Quality Assurance Project Plan for the Hudson River PCBs Site

Baseline Monitoring Program

Book 1 of 2

Prepared for:
General Electric Company
Corporate Environmental Programs
Albany, NY

Prepared by:
Quantitative Environmental Analysis, LLC
Montvale, NJ

In Conjunction with:
Environmental Standards, Inc.
Valley Forge, PA

May 28, 2004

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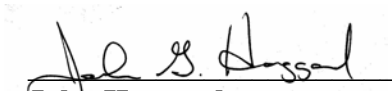
Job Number
GENbmp:130

May 28, 2004

A PROJECT MANAGEMENT

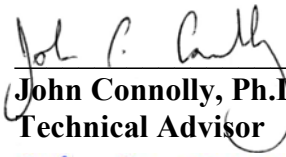
A1 TITLE PAGE AND APPROVALS

QUALITY ASSURANCE PROJECT PLAN FOR THE BASELINE MONITORING PROGRAM



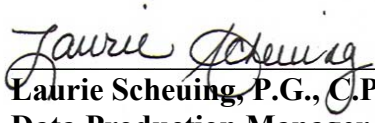
John Haggard
GE Project Manager
Date: May 27, 2004

Sean McNamara, Ph.D.
QEA Project Manager
Date: May 27, 2004



John Connolly, Ph.D., P.E., D.E.E.
Technical Advisor
Date: May 27, 2004

Mark LaRue
Field Sampling Manager
Date: May 27, 2004



Laurie Scheuing, P.G., C.P.G.
Data Production Manager
Date: May 27, 2004

David R. Blye, CEAC
QA Program Manager

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LIST OF ACRONYMS

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BMP	Baseline Monitoring Program
BMPSD	Baseline Monitoring Program Scoping Document
COC	Chain of Custody
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DQO	Data Quality Objective
DVM	Data Verification Module
EDD	Electronic Data Deliverable
EDI	Equal-Discharge Increment
LCS	Laboratory Control Spike
LIMS	Laboratory Information Management System
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCRDMP	Post-Construction Remnant Deposit Monitoring Program
POC	Particulate Organic Carbon
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
ROD	Record of Decision
RL	Reporting Limit
RM	River Mile
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
HRM	Hudson Reference Material

SSAP	Sediment Sampling and Analysis Program
TAL	Target Analyze List
TID	Thompson Island Dam
TOT	Time of Travel
TSS	Total Suspended Solids
WQ	Water Quality

A3 DISTRIBUTION LIST

Name	Agency or Company
John Haggard	General Electric Company
Bob Gibson	General Electric Company
John Connolly	Quantitative Environmental Analysis, LLC
Sean McNamara	Quantitative Environmental Analysis, LLC
Laurie Scheuing	Quantitative Environmental Analysis, LLC
Mark LaRue	Quantitative Environmental Analysis, LLC
David R. Blye	Environmental Standards, Inc.
Bob Wagner	Northeast Analytical, Inc.
Chris Cornwell	Paradigm Analytical Laboratories, Inc.
John Wilson	St. Peter's Bender Laboratory
Mr. Rusty Vicinie/Ms. Carrie Gamber	Severn Trent Laboratories-Pittsburgh
Distribution per AOC	

A4 PROJECT/TASK ORGANIZATION

The General Electric Company (GE) will maintain overall technical responsibility for conducting the Baseline Monitoring Program (BMP). The organizational structure for the BMP is illustrated in Figure A-1.

A4.1 Project Management

Overall Project Manager

John Haggard/Bob Gibson, GE

Responsibilities and duties of the GE Project Managers include the following:

- define project objectives and establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- review and analyze overall task performance with respect to planned requirements and authorizations;
- approve reports prior to their submission to the United States Environmental Protection Agency (USEPA) Region II; and
- represent GE at public meetings.

Project Manager

Sean McNamara, Ph.D., Quantitative Environmental Analysis, LLC (QEA)

The QEA Project Manager is directly responsible for activities performed by QEA personnel associated with the project. Other responsibilities include:

- provide overall direction and management of QEA activities as defined in the BMP;
- provide quality assurance (QA) management of all aspects of the project within the responsibility of QEA;
- review and analyze program achievement of data quality objectives (DQOs);
- final review of all documents prepared by QEA; and
- represent the project team at public meetings, as directed by GE.

Technical Advisor

John Connolly, Ph.D., P.E., D.E.E., QEA

The Technical Advisor will evaluate technical aspects of BMP activities. The Technical Advisor will be available for reviewing technical documents and providing input on all BMP activities.

Field Sampling Manager

Mark LaRue, QEA

All field activities will be managed by the Field Sampling Manager. Responsibilities include:

- primary contact with Agency oversight team in the field;
- oversight of the Water and Fish Program Coordinators;
- coordination and management of all field personnel and subcontractors;
- conduct field audits;
- oversee ordering and delivery of supplies;

- monitor program progress relative to schedule and determine corrective actions necessary to maintain schedule;
- review/approve the type of field equipment used and ensure that procedures are followed to achieve the DQOs;
- review field notebooks/logs with respect to completeness, consistency, and accuracy; and
- review all documents prepared by QEA, including final reports, routine progress reports, field activities summaries, and field audit results.

Data Production Manager

Laurie Scheuing, P.G., C.P.G., QEA

The Data Production Manager will oversee data management and distribution for the project. The primary duty of the Data Production Manager will be the oversight of the development and maintenance of the project database. Specific tasks include:

- coordination of analytical laboratory activities with respect to field sampling schedule;
- oversight of electronic data verification and data quality review; and
- oversight of project database management and distribution.

Database Managers

Mike Werth/Martin Hennessey, QEA

The Database Managers will be responsible for managing the data generated by the BMP field activities and reviewing the completeness and accuracy of the analytical results reported in the project database. Specific tasks include:

- development and maintenance of the project database;
- populating the database with field and laboratory data, including validation results;
- electronic data verification and review of project database for completeness and accuracy; and
- data distribution to end-users.

Quality Assurance Program Manager

David R. Blye, CEAC, Environmental Standards, Inc. (ESI; Valley Forge, PA)

The QA Program Manager will oversee all quality assurance aspects of the project. Specific tasks include:

- review of analytical laboratory standard operating procedures (SOPs) and electronic data deliverables (EDDs) and ensure their compliance with the BMP Quality Assurance Project Plan (QAPP);
- oversight of all analytical data validation;
- conduct external laboratory audits, and;
- set laboratory assessment criteria with regard to DQOs and conduct analytical data assessments to determine compliance.

Water Program Coordinator

Christopher Yates, QEA

The Water Program Coordinator is responsible for supervision and reporting of BMP water column sampling activities. Specific responsibilities include:

- conduct and supervise water column sampling activities;
- coordinate sample collection and analytical laboratory schedules;
- maintain quality assurance protocols for field samples and field data, including field data logging, Chain-of-Custody (COC) generation, sample labeling, and sample preservation;
- report any deviations from protocol to the Field Sampling Manager; and
- prepare routine progress reports, including a summary of field activities and field audit results.

Fish Program Coordinators

Adam Ayers, GE/Margaret Murphy, Ph.D., QEA

The Fish Program Coordinators are responsible for supervision and reporting of BMP fish sampling activities. Specific responsibilities include:

- conduct and supervise fish sampling;
- coordinate sample collection and analytical laboratory schedules;
- maintain quality assurance protocols for field samples and field data, including field data logging, COC generation, sample labeling, and sample preservation;
- report any deviations from protocol to the Field Sampling Manager; and
- prepare routine progress reports, including a summary of field activities and field audit results.

A4.2 Project Execution

Water Column Monitoring Program

Quantitative Environmental Analysis, LLC (Glens Falls, NY)

The field personnel conducting baseline water column monitoring activities have the following responsibilities during the design period:

- collection of weekly water column samples as outlined in the Weekly Water Column Sampling SOP (Appendix 1);
- execution of four Special Water Studies including: Lock 1, Velocity Profile, Time of Travel, and Dissolved Particulate PCB study (Appendices 2 through 5);
- placement of samples in appropriately labeled sample containers;
- preparation of sample containers for shipping to analytical laboratories;
- maintenance of COC documentation;
- maintenance of field logs; and
- delivery or shipment samples to the analytical laboratories.

Fish Monitoring Program

Quantitative Environmental Analysis, LLC (Liverpool, NY)

The field personnel conducting baseline fish monitoring activities have the following responsibilities during the design period:

- annual collection of resident fish species following the procedures in the Fish Sampling SOP (Appendix 21);

- recording fish sample collection conditions and fish length and weight measurements in the field log;
- containment and labeling of each sample;
- preparation of sample containers for shipping;
- maintenance of COC documentation;
- maintenance of field logs; and
- delivery or shipment of samples to the analytical laboratory.

Analytical Program

Northeast Analytical, Inc. (Schenectady, NY)

The responsibilities and duties of Northeast Analytical, Inc. (NEA) include the following:

- provide field personnel with adequate sample storage containers with preservatives appropriate to the analytes being measured;
- provide field personnel with adequate sample storage containers for preparation of field blanks as appropriate;
- provide field personnel with adequate decontaminated sample collection vessels;
- maintenance of in-laboratory chain of custody, including appropriate COC forms for the weekly water column monitoring program;
- performance of analytical procedures for the determination of congener-specific polychlorinated biphenyls (PCBs), total suspended solids (TSS), and particulate and dissolved organic carbon (POC and DOC) in weekly water column samples received from QEA;
- performance of sample processing and analytical procedures for the determination of PCBs (including congener-specific and sum of Aroclors) and lipid content in fish samples received from QEA, as well as organochlorine pesticides and mercury as needed;

- reporting of the data to the Data Production Manager in the required format and within required turn-around times; and
- strict adherence to all protocols in the QAPP and communication with the QA Program Manager in advance of any protocol deviations.

St. Peter's Bender Laboratory (Albany, NY)

The responsibilities and duties of St. Peter's Bender Laboratory include the following:

- maintenance of in-laboratory COC, including appropriate COC forms for the weekly water column monitoring program;
- performance of analytical procedures for the determination of nitrate, nitrite, total Kjeldahl nitrogen (TKN), total phosphorus;
- reporting of the data to the Data Production Manager in the required format and within required turn-around times; and
- strict adherence to all protocols in the QAPP and communication with the QA Program Manager in advance of any protocol deviations.

Paradigm Analytical Laboratories (Wilmington, NC)

The responsibilities and duties of Paradigm Analytical Laboratories include the following:

- maintenance of in-laboratory COC, including appropriate COC forms for the weekly water column monitoring program;
- performance of analytical procedures for the determination of dioxins and furans;

- reporting of the data to the Data Production Manager in the required format and within required turn-around times; and
- strict adherence to all protocols in the QAPP and contact the QA Program Manager in advance of any protocol deviations.

Severn Trent Laboratories (Pittsburgh, PA)

The responsibilities and duties of Severn Trent Laboratories-Pittsburgh (STL-Pittsburgh) include the following:

- maintenance of in-laboratory COC, including appropriate COC forms for the weekly water column monitoring program;
- performance of analytical procedures for the determination of TAL metals (total and dissolved);
- reporting of the data to the Data Production Manager in the required format and within required turn-around times; and
- strict adherence to all protocols in the QAPP and contact the QA Program Manager in advance of any protocol deviations.

QA/QC Program

Quantitative Environmental Analysis, LLC
Environmental Standards, Inc.
Northeast Analytical, Inc., St. Peter's Bender Laboratory, Paradigm Laboratory, Severn Trent Laboratories Pittsburgh

The GE and QEA project managers are ultimately responsible for the quality of data produced during the BMP and in meeting the DQOs of the project. All project personnel are expected to strictly adhere to the quality assurance provisions of this QAPP to meet these ends.

Field, laboratory, quality assurance, and data production managers are responsible for specific QA responsibilities described below.

The QEA Field Sampling Manager will be responsible for QA oversight for all field operations. QA responsibilities include:

- conduct field audits annually or more frequently as needed and report audit results and any corrective actions to the QEA Project Manager;
- review/approve the type of field equipment used and ensure that procedures are followed to achieve the DQOs;
- review field notebooks/logs with respect to completeness, consistency, and accuracy;
- review all documents prepared by QEA, including final reports, routine progress reports, field activities summaries, and field audit results.

The NEA, St. Peter's Bender, Paradigm and STL-Pittsburgh Laboratory Directors will be responsible for QA oversight of analytical procedures and laboratory data package production. QA responsibilities include:

- assure overall quality of laboratory operations;
- perform internal audits of laboratory procedures and report results and any corrective action to QA Program Manager;
- review COC documentation;
- assure that sample holding times and analytical SOPs are strictly adhered to; and
- review laboratory data packages for completeness, consistency, and accuracy.

The ESI QA Program Manager will be responsible for QA oversight of the analytical laboratories and analytical data validation. QA responsibilities include:

- resolution of laboratory questions/concerns about data deliverables;
- review laboratory EDDs and data compliance with the QAPP;
- review of internal laboratory audit reports;
- data validation and qualification;
- conduct external laboratory audits annually or more frequently as needed and report audit results and any corrective actions to the QEA and GE Project Managers; and
- prepare interim and final QA/QC reports, including findings on data usability in meeting project DQOs.

The QEA Data Production Manager will be responsible for QA oversight for the project database, including final electronic data verification and review for completeness and accuracy.

Data Production and Database Maintenance
Quantitative Environmental Analysis, LLC

The QEA Data Production Manager and designated personnel will be responsible for the maintenance of the project database and distribution of database deliverables in accordance with the QA provisions of this QAPP.

