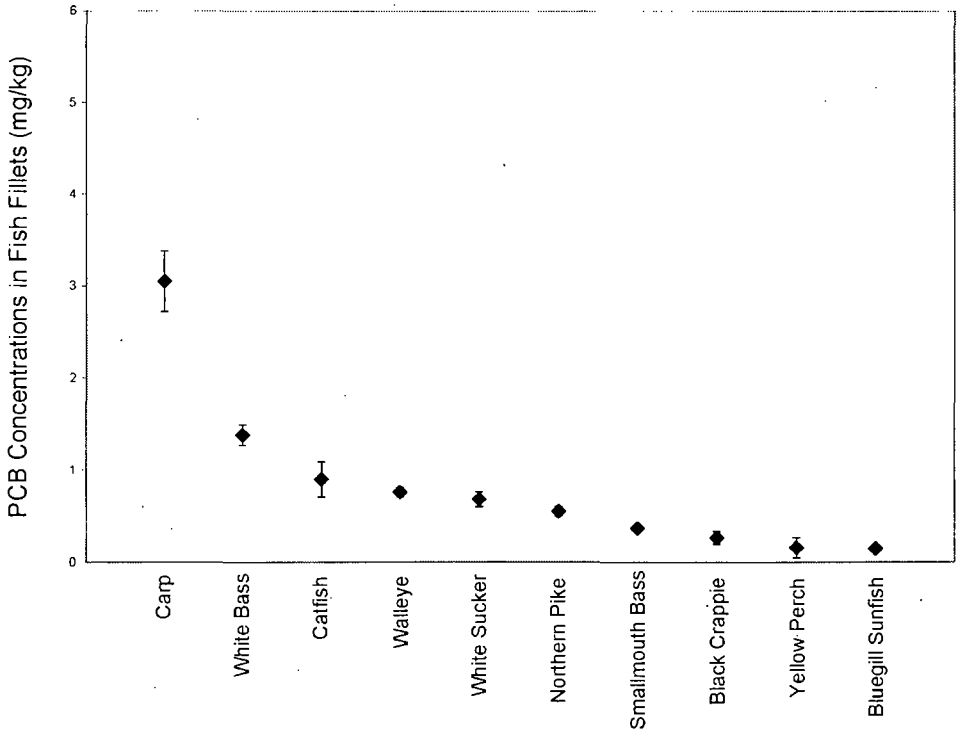
Johnston, J. 1972. Econometric Methods. McGraw-Hill.

Limno-Tech, Inc. 2002. Lower Fox River Water Column Sampling and Analysis.

Richards, R. Peter. 1999. Estimation of Pollutant Loads in Rivers and Streams: A Guidance Document for NPS Programs. Prepared under Grant X998397-01-0, U.S. EPA, Region V.

Figure 1-6. Summary Statistics of PCB Concentrations in Fish





Data Sources:USEPA, 2002a, 2004b; Stratus, 1999; Retec, 2002a, 2002b; Exponent, 1999; BBL, 1999, 2002