A5 PROBLEM STATEMENT AND BACKGROUND

The purpose and background for the remediation of the Hudson River PCBs Site is presented in the Record of Decision (ROD; USEPA 2002). The Remedial Action Objectives (RAOs) for the Site are defined in the ROD. The RAOs are:

- reduction of the cancer risks and non-cancer health hazards for people eating fish from the Hudson River by reducing the concentration of PCBs in fish;
- reduction of the risks to ecological receptors by reducing the concentration of PCBs in fish;
- reduction of PCB levels in sediments in order to reduce PCB concentrations in river (surface) water that are above surface water applicable or relevant and appropriate requirements (ARARs);
- reduction of the inventory (mass) of PCBs in sediments that are or may be bioavailable; and
- minimization of the long-term downstream transport of PCBs in the river.

The program described in this QAPP has been developed to establish baseline river conditions to allow for an evaluation of changes in those conditions that result from implementation of the selected remedy and verification that the remedy ultimately succeeds in achieving the RAOs set out in the ROD. Specifically, the data collected in the BMP will be used to satisfy the DQOs presented in Section A7. To satisfy the DQOs, it is necessary to monitor river conditions before the implementation of the remedy. This data set will provide the basis for evaluating whether remedial activities are complying with USEPA's engineering performance standards.

As specified in the Baseline Monitoring Program Scoping Document (BMPSD; QEA 2003) the overall goals of the BMP monitoring are to:

- establish pre-dredging conditions for use in evaluating achievement of performance standards; and
- provide data on PCB levels in fish and water to allow the evaluation of long-term recovery trends.

The BMP must provide the data needed to establish pre-construction river conditions and the data needed to support development of the construction and post-remedy monitoring programs. The river conditions of primary interest include PCB concentrations in the river water, PCB mass load from the Upper Hudson River to the Lower Hudson River, and PCB concentrations in fish. These conditions are the basis by which the RAOs pertaining to the reduction of PCB concentrations in fish and reduction of the long-term downstream transport of PCBs in the river will be assessed.[1]

The construction monitoring program will assess conditions during the remedial action. This program will use the results of the BMP for comparison to conditions during the remedial action. Moreover, the construction monitoring program will employ sampling techniques aimed at capturing significant short-term perturbations and will use the baseline monitoring program to provide experience in using such techniques on the Hudson River and the data necessary to characterize baseline conditions.

The data collected in the BMP will be used to:

- Document PCB concentrations in the water column at locations of interest along the river from upstream of the GE Hudson Falls facility to Waterford.
- Document PCB concentrations in the water column of the Lower Hudson River at Albany/Troy where upstream remediation may have some observable effect and at Poughkeepsie, in the vicinity of the principal water intake in the Lower Hudson River.

[1] The RAOs also include reductions in sediment PCB concentration and inventory. It should be noted that no sediment sampling is occurring under the BMP, but pre-dredging sediment sampling is being conducted under the Sediment Sampling Administrative Order on Consent (Design Support Sediment Sampling and Analysis Program; ESI and QEA 2002). While BMP data may be used to evaluate these RAOs, these objectives are not addressed directly by the BMP.

- Quantify the annual load of PCBs from the Upper Hudson River to the Lower Hudson River.
- Document PCB concentrations in Upper Hudson River and Lower Hudson River resident fish that have been historically monitored for PCB trend analysis.
- Document the distribution of PCBs between dissolved and particulate phases in the water column to provide an updated baseline of PCB partitioning between particulate and dissolved phase PCB in the water column. Should elevated levels of PCBs occur during the remedial action, this information may provide a means for evaluating the cause of the release.
- Document the water column concentrations of TSS, POC, and DOC at locations of interest along the river. This information may be useful for comparison to conditions during remedial action.

A6 PROJECT/TASK DESCRIPTION

A6.1 Description of the Work to be Performed

The BMP entails the collection and analysis of water and fish samples for the purpose of determining the PCB concentrations that exist prior to remediation in the region of the Hudson River expected to benefit from the selected remedy.

A6.1.1 Water Program

The water sampling programs, including specific sampling locations, sample collection procedures, analytical programs, and sampling frequencies are discussed in detail in Section B1. A summary is provided below:

Routine water column sampling will be conducted to define the spatial and seasonal gradients in PCB concentration and mass load. The sampling will be performed at the following stations:

- Bakers Falls (RM 197.0);
- Rogers Island (RM 194.2);
- Thompson Island (RM 187.5);
- Schuylerville (RM 181.4);
- Stillwater (RM 168.4);
- Lock 1 (RM 159.5);
- Waterford (RM 156);
- Mohawk River at Cohoes;
- Albany/Troy (RM 145); and
- Poughkeepsie (RM 75).

Weekly sampling will occur year-round, or from March to November, or from May to November depending on the station and parameters, weather and flow conditions permitting. Transect sampling will occur at most stations to capture possible lateral gradients and refine the PCB load determination. Centroid samples will be taken at the upstream background station (Bakers Falls), Rogers Island, and the Lower Hudson River stations. For these locations, "centroid" will be defined as the approximate center of the channel. This will allow samples to be collected at locations that are consistent with historical sampling locations and eliminate the need for complex hydraulic evaluations to establish a centroid location under tidal conditions in the Lower Hudson River. Water column samples will be collected using a multiple aliquot depth integrating sampler to lower 12 glass sample collection vessels simultaneously through the water column to collect a depth-integrated sample. To provide continuity and allow comparison of BMP data with historical data, in the first year of monitoring samples will continue to be

collected from the historical sampling locations at Thompson Island Dam (TID-PRW2) and Schuylerville (Rt. 29 Bridge) using techniques that are consistent with the historical GE sampling program (depth-integrated composite using a Kemmerer Bottle sampler).

Because the annual PCB load to the Lower Hudson River was a metric used in the USEPA's Feasibility Study to evaluate remedy effectiveness, the routine weekly monitoring will be supplemented with a focused sampling effort during the spring high flow period to provide an assessment of the annual PCB load in the river at Waterford. This sampling will involve collecting a depth integrated composite from the centroid (defined as approximate center channel) from the Rt. 4 Bridge in Waterford. The PCB load to the Lower Hudson River from the Mohawk River also will be assessed for comparison to the load from the Upper Hudson. This will be accomplished by monthly transect sampling from the Rt. 32 Bridge at Cohoes.

It is anticipated that TSS, turbidity, POC, and DOC will be measured during remedy implementation to provide data that will be used to trace the source of PCBs in the event that elevated concentrations are observed. During the BMP, these constituents will be monitored at the Upper Hudson River stations along with PCBs to document the levels to be expected in the absence of dredging.

Additional water samples will be collected and analyzed for other chemical constituents at the Upper Hudson River stations to provide information useful for the evaluation of short-term impacts that may occur during remedy implementation. During the 2004 field season, from May through November, nutrients (nitrate, nitrite, TKN, and total phosphorus) will be monitored weekly at all stations and dioxins and furans will be monitored monthly at a subset of the stations. TAL metals will be monitored every other sampling round (bi-weekly May through November) at all Upper Hudson River stations for the duration of the BMP.

Monthly water samples will also be collected at Albany/Troy and Poughkeepsie in the Lower Hudson River for seven months (May through November) each year, weather and flow permitting. These samples will be analyzed for congener-specific PCBs and TSS. Data from the Albany station will provide a baseline to assess the remedy effectiveness. Data from the Poughkeepsie station will provide a baseline in the vicinity of the principal Lower Hudson water intake.

Water quality (WQ) measurements will be taken for each water column sample including temperature, dissolved oxygen (DO), specific-conductivity, pH, and turbidity using appropriate field probes. Additionally, data from operating USGS flow gages will be used to facilitate PCB load calculations and precipitation data from meteorological stations will be used to assess the relationship between TSS, turbidity, and meteorological events.

A6.1.2 Fish Sampling Program

The fish sampling program, including specific sampling locations, sample collection procedures, analytical program, and sampling frequency is discussed in detail in Section B2. The following paragraphs provide an overview of the program.

Fish will be collected twice per year (spring and late summer/early fall, depending on species) from each of the three River Sections defined by USEPA in the ROD for purposes of remediation and evaluation of remedy effectiveness and at an upstream background location to characterize background PCB concentrations. The fish from each River Section will be analyzed for Aroclor PCBs (10% will also be analyzed for congener-specific PCBs) and the resulting data will be incorporated into statistical analyses that will be used to evaluate the progression toward attainment of the RAOs. These statistical evaluations will include trend analysis as well as comparisons of PCB concentrations before and after remediation using parametric or non-

parametric methods. The PCB levels in fish from the upstream background location will be used to assess the extent to which regional PCB sources will maintain a base level of PCBs in fish from the site, independent of the PCB sources within the site.

While the Albany/Troy station is actually located in the Lower Hudson, it is included with the Upper Hudson Fish Monitoring program.

A number of fish species including black bass (largemouth/smallmouth bass), yellow/brown bullhead, yearling pumpkinseed, yellow and white perch, and spottail shiner will be collected. Other resident forage fish will be substituted if spottail shiners are not available. These species include resident sport fish consumed by humans and wildlife, and resident forage fish consumed by wildlife, and cover a range of exposure through sediment and water column based food resources.

Standard sampling methods including netting, electroshocking, and angling will be used to collect target species. The edible portions for humans and wildlife will be monitored: fillets for bass, bullhead, and perch; individual whole body for yearling pumpkinseed; and whole body composites for spottail shiners or other resident forage fish species.

Bass, bullhead, and perch will be collected in the spring from all stations. Equal numbers of largemouth and smallmouth bass will be collected where available. While brown bullhead collections will be targeted where available and yellow bullhead will be collected only if brown is not available. Yearling pumpkinseed and resident forage fish will be targeted in the fall at all locations. Aroclor PCBs and percent lipid will be measured to monitor baseline PCB levels in fish. Ten percent of the total number of samples will also be analyzed for congener-specific PCBs. Mercury, dioxins and furans, and organochlorine pesticides will be analyzed one time during the BMP in 10% of the total number of adult fish samples, earlier rather than later, in the

program. The weight and length of collected fish will also be measured to assess fish condition. Any external abnormalities that are easily observed will be noted.

A6.1.3 Special Studies

In addition to the routine water column and fish monitoring elements described above, several special studies will be conducted as part of the BMP. Details of the special studies programs, including specific sampling locations, sample collection procedures, analytical programs, and sampling frequencies are discussed in detail in Section B1. The following paragraphs provide an overview of the programs.

First, the PCB data obtained from the Lock 1 station during the seven months (May through November) of 2004 will be compared with the paired data from the Waterford station to determine the degree to which they are correlated. If a strong correlation exists, the Lock 1 station will be abandoned. See Section A7.2.1 for a list of criteria for assessing the utility of continued sampling at Lock 1.

Second, hydrologic surveys will be conducted at each routine monitoring station as early as possible during the first year of the program to refine the equal-flow, depth-integrated sampling locations. Velocity and water depth measurements will be taken along each transect under a range of flow conditions until sufficient data have been collected to reasonably establish equal-flow sampling locations for the range of flow conditions typically observed.

Third, pseudo time-of-travel (TOT) sampling will take place at the routine monitoring stations in the Upper Hudson River once per month for seven months (May through November) during 2004. This special study is aimed at assessing the value of attempting to sample a single parcel of water as it traverses the Upper Hudson River. It is termed "pseudo" because true time-

of-travel sampling is impractical due to continual changes in river flow and the need to avoid health and safety risks associated with attempting to sample at night. Sampling will be restricted to Monday-Friday during daylight hours to alleviate worker scheduling and safety logistics. The value of TOT sampling will be evaluated after the first year of the baseline monitoring program. The sampling program may be modified to utilize more frequent TOT sampling if the data indicate that this technique provides useful information beyond that provided by routine weekly sampling. However, if the results of data evaluation indicate that TOT sampling does not provide data that are significantly superior to routine non-TOT sampling, the pseudo-TOT sampling program will be discontinued after 2004. Criteria to assess the benefit of TOT sampling over non-TOT sampling will be developed during the first field season. GE and USEPA will collectively determine the need for additional pseudo-TOT sampling beyond that proposed in this QAPP.

Fourth, a dissolved/particulate PCB study will be conducted at Thompson Island and Schuylerville to confirm that the PCBs are partitioned between particulate and dissolved phases in the manner observed during the Remedial Investigation studies. Knowledge of how PCBs are distributed between particulate and dissolved phases under baseline conditions may provide a means to evaluate the cause of elevated PCB levels that may potentially be observed during remedial action. Once per month (May through November) during 2004, high volume composites will be field-filtered at the equal discharge increment (EDI) locations at Thompson Island and Schuylerville locations and separate extractions and congener-specific PCB analyses will be performed on the filtrate and filter residue. The dissolved/particulate PCB study will coincide with pseudo-TOT sampling.

A6.2 Schedule

The sampling program is scheduled to begin in January 2004 or, if necessary, at some later date in 2004 within 30 days of approval of the QAPP, and continue until the commencement of remediation. The scope of the program will be evaluated and may be revised to enhance its effectiveness at meeting the project DQOs. The project schedule is presented in Table A-1. It is anticipated that the routine weekly sampling will be performed over a two day period each week. The Lock 1, pseudo-TOT, and field filtration special studies will be conducted in 2004. The fish sampling program will commence in 2004.

A7 QUALITY OBJECTIVES AND CRITERIA

A7.1 Data Quality Objectives

The ROD for the Hudson River PCBs Site mandates that monitoring programs be developed. "These monitoring programs should include sampling of water, biota and sediment such that both short- and long-term impacts to the Upper and Lower Hudson River environs, as a result of the remedial actions undertaken, can be determined and evaluated" (ROD at page 99). Baseline monitoring, the first of these programs, is meant to document the condition of the river prior to remediation and the potential impacts associated with the remedy. The goals and details of the BMP are defined in the BMPSD (QEA 2003). This QAPP is consistent with the USEPA-approved BMPSD. As described in the BMPSD, the overall goals of the program are to:

1) establish pre-dredging conditions where necessary for use in evaluating achievement of performance standards; and
2) provide data on PCB levels in fish and water to allow the evaluation of changes and recovery trends.

These goals represent two high-level DQOs that were used to develop the following detailed DQOs:

1) establish baseline PCB concentrations and mass loading rates at Thompson Island, Schuylerville, Stillwater, Lock 1, and Waterford to be used in determining dredging compliance with resuspension performance standards;
2) provide a means to translate between the historical record of PCB water column concentrations at Thompson Island and Schuylerville and the proposed baseline data;
3) establish the baseline annual PCB load at Waterford and on the Mohawk River at Cohoes to provide a basis to assess the effectiveness of the remedy in reducing PCB load to the Lower Hudson River;
4) establish baseline PCB concentrations upstream of the GE Hudson Falls facility to determine background PCB levels;
5) establish baseline PCB concentrations at Rogers Island to determine the PCB contribution downstream of the background station and upstream of the sediment remedial action;
6) establish reference concentrations of nutrients, metals, and dioxins/furans prior to dredging;
7) establish a relationship between turbidity and meteorological events;
8) establish baseline conditions of parameters potentially useful for comparison to conditions during the dredging operation;
9) confirm particulate and dissolved phase PCB partitioning behavior under baseline conditions to provide a means to evaluate the cause of elevated PCB levels that may be potentially observed during remedial action;

10) establish baseline PCB concentrations in the Lower Hudson River to assess post-construction remedy effectiveness and provide a baseline in the vicinity of the principal Mid-Hudson River water intake; and
11) establish baseline PCB levels in Upper Hudson River resident sport fish and resident forage fish to allow for documentation of the changes in PCB concentration that result from remediation.

A7.2 Measurement Performance Criteria

Measurement performance criteria describe how the DQOs will be satisfied. For each DQO, the types of measurements to be conducted are introduced and their performance requirements are discussed. The analytical data generated for the BMP will be evaluated based on QA/QC criteria as described in Sections A7.3, B5, D1 and D2 and the quantitative DQOs summarized in Tables A-2, B-6 and B-7a – B-7k. Only data qualified as "rejected" (flagged with R or UR) will be omitted from data analyses as these data are considered by data validation guidance unusable for either quantitative or qualitative purposes.

A7.2.1 Establish Baseline PCB Loading Rate at Thompson Island, Schuylerville, Stillwater, Lock 1, and Waterford to be used in Determining Dredging Compliance with Resuspension Performance Standards

This DQO requires measurement of PCB concentration in water flowing past each of the main stem Upper Hudson River monitoring stations and the associated river flow rate. The product of PCB concentration and river flow rate will yield the mass loading rate of PCBs passing each station (i.e., grams of PCB per day). Because it is possible that PCB concentration will vary across the width of the river at each station, the water samples will be depth and width-

integrated. Width integration will be achieved by sampling at multiple discrete locations across the river channel and compositing the discrete samples. Depth integration will be accomplished using a multiple aliquot depth integrating sampler. The discrete locations will be chosen such that the composite sample represents a discharge-weighted average of the discrete location concentrations. This will be accomplished by using an EDI sampling method (USGS 1999). The EDI method requires that flow in the cross-section be divided into increments of equal discharge. Five increments will be used at Stillwater, Lock 1, and Waterford; six increments will be used at Thompson Island and Schuylerville. Equal-volume depth integrated samples will be collected at the centroid of each of the equal discharge increments along the cross section. Hydrologic survey will be conducted under a range of flow conditions at each monitoring station during the first few months of the program to refine the equal-flow sampling locations. Velocity and water depth measurements will be taken along each transect until sufficient data have been collected to reasonably establish equal-flow sampling stations across the range of expected flow conditions.

Historical data indicate that the PCB load passing the main stem Upper Hudson River monitoring stations varies seasonally (e.g., QEA 2001a). The table below provides the loading statistics by month for 2000 through 2002 at TID (Station TID-PRW2) and Schuylerville, stations monitored weekly by GE.

Month	Thompson Island Dam				Schuylerville			
	Number of Samples	Avg. River Flow (cfs)	PCB Load (g/d)		Number of Samples	Avg. River Flow (cfs)	PCB Load (g/d)	
			Avg.	Std Dev			Avg.	Std Dev
May	11	7470	680	290	15	9560	1360	1170
June	12	6450	720	200	12	7220	1380	370
July	11	3580	490	150	11	4000	740	380

Month	Thompson Island Dam				Schuylerville			
	Number of Samples	Avg. River Flow (cfs)	PCB Load (g/d)		Number of Samples	Avg. River Flow (cfs)	PCB Load (g/d)	
			Avg.	Std Dev			Avg.	Std Dev
Aug	12	2830	380	120	13	3180	530	130
Sept	12	2810	280	120	12	3150	410	190
Oct	13	2630	370	220	13	2950	540	330
Nov	11	3990	300	140	12	4230	530	280

Data source: QEA, 2001a, 2002c.

An accurate estimate of baseline PCB loading is needed to provide a basis to estimate the portion of the load observed during dredging that may be attributable to the dredging activities. Given the seasonal variability observed historically in the loading, the baseline load must be established on a month-by-month basis over the period from May to November when dredging is likely to occur.

The USEPA Draft Performance Standard for Resuspension (USEPA 2003) proposes to subtract the baseline loading from that observed during construction to calculate the loading that may be associated with the dredging activities. The number of samples needed for this calculation can be defined by specifying a minimum difference that must be significant at a level a and must have a probability P of being observed. This is a classic statistical sampling problem. The goal is to ascertain whether PCB loads during dredging exceed critical values chosen to protect downstream resources from the impacts of resuspension. The draft performance standards document (USEPA 2003) presents the following criteria:

- Evaluation level: Exceedance of baseline load by 300 g/d, based on a 7-d average.
- Concern level: Exceedance of baseline load by 600 g/d, based on a 7-d average.
- Control level: Exceedance of baseline load by 600 g/d, based on a 28-d average.

The 300 g/d level was estimated by USEPA to be the minimum detectable exceedance of baseline loads. "The 600 g/day load…is twice the load detection threshold and therefore measurable. It is less than the 350 ng/L – 1,600 g/day condition and results in acceptable Tri+ and Total PCB load increases to the Lower Hudson...this load increment would have negligible impacts on the long-term river recovery, generating only brief (1 - 2 year) increases in fish tissue concentrations relative to the MNA scenario. Based on these considerations, the value of 600 g/day has been selected as the primary load criterion" (USEPA 2003; page 49).

Thus, the PCB loading standards are semi-quantitative, and the goal of the monitoring program can be stated as follows: to provide reasonable confidence that if PCB loadings have increased to levels that would be of long-term concern, the appropriate level of additional monitoring or other actions will be initiated. The 300 and 600 g/d levels were chosen as indicator values, but not precise measures of acceptable risk.

The sufficiency of weekly monitoring during baseline for meeting this goal depends on the uncertainty of the monthly average baseline PCB load that results from this monitoring. The greater the uncertainty of the monthly average, the less power of a statistical test aimed at detecting an incremental load increase during dredging that is equal to or greater than the specified triggers. A statistical simulation analysis was performed to evaluate the sufficiency of weekly monitoring. Details of this analysis are provided in Appendix 41. The analysis accounted for uncertainties inherent in both the baseline data and the dredging program data. The evaluation also included a time component, since each day of monitoring presents an opportunity to "catch" an unacceptable PCB loading, and such exceedances may be "caught", before or after a 7 or 28 day averaging period has transpired. This analysis indicated that weekly sampling during baseline provides good statistical power to detect dredging-related releases exceeding the performance standard triggers. For example, a release of 400 g/d would be detected (using a five percent significance level) after seven days about 78 to 97 percent of the

time (depending on the month) at Thompson Island Dam, and would be detected 94 to 100 percent of the time if it persisted for 14 days. A release of 700 g/d would be detected after 28 days 86 to 100 percent of the time. Similar, but slightly lower percentages were obtained using the data from Schuylerville (Appendix 41).

The Lock 1 and Waterford data may be duplicative given the proximity of these two stations. The data collected during 2004 will be used to determine the extent to which these stations do not yield statistically significant results. To assess this, a linear regression of paired results will be conducted, and the Lock 1 station will be considered for abandonment if the regression produces the following results:

- correlation coefficient greater than 0.9;
- slope not statistically different from one at a five percent level of significance; and
- intercept not statistically different from zero at a five percent level of significance.

A7.2.2 Provide a Means to Translate Between the Historical Record of PCB Concentrations at TID and Schuylerville and the Proposed Baseline Data

PCB concentrations have been measured by GE weekly since October 1997 at TID (Station TID-PRW2) and Schuylerville. These data may be useful in increasing the statistical power of the baseline data to be collected at these locations. However, these data were collected using depth-integrated sampling at a single point along the river cross-section at each station; a sampling protocol different from that which will be used during baseline monitoring. Moreover, the locations of the historical stations may differ from the locations to be used during the BMP. For these reasons, paired measurements at the historical and baseline monitoring stations using the historical and baseline monitoring sampling protocols, respectively, will be taken to determine whether the historical data may be combined with the baseline data. The

determination will be made using a paired t-test if the paired differences appear normally distributed or a Wilcoxon signed-ranks test if the paired differences do not appear normally distributed. The signed-ranks test requires a minimum of five data pairs. Nine data pairs will be collected at Thompson Island (monthly sampling March through November 2004) and 12 data pairs at Schuylerville (monthly sampling in 2004) by sampling at the historical stations using the historical sampling protocol at times coincident with baseline monitoring. Appendix 42 presents statistical tests that support the hypothesis that only a limited number of paired sampling events (e.g., 9) are required in order to adequately detect a statistical difference between the historical and transect sampling results.

A7.2.3 Establish the Baseline Annual PCB Load at Waterford and Cohoes on the Mohawk River to Provide a Basis to Assess the Effectiveness of the Remedy in Reducing PCB Load to the Lower Hudson River

The PCB load to the Lower Hudson River is a primary metric used to assess the effectiveness of the selected remedy. As such, it is important to establish the current load so that changes resulting from the selected remedy may be determined. The sampling discussed in Section A7.2.1 will provide the data with which to calculate the PCB load at Waterford for the period from May through November. Sampling at Waterford will also be conducted weekly from December through April of each year using the protocols discussed in Section A7.2.1 to allow an estimation of the total annual load. Weekly sampling is not necessary on the Mohawk River at Cohoes because of the believed absence of significant sediment PCB sources in the Mohawk (USEPA 1997). This station will be sampled monthly year-round using the EDI approach with five increments.

A7.2.4 Establish Baseline PCB Concentrations Upstream of the GE Hudson Falls Facility to Determine Background PCB Levels

Background PCB levels are needed to establish the PCB contribution from upstream of the site. Knowledge of this contribution provides a basis for evaluating loading within the site and the effectiveness of remediation on such loading. The upstream boundary of the site is Bakers Falls in the town of Hudson Falls. Water samples have been collected weekly from the river at this bridge and analyzed for PCBs since 1991 as part of the Post Construction Remnant Deposit Monitoring Program (PCRDMP). PCBs typically are not detected at this site using a methodology with a detection limit of 11 ng/L (ppt; QEA 2002a). A more sensitive PCB analysis method is needed to quantify the PCB concentrations in the Hudson River at the Bakers Falls; the average PCB concentration in the Hudson at Fennimore Bridge in Bakers Falls measured by USEPA for the Phase II study was 1.2 ng/L (USEPA 2000) and semi-permeable membrane devices (SPMDs) that were deployed by GE at Bakers Falls from June 24 to July 7, 1999 provided a concentration estimated to be less than 1.3 ng/L[2]. Additionally, studies have shown that PCB concentrations in rain water from non-urban sites are about 1 ng/L (Van Ry et al. 2002; Simcik et al. 2000). Thus, the congener-specific PCB analysis method must be able to quantify background PCBs at a level of about 1 ng/L.

It is not known if PCB levels in the Hudson River at the Bakers Falls exhibit the type of seasonal variability seen further downstream. Presuming that such variability does exist, samples initially will be collected at the same frequency as the downstream stations (i.e., weekly). If the data obtained in the first year of baseline sampling indicate that PCB concentrations do not exhibit significant variability, the frequency of sampling will be reduced.

[2] This value is based on water column PCB concentrations of 19, 17 and 15 ng/L measured at Rogers Island on June 23, June 30 and July 7, respectively and PCB masses in the SPMDs from Bakers Falls and Rogers Island of <0.224 µg and 3.0 µg, respectively.

An analysis of variance on the weekly concentrations grouped by month will be conducted to determine whether there is a significant variance component among months. If a monthly effect is not found, the sampling frequency will be reduced to monthly. The statistical power of the test will be assessed and used to determine whether the power is sufficient to support the reduction in sampling frequency. Sampling must occur twelve months each year (weather permitting) to satisfy the requirements of the post-construction Fort Edward Dam PCB remnant deposit monitoring program (QEA 2002c).

Unlike stations further downstream that are subject to spatially variable PCB loading from the sediments, PCB concentration at the Bakers Falls is not expected to vary significantly across the width of the river. A single sampling location at the approximate centroid of flow (defined as the approximate center of the channel to coincide with the historical sampling location) will be used to measure PCB concentration and load at the Bakers Falls sampling station.

A7.2.5 Establish Baseline PCB Concentrations at Rogers Island to Determine the PCB Contribution Downstream of the Background Station and Upstream of the Sediment Remedial Action

Potential sources of PCB to the river exist in the reach between the Bakers Falls Bridge and Rogers Island. These loads may have the potential to impact the recovery of the river and knowledge of their magnitude and change over time is useful to interpret trends observed at stations downstream of sediments targeted for remediation. Routine sampling at the Route 197 Bridge at Rogers Island has been conducted since 1991 as a basis to assess the PCB contribution from the upstream sources. In the last few years, PCB concentrations have been consistently below the 11 ng/L detection limit of the employed congener-specific PCB analysis method. Baseline monitoring must employ a more sensitive method to permit an accurate assessment of

the PCB levels at Rogers Island. The proposed need to achieve a 1 ng/L detection limit for the purpose of sampling at the Bakers Falls Bridge will satisfy this requirement. PCB levels at Rogers Island were frequently above 11 ng/L prior to 2000 and it is believed that typical current concentrations are probably in the range of 5 to 10 ng/L.

PCB concentrations at Rogers Island may vary over the river width due to the location of the Hudson Falls and Fort Edward sites along the eastern shore of the river. For this reason, the composite sample at Rogers Island will be volume-weighted such that the fraction of the water collected from the east (west) channel is approximately the same as the fraction of flow through the east (west) channel; the fraction of flow at each stage height will be determined through a series of velocity profile studies (*see* Section B.1.1.3.2). Sampling will be accomplished from the center of the Rt. 197 Bridge above each channel consistent with PCRDMP.

PCB concentrations at Rogers Island are likely to vary seasonally due to variations in river flow and temperature, both of which probably affect the shore-based PCB sources. For this reason, sampling will be conducted at the weekly frequency to be used for downstream stations. Sampling will occur twelve months (weather permitting) each year to satisfy the requirements of the PCRDMP.

A7.2.6 Establish Reference Concentrations of Nutrients, Metals and Dioxins/Furans Prior to Dredging

New York State Department of Conservation (NYSDEC) is responsible for developing water quality requirements for constituents other than PCBs for potential application to the dredging project. The BMP provides an opportunity to determine the baseline levels of these constituents. Given the lack of historical data on which to base a sampling design and the secondary nature of water quality constituents other than PCBs, a reconnaissance level of effort

is appropriate. Metals are of greatest interest because of past industrial practices and the historic widespread use of lead. Dioxins and furans and selected nutrients (nitrate, nitrite, TKN, total phosphorus) also are of some interest because of past wastewater discharges from municipalities and the paper industry. TAL metals will be monitored bi-weekly from May through November of each year at each of the Upper Hudson River stations. The nutrients will be monitored weekly from May through November of 2004 at each of the Upper Hudson River monitoring stations. Dioxins and furans will be monitored monthly from May through November of 2004 at Rogers Island, Thompson Island, Schuylerville, Stillwater, and Waterford. Sampling protocols for nutrients, metals, and dioxins and furans will be the same as for PCBs.

A7.2.7 Establish a Relationship between Turbidity and Meteorological Events

During the construction monitoring program, turbidity may be used as an indicator of dredging related resuspension. Elevated turbidity will also occur due to high-flow events in the river and possibly due to localized high flow events in tributaries. By their nature, high flow events in the river will be easy to identify and the associated high turbidity is not likely to be mistaken for dredging related resuspension. On the other hand, localized high flow events in tributaries may be less evident and the associated high turbidity in the river could be mistaken for dredging related resuspension. However, such events are likely to be associated with rainfall events. The BMP provides an opportunity to document the correlation between elevated turbidity not associated with high river flow and precipitation in one or more of the tributary drainage basins. The necessary data include high frequency precipitation rates and turbidity measurements. Precipitation is measured at numerous stations within the tributary basins. Four stations are actively monitored (Sunderland2; Saratoga Springs 4 SW; Grafton; Glens Falls Airport) and two other stations are operational and data can be obtained by traveling to the station and reading the instruments (Battenville; Eagle Bridge 2 SE). Data will be compiled from all six stations. Turbidity will be measured weekly at each of the main stem Upper Hudson

River stations following the sampling protocols described in Section B1. As part of the Year 2 water monitoring program, GE will submit for USEPA approval an addendum to the QAPP that will outline a special study for continuous turbidity monitoring to correlate precipitation events with elevated turbidity.

A7.2.8 Establish Baseline Conditions of Parameters Potentially Useful for Comparison to Conditions during the Dredging Operation

Resuspension during dredging has the potential to alter surface water quality related to chemical constituents other than PCBs. Knowledge of the baseline concentrations of such constituents provides a basis for detecting a change in water quality. Such changes may be useful as part of a weight-of-evidence examination of the nature and cause of a resuspension event. Potentially relevant constituents include TSS, turbidity, DOC, POC, DO, pH, and conductivity.

Establishing monthly baseline TSS levels is a particularly important part of the BMP water program. The resuspension performance standard includes triggers for increased water column monitoring based on net increases in TSS levels over monthly baseline levels.

Historical data indicate that the TSS passing the main stem Upper Hudson River monitoring stations varies seasonally. The table below provides TSS statistics by month for 1997 through 2003 at TID (Station TID-PRW2) and 1991 through 2003 at Schuylerville, stations monitored weekly by GE.

Month	Thompson Island Dam			Schuylerville		
	Number of Samples	TSS (mg/L)		Number of Samples	TSS (mg/L)	
		Average	Standard Deviation		Average	Standard Deviation
May	21	3.05	5.09	39	4.23	5.80
June	24	3.53	5.61	34	3.79	3.55
July	26	1.74	1.18	30	1.93	1.70
August	26	2.08	1.48	31	2.53	1.81
September	28	1.48	0.61	30	1.60	1.20
October	31	1.62	0.68	36	1.58	0.76
November	29	1.82	0.98	34	2.37	1.52

Data source: GE Hudson River database.

An accurate estimate of baseline TSS is needed to provide a basis for estimating the portion of the TSS during dredging that may be attributable to the dredging activities. Given the seasonal variability observed historically in the TSS, the baseline TSS must be established on a month-by-month basis over the period from May to November when dredging is likely to occur.

The USEPA Draft Performance Standard for Resuspension (USEPA 2003) proposes to subtract the baseline TSS from that observed during construction to calculate the increase in TSS that is associated with the dredging activities. The number of samples needed for this calculation can be defined by specifying a minimum difference that must be significant at a level a and must have a probability P of being observed. This is a classic statistical sampling problem. The goal is to ascertain whether TSS during dredging exceeds critical values chosen to protect downstream resources from the impacts of resuspension. The performance standards document (USEPA 2004) presents the following criteria:

- Evaluation level: Exceedance of baseline TSS by 12 mg/L, based on a 6-hour average.
- Concern level: Exceedance of baseline TSS by 24 mg/L, based on a 9 to 24-hour average.

Thus, the goal of the monitoring program can be stated as follows: to provide reasonable confidence that if TSS have increased to levels that would be of long-term concern, then the appropriate level of additional monitoring or other actions will be initiated.

The sufficiency of semiweekly monitoring in May and June and weekly monitoring in July through November during baseline for meeting this goal depends on the uncertainty of the monthly average baseline TSS that results from this monitoring. The greater the uncertainty of the monthly average, the lower the power of a statistical test aimed at detecting an incremental TSS increase during dredging that is equal to or greater than the specified triggers. A statistical simulation analysis was performed to evaluate the sufficiency of semiweekly/weekly monitoring. Details of this analysis are provided in Appendix 43. The analysis accounted for uncertainties inherent in both the baseline data and the dredging program data. The evaluation also included a time component, since every three hours of monitoring presents an opportunity to "catch" an unacceptable TSS level, and such exceedances may be "caught", before or after a 6, 9, or 24-hour averaging period has transpired.

This analysis indicated that semiweekly sampling in May and June and weekly sampling in July through November during baseline provides good statistical power to detect dredging-related releases exceeding the performance standard triggers. For example, a release of 16 mg/L would be detected (using a five percent significance level) after 6 hours at least 96 percent of the time (depending on the month). A release of 28 mg/L would be detected after 9 hours at least 97 percent of the time in a 9-hour running average. A release of 28 mg/L would be detected after 24 hours at least 98 percent of the time in a 24-hour running average (Appendix 43).

TSS and turbidity provide direct measures of the sediment load in the water column that, if elevated above baseline conditions, provide evidence of resuspension potentially related to dredging activities. The DOC in the sediment pore water is much higher than the DOC in the

water column (O'Brien and Gere 1993). Conversely, the POC of the sediments as a fraction of the sediment dry weight is much lower than is typically found in the water column (e.g., USEPA 1997). The sediments typically are anoxic and have significant oxygen consumption potential. Thus, increases in DOC, decreases in POC, and decreases in DO are supportive of other evidence that significant resuspension has occurred. Conductivity and pH may also differ between the sediments and the water column, providing additional supporting information.

Water column TSS, turbidity, DOC, and POC will be monitored in conjunction with the PCB samples described in Section A7.2.1 to provide paired data to facilitate correlation analyses. The TSS and turbidity data are expected to correlate and the data will be analyzed to establish the correlation. The properties of the sediment resuspended during the remediation may differ from the material suspended during the baseline period resulting in a different relationship during remediation. The goal of the correlation will be to assess the use of turbidity as a primary measure of resuspension. This is advantageous because turbidity data can be generated real time, allowing continuous evaluation of resuspension during dredging. Dissolved oxygen, turbidity, temperature, conductivity, and pH will be monitored *in situ* using a probe at each of the EDI locations at each of the water column sampling stations.

A7.2.9 Confirm Particulate and Dissolved Phase PCB Partitioning Behavior under Baseline Conditions to Provide a Means to Evaluate the Cause of Elevated PCB Levels That May Potentially be Observed During Remedial Action

To satisfy this DQO dissolved/particulate phase PCB studies will be conducted at Thompson Island and Schuylerville once per month (May through November) during the 2004 field season, and will coincide with the pseudo-TOT sampling program. High volume samples will be collected and filtered in the field, and the aqueous (i.e., filtrate) and particulate (i.e., filter residue) phases will be extracted and analyzed for PCBs separately.

A7.2.10 Establish Baseline PCB Concentrations in the Lower Hudson River to Assess Remedy Effectiveness and Provide a Baseline in the Vicinity of the Mid-Hudson River Water Intakes

The reduction in PCB mass load to the Lower Hudson River achieved by the selected remedy, in combination with natural recovery, is expected to reduce water column PCB concentrations in the Lower Hudson River. Any response in the Lower Hudson River to changes in the PCB mass load from the Upper Hudson River will be greatest at the upstream limit of the Lower Hudson and will decline moving downstream as the contribution of PCB sources within the Lower Hudson River to water column PCBs increases and tributary inflows provide dilution. Thus, the response to remediation and natural recovery will be greatest in the Albany/Troy area. Consequently, samples will be collected from this location to provide a baseline of PCB concentrations to be used later in the assessment of the effectiveness of the remedy.

In the estuarine portion of the river downstream of Poughkeepsie, dilution by ocean water and the influence of urban PCB sources complicate the assessment PCB concentration reductions that might be achieved by the remedy. There are several water intakes in the Mid-Hudson region upstream of the Poughkeepsie station. The data collected from this station are representative of the baseline conditions in the vicinity of the upstream water intakes because of the tidal, turgid, and slow-moving nature of the Mid-Hudson River.

Samples will be collected from the Poughkeepsie vicinity upstream of the estuarine boundary to provide a baseline of PCB concentrations in the vicinity of the principal Lower Hudson River water intake.

Samples will be collected monthly (May through November) on an annual basis. Depth integrated samples will be taken at the centroid of the river at these sampling stations.

A7.2.11 Establish Baseline PCB Levels in Upper Hudson River Resident Sport Fish and Resident Forage Fish to Allow for Evaluation of Long Term Recovery Trends

To determine whether the remedy achieves a reduction in Upper Hudson River fish PCB levels, one must be able to compare PCB concentrations in resident sport and forage fish before, during, and after remediation, in each of the Upper Hudson River Sections. For this reason, PCB levels in resident sport and forage fish will be measured prior to the commencement of remediation so that baseline data can be generated for comparison purposes. Historical data suggest that PCB levels in fish may vary within a reach such that sampling from a single location (as has been done historically by NYSDEC) may provide an inaccurate estimate of the reach average. Thus, fish will be collected from multiple locations within each reach. Within each reach a maximum of 25 (Ft. Miller/Northumberland Pool) or 30 (Thompson Island Pool and Stillwater Pool) fish samples of each species will be collected, targeting approximately ten fish samples at the locations routinely sampled by NYSDEC and approximately five fish samples at each additional location which will be approximately evenly distributed (depending on habitat availability) within the pools. Historical data collections, which have generally targeted approximately 20 fish samples, indicate that the standard error has been approximately 25% of the mean. Thus, 25-30 samples will provide reasonable confidence in the average PCB concentration at each location. Moreover, this represents a reasonable maximum take that will not impact the health of the fishery (Ron Sloan, NYSDEC, personal communication; Sloan 2003).

A maximum of 20 fish samples of each species will also be collected from the Feeder Dam Pool in Glens Falls, which will serve as a reference location, as it is located upstream of planned remedial activities and PCB concentrations in fish collected from this location have been close to background in recent years. A maximum of 20 fish samples will also be collected from Albany/Troy just below the Federal Dam. Data generated from the Albany/Troy location will be

used to establish baseline levels in fish in this portion of the Lower Hudson River, as fish from this location have shown to be affected by changes in Upper Hudson River PCB loads.

Fish collections will consist of black bass (largemouth/smallmouth bass), yellow/brown bullhead, yearling pumpkinseed, and yellow perch. At the Albany/Troy station, both yellow and white perch will be collected (ten of each species is the goal, but more of one species may be collected than another in order to achieve a total sample size of 20 if one species is present in smaller numbers, or not at all). Spottail shiner, or other forage fish if spottail shiners are not available, will also be collected. However, the forage fish collections will be limited to 10 composite samples from each of the five sampling locations. These species include resident sport fish consumed by humans and wildlife and resident forage fish consumed by wildlife, and cover a range of exposure through sediment and water column based food resources. These species have also been the primary target species collected historically by NYSDEC. Thus, there is a large historical PCB dataset available for these species and historical collections indicate these species are available from the historical NYSDEC sampling locations. However, flexibility in species selection is built into the program to ensure the target number of fish samples will be collected from the additional proposed sampling locations. For example, if largemouth bass is not available then more smallmouth bass will be targeted. If both largemouth and smallmouth bass are not available then another resident sport fish will be targeted. Similarly, if yellow perch (and white perch at Albany/Troy) is not available then a similar species will be targeted. The substitute species targeted in these situations will be dependent upon availability. The proposed number of fish samples are based on the number of samples collected historically by NYSDEC.

Pumpkinseed collections will target yearling (age 1+) fish only. Pumpkinseeds, as well as other forage fish, are generally considered to be in the yearling category if they are approximately 100 mm (NYSDEC 2003); fish ranging from 70 to 150 mm will be targeted as this represents the range of yearling pumpkinseed sizes presently documented in the NYSDEC

Hudson River Biota Monitoring Database. Collections of adult fish will target the legal or edible size; >305, >200, >170, and >160 mm total length, for bass, bullhead, yellow perch, and white perch, respectively (NYSDEC 2000).

Fish collections will be conducted on an annual basis; the adult fish, bass, bullhead, and perch, will be collected in the spring (May/June) and yearling pumpkinseed and the forage fish will be collected in the fall (late August/September).

A7.3 PARCC and Sensitivity - Definitions and Equations

Data quality and quantity are measured by comparison of resulting data with established acceptable limits for data precision, accuracy, representativeness, comparability and completeness (PARCC) and sensitivity. Data outside PARCC/sensitivity QA objectives will be evaluated, according to Section B5 and the Quantitative Data Quality Objectives (Tables B-6 and Tables B-7a through B-7k) of this document, and the criteria contained in the specified analytical methods, to determine what, if any, aspects of the data can be defensibly used to meet the project objectives.

A7.3.1 Precision

Precision measures the reproducibility of data or measurements under specific conditions. Precision is a quantitative measure of the variability of a group of data compared to their average value. Precision is usually stated in terms of relative percent difference (RPD) or percent relative standard deviation (%RSD). Measurement of precision is dependent upon sampling technique and analytical method. Field duplicate and laboratory duplicate samples will be used to measure precision for project samples. Both sampling and analysis will be as consistent as possible. For

a pair of measurements, when the detected concentrations are > 5x the sample-specific reporting limits (RLs) RPD will be used in this project. The absolute difference between the results will be used to assess precision for a pair of measurements when at least one result is ≤ 5x the sample-specific RL (including cases where one of the results is not-detected where a value of ½ the RL will be used as the value when calculating the absolute difference). For a series of measurements, %RSD will be used. The total precision of a series of measurements can be related by the additive nature of the variances. Equations for RPD and %RSD are presented below:

$$RPD = \frac{|D1 - D2|}{(D1 + D2)/2} \times 100\%$$

Where:

D1 and D2 = the two replicate values

$$\%RSD = S/x \times 100\%; \text{ and } S = \frac{\sqrt{\left(\sum_{I=1}^{n} \frac{(x_i - x)^2}{n-1}\right)}}{x}$$

Where:

S = standard deviation

x_i = each observed value

x = the arithmetic mean of all observed values

n = total number of values

A7.3.2 Accuracy

Accuracy measures the bias in a measurement system that may result from sampling or analytical error. Sources of error that may contribute to poor accuracy are:

- laboratory error;
- sampling inconsistency;
- field and/or laboratory contamination;
- handling;
- matrix interference; and
- preservation.

Equipment blanks, as well as matrix spike QC samples and Laboratory Control Spikes (LCSs), will be used to measure accuracy for project samples. Accuracy is calculated using the equation below:

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

Where:

%R = % recovery
SSR = spike sample result
SR = sample result
SA = amount of spike added to sample

A7.3.3 Representativeness

Representativeness expresses the degree to which sample data represent the characteristics of the media or matrix from which they are collected. Samples that are considered representative are properly collected to accurately characterize the nature and extent of contamination at a general sample location. Representativeness will be measured by using

standardized collection methods (e.g., sampling, handling, and preserving) and analytical laboratory analytical methods.

Representativeness will also be measured by the collection of field duplicates during weekly water sample collection (no duplicate fish). Comparison of the analytical results from field duplicates will provide a direct measure of individual sample representativeness.

A7.3.4 Comparability

Comparability expresses the confidence with which one data set can be compared with another data set from a different phase or from a different program. Comparability involves a composite of the above parameters as well as design factors such as sampling and analytical protocols. An acceptable level of comparability will be accomplished through the consistent use of accepted analytical and sampling methods.

A7.3.5 Completeness

Completeness is defined as the percentage of data that is judged to be valid to achieve the objectives of the investigation compared to the total amount of data. Deficiencies in the data may be due to sampling techniques, poor accuracy, precision, or laboratory error. While the deficiencies may affect certain aspects of the data, usable data may still be extracted from applicable samples. An evaluation of completeness necessarily involves an evaluation of the impact of missing data on the ability of the project to achieve its goals. The goal for completeness is 95% as listed on Tables B-7a through B-7k. The equation used for completeness is presented below:

$$C\ (\%) = \frac{D \times 100}{P \times n}$$

Where:

D = number of confident quantifications
P = number of analytical parameters per sample planned for analysis
n = number of samples planned for analysis

Confident quantifications are data that are valid as reported by the laboratory (i.e., unqualified positive results, results reported as not-detected "U," and results reported as estimated "J" between the MDL and RL). As indicated previously, assessment of completeness alone does not provide a comprehensive evaluation of data quality. Therefore, the percentage of usable and unusable data will also be calculated through use of the database by the following equations:

% Usable Data = #Unqualified Positive + #U + #U* + #JN + #J + #UJ [+ #MPC for PCDD/PCDFs]/Total Number of Results
% Unusable Data = #R + #UR/Total Number of Results

Separate % Completeness, % Usable Data, and % Unusable Data calculations will be performed for the project data. The definitions for the qualifier codes U, U*, J, UJ, MPC, R and UR are presented in Section D2.1.

A7.3.6 Sensitivity

Sensitivity is defined as the ability to achieve the project-required reporting limits as defined in Tables B-7a through B-7k.

A8 SPECIAL TRAINING/CERTIFICATION

The BMP will be conducted in parallel with remedial design activities and will require that BMP field personnel adhere to all applicable procedures specified in the Revised Health and Safety Plan (HASP; BBL 2003) and any associated addendum(s), including having met the following requirements prior to the commencement of sampling:

- A training course of at least 40 hours that meets the requirements specified in 29 CFR Part 1910.120(e) on safety and health at hazardous waste operations; and a refresher course of at least 8 hours that meets the requirements of 29 CFR Part 1910.120(e) on safety and health at hazardous waste operations within the last 12 months.

No other specialized training is anticipated for this project. Field personnel performing sample collection and measurement activities will be properly trained in equipment use and procedures necessary for each task prior to entering the field. Training courses or workshops on specific equipment, techniques, or procedures shall all be documented. The requirements of this QAPP will be reviewed by management and field personnel of each participating organization to ensure that persons with appropriate credentials and experience are assigned to the tasks to be performed. It will be the responsibility of the Field Sampling Manager to ensure that field personnel understand and comply with the applicable QAPP requirements for their individual tasks.

Personnel who are responsible for performing laboratory analyses will be properly trained by the laboratory director or her/his designee to conduct the various laboratory analyses described in this QAPP. The laboratories participating in this project will be accredited through New York State's ELAP and the National Environmental Accreditation Program (NELAP) for the analyses being performed. Table A-3 lists the analyses being performed by each laboratory

for the BMP and indicates the certification status or if certification is not available for that analyte. The laboratory shall have sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned functions. Data verification and validation will be under the direction of the QA Program Manager who is experienced with the production, reporting, verification, and validation of analytical data.

A9 DOCUMENTATION AND RECORDS

This QAPP will be distributed to each contractor responsible for the collection, generation, and interpretation of field and analytical data. The QA Program Manager will be responsible for ensuring that necessary changes occur so that the QAPP is up to date with actual practices. The QA Program Manager will ensure that a distribution list of QAPP recipient organizations or individuals is maintained such that revisions and updates can be distributed. The document control format used in this QAPP will identify the QAPP revision number and revision date. A QAPP revision history will be maintained that identifies each revision and a summary of the revision. This revision history will be incorporated into Section A9.1 of the QAPP.

Analytical data for this project will be reported in both an EDD and an analytical data package. The EDD will be generated by the participating laboratories and will be used by the Data Production Manager to facilitate loading the analytical data into the project database. The EDD specification is included as Appendix 37.

Analytical data packages will be prepared by the laboratories according to the procedures described in the SOP "Data Package Deliverable" (SOP DPSOP) which is included in Appendix 38. Data packages will be provided by the laboratory in an Adobe® Acrobat® .pdf electronic format for all analyses. The .pdf electronic data package will be delivered to the QA Program

Manager for data validation. A summary of results (described as Level A deliverables in SOP DPSOP) will be provided to the Data Production Manager and other necessary contractors for use in checking the project analytical database against hard copy results or other preliminary evaluation.

Appropriate records will be maintained to provide adequate documentation of the entire data generation process, including field sampling and laboratory analysis. Field sampling records will include maintaining field logs and sample COC documentation. Example field logs for water and fish monitoring, and sample chain of custody forms for water and fish are presented in Figures B-1, B-4a and b, B-2, and B-5; respectively. Field QA/QC samples will be documented on both the field log and sample COC forms.

The final evidence file will be the central repository for documents that constitute evidence relevant to sampling and analysis activities as described in this QAPP. GE and QEA are custodians of, and will maintain the contents of, the evidence files for the BMP, including all relevant records, correspondence, reports, logs, data, field records, pictures, subcontractor reports, analytical data, and data reviews. The final evidence file will include where generated:

- field records;
- field data and data deliverables;
- photographs;
- drawings;
- GIS maps;
- sample logs;
- laboratory data deliverables;
- data validation reports;
- field and laboratory audit reports;

- progress reports, QA reports; and
- custody documentation.

A9.1 QAPP Revision History

- Revision 0, September 17, 2003. This version is the initial document submitted to USEPA Region 2 for review and comment.
- Revision 1, January 21, 2004. This revision incorporates changes in response to written comments received from USEPA on October 3, October 17, and December 17, 2003.
- Revision 2, May 10, 2004. This revision incorporates changes in response to comments received on the January 21, 2004 version.

B DATA ACQUISITION

B1 SAMPLING PROCESS DESIGN

The BMP consists of two components: water column monitoring and fish monitoring. These data will be used to establish pre-dredging conditions for use in evaluating conditions during remedial action and will provide data on PCB concentrations in fish and water to allow the evaluation of long-term recovery trends. A detailed description for each of these components is provided in the sub-sections below. Sediment sampling and analysis are performed under a separate program, the SSAP (QEA 2002a), which will provide the data to support the dredge area delineation component of the remedial design.

B1.1 Water Column Sampling

Water column monitoring will be conducted at stations in the Upper and Lower Hudson as well as a site in the Mohawk River in accordance with the sampling methods in Section B2.1.1 and the SOP presented as Appendix 1. The analytical program is defined in Section B5. Field and laboratory QA/QC issues – including a discussion on corrective actions that may require resampling by the field team or reanalysis of samples by the laboratory - are addressed in Section C1. Data validation and verification procedures and methods are presented in Section D. The water column monitoring component of the BMP will be conducted for three years and re-evaluated if, after that time, the dredging operation has not yet commenced.

B1.1.1 Upper Hudson Water Column Monitoring Locations

The following locations comprise the Upper Hudson River routine water column monitoring stations:

- Bakers Falls (RM 197.0);
- Rogers Island (RM 194.2);
- Thompson Island (RM 187.5);
- Schuylerville (RM 181.4);
- Stillwater (RM 168.4);
- Lock 1 (RM 159.5);
- Waterford (RM 156); and
- Mohawk River at Cohoes.

These sampling stations are described in detail in Table B-1 and are illustrated in Figure A-2. Samples collected at these stations will be analyzed for congener-specific PCBs and other parameters using methods compatible with the historical data set found in the General Electric Hudson River Database. Analytical methods are defined in Section B4. A summary of the water program is provided in Table B-2**.**

Whole water samples will be collected weekly at all Upper Hudson River stations (except the Mohawk River at Cohoes) to establish the baseline PCB loading for comparison with conditions during remedial action and to assess long-term recovery and attainment of one of the RAOs. At Stillwater and Lock 1 (see Section B1.1.3.1) sampling will occur from May to November, the anticipated dredging season. At Thompson Island, sample collection will occur from March to November. The March and April data will be collected to establish the baseline PCB load during the higher flow conditions typical of these months. Weekly collection will

occur year round at Bakers Falls, Rogers Island, Schuylerville, and Waterford. The March and April data will be collected to establish the baseline PCB load during the higher flow conditions typical of these months. Collection of samples during December-April is required at Bakers Falls and Rogers Island to satisfy the requirements for the Post Construction Fort Edward Dam PCB Remnant Deposit Monitoring Program (QEA 2002c) However, ice cover, severe winter weather conditions, and safety concerns may prevent sampling at one or more of the sampling stations. Sampling year-round at the Schuylerville, Waterford, and Mohawk stations will generate data to compute baseline annual loads to assess the effectiveness of the remedy in reducing the PCB load within the Upper Hudson River and to the Lower River. The Mohawk station will be sampled monthly.

Sampling at the Bakers Falls station will be reduced to monthly after the first year if concentrations or loadings are uniformly low. Samples will be taken weekly across a transect positioned upstream of Lock 1 for seven months (May through November) during the 2004 field season. If the data exhibit a strong correlation with data from the Waterford station, the Lock 1 station will be abandoned.

Sampling will consist of upstream to downstream sampling conducted over the course of two days, except during pseudo-TOT sampling events, which will occur once per month (May through November) during the 2004 field season (See Section B1.1.5.3). A single composite sample for each parameter or related set of parameters will be generated for each station. Samples will be collected at the centroid of flow (defined as the approximate center of the channel to be consistent with the historical sampling station) at Bakers Fall because significant lateral gradients are not expected at this background station. At Rogers Island, samples will be taken at the centroid of the east and west channel (defined as the approximate center of the channels to be consistent with the historical sampling stations) and will be composited at a volume ratio consistent with the flow ratio in each channel (see Section B2.1.1). Transect

sampling will occur at all other stations to capture possible lateral gradients and refine the PCB load determination.

Water column samples will be collected using a multiple aliquot depth-integrating sampler in accordance with the weekly water sample collection SOP presented in Appendix 1. This sampler will be used to lower twelve 500 ml glass sample collection vessels simultaneously through the water column to collect a depth-integrated sample. Sampling will occur at six equal-flow locations over the cross section at Thompson Island and Schuylerville and at five equal-flow locations at the other stations. The entire sample volume collected from each location along the transect will be combined to generate a single composite sample for each parameter or related set of parameters at each monitoring station. Collection of water samples for congener-specific PCB analysis will be accomplished by collecting an aliquot in one sample collection vessel (or more as required for stations where high volume samples will be collected) at each sampling station, either at the centroid or EDI substation location, as appropriate and transferring that volume to an appropriate sample container (see Section B2.1.1). Container specifications for the various laboratory analyses are defined in Table B5. This process will be repeated at each transect location using the same sample collection vessels. The empty sample container used to collect the sample(s) at each station will be transported to the laboratory along with the water sample(s). The empty sample container will be rinsed with hexane and the hexane rinsate will be combined with the sample extract prior to PCB analysis.

To provide a means to translate between the historical record of PCB concentrations at Thompson Island and Schuylerville and the proposed baseline data, the historical single point sampling locations at TID (TID-PRW2) and Schuylerville will be sampled simultaneously with the transect sampling; samples at these locations will be collected using the historical sampling method (see Section B2.1.1). This dual sampling will be conducted monthly for the first 12 months of the program and result in collecting 9 samples at TID-PRW2 and 12 samples at Schuylerville.

The routine measurements on water samples will include congener-specific PCBs, TSS, POC, and DOC. NEA will analyze 1-L water samples for TSS following the standard USEPA protocol for the analysis of suspended sediment (Appendix 18 – SOP for the Determination of Suspended Solids by USEPA Method 160.2) with the modifications listed in Section 4.1.2.1 to be consistent with ASTM D 3977-97 Standard Test Methods for Determining Sediment Concentration in Water Samples, Test Method B – Filtration.

Congener-specific PCBs will be quantified by single, whole water extraction, with the exception of a monthly (May through November) Dissolved/Particulate Phase PCB study conducted during the 2004 field season (see Section B1.1.3.4). Turbidity measurements will be taken during the course of sample collection to correlate turbidity with TSS.

Selected nutrients (nitrate, nitrite, TKN, total phosphorus), TAL metals, and dioxins and furans will be measured in a subset of the water samples to establish reference concentrations prior to dredging. Nutrients will be monitored each sampling round at all Upper Hudson River stations for seven months (May through November) during the 2004 field season; TAL metals will be monitored every other sampling round during May through November at all Upper Hudson River stations for the duration of the program. Dioxins and furans will be sampled once per month for seven months (May through November) during the 2004 field season at Rogers Island, Thompson Island, Schuylerville, Stillwater, and Waterford.

Water quality measurements will be recorded for each water column sample in accordance with the SOP for obtaining WQ measurements (Appendix 2). These measurements will be made for temperature, specific-conductivity, pH, turbidity, and DO using a probe. Associated measurements will be made for river flow and rainfall. Flow measurements are needed to calculate PCB load. Data from operating USGS flow gages will be used to satisfy the flow monitoring requirement. Rainfall monitoring will help establish a relationship between

TSS, turbidity, and meteorological events. Data from existing meteorological stations will be used to satisfy the rainfall monitoring requirement.

During the months of May and June, TSS samples will be collected two times per week at the Thompson Island and Schuylerville stations (once during the routine weekly monitoring and one other day during the week) using the sampling protocols discussed above. If, after the first year of twice weekly sampling at Thompson Island and Schuylerville, it is determined that the variability in the TSS data is greater than that observed in the historical record, then the frequency of monitoring will be increased to three times per week for the final year of baseline monitoring. These TSS measurements will provide USEPA with information on TSS variability to be used for evaluating compliance with the resuspension performance standard.

B1.1.1.1 Waterford High Flow Sampling

Centroid (defined as the approximate center of the channel for consistency with the historical sampling station), depth integrated whole water samples will be collected during high flow periods at Waterford. High flow conditions are defined as flow at Fort Edward exceeding 15,000 cfs or peak flow at Waterford expected to reach 22,500 cfs. Samples will be collected at Waterford at 2000 cfs increments along the hydrograph (at Fort Edward) to the extent that sampling is practicable. Sampling will be limited to the rising limb of the Fort Edward hydrograph and two rounds of sampling after the peak flow rate.

Congener-specific PCBs, TSS, temperature, specific conductivity, turbidity, particulate organic carbon, and DOC will be measured to provide an assessment of baseline conditions potentially useful for comparison to conditions during the dredging operation, and river flow measurements will be taken to facilitate the calculation of PCB and TSS loads.

B1.1.2 Lower Hudson Water Column Monitoring Locations

The following stations comprise the Lower Hudson River water column monitoring stations:

- Albany/Troy (RM 145); and
- Poughkeepsie (RM 75).

Data from the Albany/Troy station will provide a baseline to assess the remedy effectiveness. Data from the Poughkeepsie station will provide a baseline in the vicinity of the principal Lower Hudson water intake. Samples will be collected monthly for seven months (May through November) per year. Depth-integrated composite samples will be taken at the centroid (defined as the approximate center of the channel to avoid performing complex hydraulic evaluations under tidal conditions) of the River at these sampling stations in accordance with the SOP presented in Appendix 1.

Congener-specific PCBs and TSS will be measured at these stations. Water quality measurements also will be recorded for each surface water sample. These measurements will be made for temperature, specific-conductivity, pH, turbidity, and DO using a probe. The SOP for obtaining WQ measurements is included as Appendix 2.

B1.1.3 Special Surface Water Studies

Special studies will be scheduled such that all data are collected during the same calendar year.

B1.1.3.1 Lock 1

Samples will be taken weekly in accordance with the Weekly Water Column Sampling SOP (Appendix 1) at a transect upstream of Lock 1 for seven months (May through November) during the 2004 field season. If the data exhibit a strong correlation with data from the Waterford station, the Lock 1 station will be abandoned.

B1.1.3.2 Velocity Profile Study

Velocity profile studies will be conducted in accordance with the SOP for Determining EDI (Appendix 3) at each routine monitoring station where EDI sampling or flow-weighted, centroid sampling (i.e., Rogers Island) will occur. These studies will be performed as early in the sampling program as possible (flow and weather permitting) in order to refine the EDI sampling locations and determine the flow distribution at Rogers Island across the range of expected flow conditions. .

B1.1.3.3 Time of Travel

Pseudo-TOT sampling will take place monthly at the routine monitoring stations in the Upper Hudson River for seven months (May through November) during the 2004 field season. The procedures to be followed for this study are presented in Appendix 5. This special study is aimed at assessing the value of attempting to sample a single parcel of water as it traverses the Upper Hudson River. It is termed a "pseudo-TOT" study because true TOT sampling is impractical due to continual changes in river flow and the need to avoid health and safety risks that would be associated with attempts to sample at night. Sampling will be restricted to

Monday-Friday during daylight hours to alleviate worker scheduling and safety logistics. The sampling schedule will be developed to come as close as possible to sampling a single water parcel without violating the sampling time constraints. The value of TOT sampling will be evaluated after the first year of the baseline monitoring program. The sampling program may be modified to utilize more frequent TOT sampling if the data indicate that this technique provides useful information beyond that provided by the routine, non-TOT sampling. However, if the results of data evaluation indicate that TOT sampling does not provide data that are significantly superior to routine non-TOT sampling, GE will determine, in consultation with USEPA, whether it is appropriate to discontinue the pseudo-TOT study.

B1.1.3.4 PCB Partitioning Study

A Dissolved/Particulate Phase PCB study will be conducted at Thompson Island and Schuylerville to provide an updated baseline of PCB partitioning between particulate and dissolved phases. The SOP to be followed during the PCB Partitioning study is included as Appendix 4. Knowledge of how PCBs are distributed between particulate and dissolved phases under baseline conditions may provide a means to evaluate the cause of elevated PCB levels that may be potentially observed during remedial action. Once per month (May through November) during the 2004 field season, high volume composites will be field-filtered at these two stations and separate extractions and congener-specific PCB analyses will be performed on the filtrate and particulate matter. The Dissolved/Particulate Phase PCB study will coincide with pseudo-TOT sampling.

B1.2 Upper Hudson River Fish Monitoring

The fish monitoring component of the BMP is designed to collect the information necessary to characterize the PCB concentrations in representative Upper Hudson River resident sport and forage fish prior to dredging. In addition, the data generated during the BMP, combined with historical data, will be used in spatial and temporal trend analysis of PCB concentrations in the Upper Hudson River fish. USEPA has indicated that it and NYSDEC will conduct fish sampling in the Lower Hudson River. The PCB data from this sampling will form a complementary dataset to the one produced from this program. For data comparability purposes, the historical Hudson River fish sampling program (NYSDEC 2000; Sloan et al. 2002; NYSDEC 2003) forms the basis for the design of the baseline fish monitoring program; additional elements are incorporated as necessary to fulfill the needs of the BMP. The fish component of the BMP will be conducted for three years and re-evaluated if after that time, the dredging operation has not yet commenced.

Fish collections will consist of black bass (largemouth/smallmouth bass), yellow/brown bullhead, yearling pumpkinseed, yellow perch, and spottail shiner. Other forage fish will be substituted if spottail shiners are not available. These species cover a range of association with sediments, including resident sport fish consumed by humans and wildlife and resident forage fish consumed by wildlife, and are the primary species targeted historically by NYSDEC.

B1.2.1 Upper Hudson River Fish Sampling Locations

Annual fish collections will be conducted in the Hudson from each of the River Sections at the stations listed below:

Upper Hudson River

- Feeder Dam Pool (1 location);
- Thompson Island Pool (multiple stations);
- Northumberland/Fort Miller Pools (multiple stations); and
- Stillwater Pool (multiple stations).

Lower Hudson River

- Albany/Troy (1 location).

These sampling stations are described in detail in Table B-3 and illustrated in Figure A-3. Sample collection and PCB analytical methods will be compatible with the historical data set found in the NYSDEC Hudson River Biota Monitoring Database in order to facilitate evaluation of temporal trends. A summary of the Fish Program is provided in Table B-4. Reasonable attempts will be made to maintain sample location integrity throughout the program.

The Feeder Dam Pool will serve as a reference location. Twenty fish per species will be targeted within the pool.

Multiple locations will be sampled in Thompson Island Pool to determine if the routine historical sampling locations are representative of the reach average. Ten fish per species will be collected at the historical locations routinely sampled by NYSDEC. A minimum of five fish per species will be collected at each of four additional locations approximately evenly distributed within the pool (depending on habitat availability), for a total of 30 fish per species. At a minimum, at least two locations within the pool will be sampled. It should be noted that the sample locations may vary by species. For example, historically largemouth bass and brown

bullhead have been collected from the backwater channel of Griffin Island while yearling pumpkinseed have been collected from the east side of the main channel opposite Griffin Island.

In the combined Northumberland/Fort Miller Pools, approximately five fish per species will be targeted at locations approximately evenly distributed (depending on habitat availability) for a target of 25 in these pools. As in Thompson Island Pool, the discrete sampling locations within the Northumberland/Fort Miller Pools may vary by species. Additionally, as in Thompson Island Pool, 5 discrete locations will be targeted while at least two locations within the Pool will be sampled.

Sampling in Stillwater Pool will be the same as in Thompson Island Pool. Ten fish per species will be collected at the historical locations routinely sampled by NYSDEC. Five fish per species will be collected at each of four additional locations, for a total of 30 fish per species in the pool. Similar to Thompson Island Pool, the historical sampling location for bass and bullhead is distinct from that of yearling pumpkinseed. These locations will be preserved and additional sampling locations may also vary by species. Additionally, as with the other pools, at least two locations will be sampled, while five locations will be targeted, within the Pool.

Twenty fish per species will be collected from one location in the Lower Hudson River at Albany/Troy. While the Albany/Troy station is actually located in the Lower Hudson, it is included with the Upper Hudson Fish Monitoring program. One modification at the Albany/Troy station is that both yellow and white perch will be collected (10 each), instead of collecting just yellow perch, in accordance with NYSDEC protocol (NYSDEC 2003). USEPA and NYSDEC have indicated they will conduct a sampling program in the Lower Hudson River which will form a complimentary dataset to the one produced from this program.

B1.2.2 Fish Sampling Timing

Fish samples will be collected once per year, as in the historical NYSDEC program. Bass, bullhead, and perch will be collected in the spring (May/June) from all stations. Pumpkinseed and forage fish will be targeted in the fall (late August/September) at all locations.

B1.2.3 Fish Data Analyses

The Aroclor-based PCB concentration and percent lipid will be measured to monitor baseline PCB levels in fish. Congener-specific PCBs will be analyzed during the program in 10% of the total number of fish samples. Mercury, dioxins and furans, and organochlorine pesticides will be analyzed one time during the program in 10% of the total number of adult fish samples. The weight and total length of collected fish will also be measured and any external abnormalities which are easily observed will be noted to assess fish condition. Total PCB concentrations, lipid contents, and the weight and total length of the collected fish are critical to achieve the project objectives, as these measurements are required to satisfy the DQOs set forth in Section A7. The additional analyses, namely PCB congeners, mercury, dioxins and furans, and organochlorine pesticides, are non-critical for achieving project objectives.

The goal of the fish sampling within the three River Sections, Thompson Island, Northumberland/Fort Miller, and Stillwater Pools, is to provide a reasonable estimate of reach-average fish PCB concentrations. However, statistically significant differences in the concentrations of total PCBs in fish tissue may exist between sampling locations within each Pool. Therefore, an analysis of variance, or similar statistical analysis, will be performed to determine whether there are significant differences among sub-locations within each pool. Based on the results of the statistical analysis, reach averages will be obtained by pooling the data, by species, and computing a reach-wide average or computing a weighted mean.

B2 SAMPLING METHODS

B2.1 Water Program Methods

The collection and processing of water column samples will follow the SOP included as Appendix 1 and is summarized below. The determination of EDI locations is described in Appendix 3.

B2.1.1 Sample Acquisition Methods

Water column samples will be collected using a multiple aliquot depth integrating sampling with pre-cleaned, glass collection vessels. Depth-integrated samples will be collected at each EDI location by lowering the sampler through the water column to approximately 75% of the location's depth, using care to prevent the sampler from contacting the river bottom, before raising it again. Depth versus stage relationships for each EDI location will be developed as part of the velocity profile study. The deployment speed of the sampler will be selected such that the target EDI volume (± 20%) is collected during the deployment interval. For example, for routine "1-L" composite samples taken at 5 EDI locations along a transect, the target EDI volume for each deployment is 200 ± 40 mL. If the target EDI volume is not met during a particular deployment, the sample will be discarded and another sample will be taken in order to consistently generate unweighted EDI sample composites along each transect. The entire volume collected during each deployment will be transferred into composite sample containers, consistent with USGS suspended sediment sampling methods. The multiple aliquot depth integrating sampler will be capable of obtaining sufficient sample volume for each analysis - PCBs, TSS, nutrients, etc. After all samples have been collected at each sampling location, one (or more if multiple sample collection vessels are used to collect high volume samples for PCB

analysis) of the sample collection vessels will be removed from the sampler, placed in a re-sealable plastic bag and labeled with the sample location ID. This empty container will accompany the samples to the laboratory, where it will be rinsed with hexane and added to the PCB extract.

Samples collected at Bakers Falls will be taken at the approximate centroid of the river from the downstream side of Bakers Falls Bridge (County Rt. 27 Bridge). High volume (8 L) samples will be collected for each PCB sample collected at this station to satisfy the lower PCB analytical sensitivity requirements.

Samples collected at Rogers Island will be composited using a volume ratio that is consistent with the flow ratio in the east and the west channel; the flow ratio will be determined for a range of flows through hydrologic surveys (see Appendix 3).[3] To satisfy the lower PCB analytical sensitivity requirements at this station, 8 L of water will be collected for each PCB sample. Lower volumes of water will be collected for other analytes (see Tables B-2 and B-5 for analytes and sample volumes).

Transect sampling below Thompson Island will be conducted from a boat, weather and flow permitting, at six EDI stations placed along a transect located downstream of the southern tip of Thompson Island (Figure A-2). Placing this transect at this location will allow safe boat access during higher flows compared to locating a transect immediately up or downstream of the dam. In addition to the EDI composite, a single sample will be collected at historical sampling location TID-PRW2 for the first 12 months of the sampling program (March – November; nine

[3] EDI transect sampling may be conducted at Rogers Island if there is a change in upstream river conditions that may result in insufficient cross-channel mixing. If such sampling is deemed necessary, GE will comply with the applicable modification of work plan, reporting, and notification requirements of RD AOC, as well as the procedures set forth in Section C1.3.1 – Field Corrective Action.

measurements total) using the historical sampling method associated with the PCRDMP (i.e., with a Kemmerer bottle sampler; QEA 2000). Appendix 42 presents statistical tests that support the hypothesis that only a limited number of paired sampling events (e.g., 9) are required in order to adequately detect a statistical difference between the historical and transect sampling results.

Transect sampling at Schuylerville will be conducted from the Rt. 29 Bridge at six EDI stations. The results of the velocity profile study will determine the actual locations of these stations; it is anticipated that two stations will be located in the west channel, with the remainder of the stations in the east (main) channel. In addition to the EDI composite, a single sample will be collected at historical sampling location on the Rt. 29 bridge for the first 12 months of the sampling program (12 measurements total) using the historical sampling method associated with the PCRDMP (i.e., with a Kemmerer bottle sampler; QEA 2000). Appendix 42 presents statistical tests that support the hypothesis that only a limited number of paired sampling events (e.g., 9) are required in order to adequately detect a statistical difference between the historical and transect sampling results.

Transect sampling at Stillwater will be conducted from the County Rt. 125 Bridge at five EDI stations to the west of the entrance to Lock 4. Transect sampling at Lock 1 will be conducted by boat at 5 EDI locations above Waterford Dam.

Transect sampling at Waterford will be conducted from the Rt. 4 Bridge at 5 EDI locations. Samples will be collected at the centroid of flow (defined as the approximate center of the channel) during high flow events. One-liter PCB samples will be collected at Waterford, however, if the 1-L method comes back above the MDL, but below the RL for two weeks in a row, the following week's duplicate sample will be taken at Waterford. This will allow better determination of the precision of the modified Green Bay method between the MDL and RL as compared to duplicate precision above the RL. Eight-liter samples will be collected at this station if the routine 1-L sample volume produces non-detects for 3 weeks in row. One-liter

routine sampling would resume at this station when the results of the 8-L method are above the 1-L MDL for two weeks in a row, provided that duplicate analyses between the MDL and RL show no statistically significant loss of precision compared to those above the RL, otherwise 8-L sampling will continue until results are above the 1-L RL for two weeks in a row.

Sampling from the Mohawk River at Cohoes will be conducted at five EDI locations from the Rt. 32 Bridge.

Sampling in the Lower Hudson River at Albany/Troy (RM 145) will be conducted by boat at a centroid location (defined as the approximate center of the channel). A single, depth-integrated sample will be collected. Sampling at Poughkeepsie will be conducted by boat at the centroid of flow (defined as the approximate center of the channel). A single, depth-integrated sample will be collected.

At each sampling location, surface water quality measurements will be taken at mid-depth in the water column. These measurements will be made for temperature, specific-conductivity, pH, DO, and turbidity using a probe. A multi-parameter probe (YSI 6920 or equivalent) will be calibrated at the beginning of each sampling day following the manufacturer's calibration procedure. All field measurements, as well as the date, time, weather conditions, sampling personnel, the number of containers, and QA/QC samples, will be recorded on a Water Sampling Field Log (Figure B-1). COC forms (Figure B-2) will be maintained and samples kept cool until analysis.

B2.1.2 Sample Preservation Methods

Water column samples to be analyzed for PCBs will be preserved in 1-L or 4-L amber glass jars with Teflon-lined caps at approximately 4±2°C. The holding times for all water

samples are seven days from collection to extraction and 40 days from extraction to analysis. Preservation for other analyses is summarized in Table B-5.

B2.1.3 Decontamination Method

With the exception of the dedicated, specialized caps and nozzles developed for the multiple aliquot depth integrating sampler, all non-disposable equipment that come in contact with river water will be decontaminated in the laboratory prior to reuse in accordance with the procedures specified herein. These procedures include:

For sampler caps and nozzles:

- Rinse thoroughly with distilled water in the field.
- Place in a re-sealable plastic bag and label with the sampling station.
- Store in bag until next sampling event.

For all other reusable equipment:

- wash with laboratory grade detergent and water;
- rinse with distilled water;
- rinse with acetone and allow to dry (contain rinsate for appropriate disposal);
- rinse with hexane and allow to dry (contain rinsate for appropriate disposal); and
- rinse with distilled water.

Residual decontamination fluids (acetone and hexane) will be stored at the laboratory in an appropriately designed storage container prior to shipment for off-site disposal in accordance with applicable regulations. Disposable materials that come into contact with river water, such

as personal protective equipment, will also be collected and stored prior to appropriate off-site disposal.

B2.2 Fish Program Methods

B2.2.1 Sample Acquisition Methods

Standard sampling methods including netting, electroshocking, and angling will be used to collect target species. The edible portions for humans and wildlife will be monitored; fillets for bass, bullhead, and perch; individual or whole body composites for pumpkinseed; and whole body composites for spottail shiners, or other forage fish species. Pumpkinseeds, as well as other forage fish, are generally considered to be in the yearling category if they are approximately 100 mm in total length (NYSDEC 2003); fish ranging from 70 to 150 mm will be targeted. Collections of adult fish will target the legal or edible size; >305, >200, >170, and >160 mm total length, for bass, bullhead, yellow perch and perch white perch, respectively.

Scale samples will be collected from pumpkinseeds to estimate age, if necessary, to ensure that they are yearling fish (age 1+). Yearling pumpkinseed, spottail shiner, as well as substitute forage fish will be prepared and analyzed as whole body samples. Potential substitute resident forage fish species include banded killifish, bluegill, blacknose dace, common shiner, fallfish, golden shiner, longnose dace, or tessellated darter. Black bass, bullhead, and perch, or substitute resident sport fish, will be analyzed as standard fillet samples. Potential substitute resident sport fish include white catfish, rock bass, black crappie, northern pike, or walleye. All fish will be prepared for contaminant analyses following collection according to the SOP for Annual Fish Sampling (Appendix 21; adapted from NYSDEC procedures). Fish samples will be analyzed for total Aroclor PCBs and lipid content, similar to analyses performed on fish collected through the current NYSDEC monitoring program (NYSDEC 2000). Additionally,

PCB congener analysis will be performed on 10% of the total number of fish samples according to the Green Bay Congener Method. Additional analysis of mercury, dioxins and furans, and organochlorine pesticides will be conducted once during baseline on 10% of the total number of adult fish samples.

Methods of collection may vary depending on the sampling location and the targeted species, although electrofishing is the preferred sampling method. Electrofishing will be accomplished with an 18-foot boat (or similar) equipped with a variable output gas-powered DC generator. Operating amperage will be amperage will be adjusted according to water conductivity to minimize injury; stunned fish will be immediately removed from the electrical field using dip nets to minimize the duration of the shock. Adult fish will be predominantly collected using boat electrofishing techniques. If electrofishing proves ineffective, gill nets will be set to collect the desired number of resident sport fish. Gill nets will be set for brief periods (4-8 hours) to limit mortality of non-target species. Seining for yearling pumpkinseed and forage fish may be used as an alternate to electrofishing, if necessary. Fish will be held in live-wells or buckets with frequent water changes. Fish will be killed by a blow to the head or by breaking the neck.

Fish will be collected from a single location at both the Feeder Dam Pool and Albany/Troy sampling stations. At Thompson Island, Ft. Miller/Northumberland, and Stillwater Pools, fish will be collected on a reach average basis. This will be accomplished by collecting approximately 10 fish of each species at the routine historical locations in Thompson Island and Stillwater Pools and a minimum number of fish (approximately 5 for proper statistical analysis) of each species at four additional locations approximately evenly distributed within the pools, with a maximum of 30 fish samples per species. As there are no routine historical sampling locations within the Ft. Miller/Northumberland Pool, a minimum number of fish (approximately 5 for proper statistical analysis) of each species at locations approximately evenly distributed within the pools with a maximum of 25 fish samples per species. Access to the Fort Miller Pool

will be accomplished by either an agreement with a private landowner or by craning the boat into the pool. Sample will be collected from available habitats with a series of sampling runs. These runs will be documented on a Reach Averaging Sampling Run Log (Figure B-3). Discrete sampling locations, within the appropriate habitat type for the species being sampled, will extend no more than 1000 meters along the shoreline. The determination of whether or not the maximum number of samples can be reached will be a joint decision between GE and USEPA and/or its oversight representative. If an agreement between USEPA and/or its oversight representative and GE field staff cannot be reached, USEPA will consult with the GE project manager to make the final determination. GE would then direct its field staff as appropriate.

Fish will be handled according to standard procedures developed by NYSDEC (NYSDEC 2000). For each specimen, the date of collection, a unique identification number or code, the location including GIS coordinates, genus and species, total length in millimeters (to nearest mm), weight in grams (to nearest 0.1 gram), sex (if possible), and method of collection will be recorded on a Fish Collection Field Log (Figure B-4a and b). The same information will also be collected for composited fish, as well as the number of individuals within the composite. Any external abnormalities which are easily observed will also be noted on the Field Log. COC forms (Figure B-5) will be maintained and processed samples kept cool (below 4°C) and delivered by courier or shipped overnight to NEA. Samples will be processed by experienced personnel at the laboratory and. prepared tissues, standard fillets or whole bodies, will be frozen until analyzed.

In the event that targeted numbers of fish samples cannot be obtained within the target coordinates at a location, the site will be extended if appropriate habitat types for the species are located adjacent to the sampling location. If a suitable location is not located adjacent to the target sample location, the site will be abandoned for that sampling event. Generally, if targeted species numbers cannot be collected from a site within a sampling day, appropriate alternate

species, if available, will be substituted, or the sampling for that species will be terminated. Location alterations will be done in consultation with USEPA or USEPA oversight personnel.

If fish QC samples fall outside the control limits and the problem is attributable to matrix interference, the samples will be reported and flagged appropriately by the laboratory. If a preparation or instrument problem that caused the failed QC is detected, the problem will be corrected and the tissue samples and QC will be re-extracted and/or re-analyzed.

B2.2.2 Sample Preservation Methods

Measurements will be made as soon as possible following collection, with calibrated instruments. Each fish will be weighed (to nearest 0.1 g) and total length (to nearest mm) will be measured and recorded. Fish will be processed according to the procedures in the Fish Sampling SOP (Appendix 21). Each sample will then be placed in clean aluminum foil (shiny side out); placed in a labeled plastic, zip-lock storage bag; and kept at a temperature below 4°C immediately following data processing. Samples will then be directed to the analytical facility where they will be prepared for analysis. Prepared fish samples will be kept frozen at a temperature below -18°C until analysis. The maximum holding time for frozen fish samples is one year (Table B-5).

B2.2.3 Decontamination Methods

Filleting knives and scalers that come in contact with river water or fish will be decontaminated by the laboratory prior to reuse according to the following procedures:

- wash with laboratory grade detergent and water;

- rinse with distilled water;
- rinse with acetone and allow to dry (contain rinsate for appropriate disposal);
- rinse with hexane and allow to dry (contain rinsate for appropriate disposal); and
- rinse with distilled water.

Other non-disposable equipment (scale, fillet board) will be covered with a clean piece of aluminum foil (shiny side down) prior to weighing or processing each fish.

Residual decontamination fluids will be stored in an appropriately designed storage container prior to off-site disposal in accordance with applicable regulations.

Disposable materials that come into contact with fish, such as personal protective equipment, will also be collected and stored prior to appropriate off-site disposal.

B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

B3.1 Field Activities Sample Custody

Appropriate COC procedures will be followed throughout the sampling program. These procedures include sample custody in the field and in the laboratory. COC records will be created when sample collection is completed. The COC record will include field logs (Figures B-1, B-3, and B-4a and b) as well as COC forms (Figures B-2 and B-5).

Sample containers needed for a specific sampling task will be relinquished by the Fish Program Coordinator or Water Program Coordinator (or designee) to the sampling team after

verifying the integrity of the containers and confirming that the proper containers have been assigned for the task to be conducted.

Each sample collected in the field will be clearly labeled with a unique sampling ID that will be logged on both the field log and the COC form. An example label is provided in Figure B-6. At a minimum, the sample label will contain:

- field sample identification number;
- sampling location (except for blind duplicates);
- date and time collected; and
- custodian's initials.

Immediately after sample collection, labeling, and logging, each sample container designated for analysis will be placed into an insulated cooler with ice or icepacks and appropriate packing materials for shipment to the laboratory. A temperature blank, consisting of a bottle filled with distilled water, will be included in each shipment for samples requiring temperature preservation. All sample coolers will be delivered to the analytical laboratory by either direct courier or 24-hour delivery courier (i.e., UPS) at the end of each day's sample collection and processing activities.

B3.2 Laboratory Receipt and Custody

Once samples are received at the laboratory, the field COC record is completed and signed by the individual Laboratory Sample Custodian. The Laboratory Sample Custodian will check the sample labels against the corresponding information listed on the field COC records and note any discrepancies. Additionally, the laboratory sample receipt personnel will note any damaged or missing sample containers. This information will be recorded on the field COC

record and/or in a separate logbook. The temperature of the bottle blank included in each cooler of samples will also be recorded at the time of sample receipt by the laboratory personnel. This temperature will also be recorded on the field COC record and/or in a separate logbook. Any discrepancies in sample identifications, sample analysis information, any indication that samples are missing upon receipt at the laboratory, or any indication that samples not received at the correct pH or temperature (4°± 2°C) will be communicated to the QA Program Manager and Field Sampling Manager within 24 hours of sample receipt so that appropriate corrective action can be determined and implemented.

After the sample receipt information is checked and recorded, sample analysis information will be entered into the individual Laboratory Information Management System (LIMS; or equivalent). Each sample will be provided a unique laboratory identification number and the analysis tests requested on the COC records entered into the LIMS. After the required information has been entered into the LIMS, the Laboratory Sample Custodian will initiate an internal laboratory COC. The internal COC will document the transfer of samples from the storage location to the analyst for analysis and subsequently through final disposition at the laboratory. At a minimum, the internal COC will include client identification, laboratory sample number, sample matrix, signatures for relinquishing and receiving samples or sample extracts, and reasons for the COC (procedure to be performed).

All completed field and laboratory COC records will be provided in the laboratory analysis data package as part of the required deliverable report.

Samples will be stored in secure, limited access areas in an environment that maintains any required temperature preservation noted in Table B-5. According to Table B-5, samples for most water analyses are required to be refrigerated at a temperature of 4° ± 2° C, fish samples at -18°C. The temperature of the refrigerators or freezers used to store samples will be monitored by the project laboratories according to their internal standard operating procedures. Samples

which do not require temperature preservation will be stored at room temperature. Disposal of unused raw sample volumes, sample extracts, and sample digestates will be in accordance with each laboratory's waste management procedures. Disposal of raw samples will occur after 14 days from the date the analysis report (full data package) was issued.

B3.3 Extract and Sample Archive Procedures

Sample extracts for PCB analysis and homogenized tissue from fish samples will be held (frozen at <-10ºC for extracts and <-18ºC for fish tissue) from each calendar year of the BMP until such time as USEPA has approved the calendar year Data Summary Report. USEPA will have the option of obtaining some or all of the archived samples extracts pursuant to the Remedial Design AOC.

B4 ANALYTICAL PROCEDURES

The BMP will involve analysis of water and fish samples for chemical and physical parameters. The justification and rationale for the selected analyses are presented in Section A7. Table B-6 lists the Method Detection Limit (MDL) and Reporting Limit (RL) for each analyte and method. Results will be reported to the MDL for each method with exception of the select nutrients (nitrate, nitrite, TKN, and total phosphorus), TSS, DOC, POC and percent lipids. Results reported between the MDL and RL will be flagged as estimates ("J" qualifier code) by the laboratories. Further details on reporting PCBs are presented in Section 4.1.2.2.

B4.1 Water Samples

Extraction and analysis techniques for PCBs in Hudson River water have been customized based on whether sampling stations require lower detection limit methods. The procedures to be employed are modifications to existing USEPA methods to improve sensitivity and/or to take advantage of current extraction technology. Brief descriptions of the extraction and analytical methods for routine (1 L) and large volume (8 L) samples are described below.

B4.1.1 Extraction Method: USEPA Method 3535 – Solid Phase Extraction

Routine 1 L water samples (Appendix 6):

Hudson River water column samples that are 1 L in volume will be extracted by utilizing SW846 Method 3535, which is a solid phase extraction technique. The water sample will be extracted using styrene divinylbenzene extraction disks. A Horizon Technology SPE-DEX® 4790 automated extraction system will be employed to automatically pre-clean and activate the SPE disk, extract the water sample, and elute the PCBs from the disk into a collection vessel for further processing. The extract will undergo solvent exchange and clean-up procedures prior to analysis.

Large volume water samples (Appendix 7):

For Hudson River sampling sites that require lower detection limits a larger volume (8 L) of water will be collected to achieve a 1 ng/l detection limit. The extraction employed will be SW846 Method 3535 (solid phase extraction). The water sample will be

extracted using styrene divinylbenzene extraction disks. SW-846 Method 3535 (see Section 4.2) indicates that "solid-phases other than C_{18} may be employed, provided that adequate performance is demonstrated for the analytes of interest." NEA explored using C_{18} disks and found inconsistencies in their extraction performance. The styrene divinylbenzene disks were found to perform better and consistently produce more reliable results. A Horizon Technology SPE-DEX® 4790 automated extraction system will be employed to automatically pre-clean and activate the SPE disk, extract the water sample, and elute the PCBs from the disk into a collection vessel for further processing. The automated system has the capability to extract multi-liter samples. The extract will undergo solvent exchange and clean-up procedures prior to analysis.

B4.1.2 Determinative Method: USEPA GLNPO Green Bay Mass Balance Method

Analysis method for routine 1 L water samples:

A congener-specific method will be employed to quantify PCB totals in routine 1 L water samples. This method follows guidelines established in the following methods (USEPA 1987; 1994):

"Quality Assurance Plan Green Bay Mass Balance Study I. PCBs and Dieldrin, USEPA Great Lakes National Program Office, Final Draft, December 11, 1987."

"Standard Operating Procedure for the Gas Chromatographic Analysis of Hydrophobic Organic Contaminant Extracts from Great Lakes Water Samples USEPA GLNPO Organics: SOP-10, June 1, 1994."

This method is in current use for the GE weekly water-column monitoring program.

Analysis method for large volume water samples:

A congener-specific method will be employed to quantify PCB totals in the large volume water samples. The method to be employed is the same as above for the routine 1L water samples with several modifications to increase detection sensitivity. To achieve lower detection sensitivity the GC/ECD system has been optimized to be able to calibrate 10 times lower than the current established method. The enhanced sensitivity will not impact the ability to achieve comparable results between the low and normal detection limit methods.

NEA will analyze 1-L water samples for TSS following the standard USEPA protocol for the analysis of suspended sediment (Appendix 18 – SOP for the Determination of Suspended Solids by USEPA Method 160.2) with the following modifications to be consistent with ASTM D 3977-97 Standard Test Methods for Determining Sediment Concentration in Water Samples, Test Method B – Filtration.

- The entire sample volume will be used for analysis. The water meniscus will be marked on the sample bottle prior to pouring the sample into the filtration apparatus.
- While applying suction to the filter, flush the inside of the sample container with DI water and transfer the water to the filtration apparatus. Rinse sufficiently to ensure solids inside the

bottle are transferred to the filtration apparatus. After the sample bottle is flushed, fill the bottle with water to the meniscus mark and record the sample volume using a graduated cylinder.

- As filtering proceeds, the filtrate will be inspected. If it is turbid, pour the filtrate back through the filter a second and possibly a third time. If the filtrate is still turbid, the filter may be leaking. In this case, substitute a new filter and repeat the process. If the filtrate is transparent but discolored, a natural dye is present; refiltration is not necessary.
- Dry the filter at 103 to 105ºC overnight. After the filter is desiccated, the filter will be weighed to the nearest 0.1mg (0.0001g).
- Results will be reported in units of mg/L to three significant figures.

Particulate organic carbon is separated from DOC by centrifugation. The solids resulting from centrifugation are analyzed for POC and the supernatant for DOC. Water samples will be analyzed for select nutrients following the SOPs in Appendix 10 through 13. Nitrate will be analyzed by USEPA Method 353.3, nitrite by USEPA Method 354.1, TKN by USEPA Method 351.3, and total phosphorous by USEPA Method 365.2. TAL metals will be analyzed following the SOPs in Appendix 14 through 17. TAL metals will be analyzed by USEPA Method 200.8, with the exception of Hg, which will be analyzed by USEPA Method 245.1 and SW846 7470A/7471A. Dioxins and furans will be analyzed using USEPA Method 1613B (Appendix 20).

B4.1.2.1 Validation of Green Bay Method

Given that the procedures for extraction and analysis of water samples to be employed for the BMP are modifications to existing USEPA methods, the level of validation necessary must only be sufficient to demonstrate the applicability of the method to the intended use. The validation of the methods will include the following:

- Method modification development – the modifications to the existing methods will be determined and experimental operating conditions refined to meet the intended objective.
- Preparation of SOPs – Extraction and/or analytical SOPs will be prepared to document the methods and provide the sample preparation and instrument quality control measures and acceptance criteria to be used to monitor the analysis.
- Spike Analysis of Target Compounds – Analysis of spike samples that include the target compounds of interest will be performed to demonstrate the performance and utility of the method through acceptable compound recovery and precision.
- Method Detection Limit (MDL) Study – The sensitivity of the methods will be documented through a Method Detection Limit Study performed in accordance with 40 CFR Part 136, Appendix 9.
- Upon completion of method validation by the laboratory, GE will prepare a blind spike performance evaluation (PE) sample for the candidate laboratory to analyze to provide an independent verification of the Green Bay method validation. The PE will be specified by GE and contain specific congeners representative of those typically encountered in a Hudson River environmental sample. The laboratory will sum the individual congener results on a homolog and total basis. An assessment of individual congener performance will be completed; however, validation of the method will be based on a comparison to the blind spike known homolog and total PCB values.

The results of the validation study for the Low-level Green Bay Congener Method including precision and accuracy results for the Spike Analysis of Target Compounds and MDLs as well as the results of the initial PE study were delivered to USEPA under separate cover (via Federal Express and electronic mail on 11/1/03, 11/11/03, and 12/10/03).

In addition to the initial PE study, GE also prepared additional PE samples for the candidate laboratory for both the 1-L and 8-L Green Bay Methods at concentrations near the RL. The PEs contain the same specific congeners representative of those typically encountered in a Hudson River environmental sample as the initial PE. The laboratory will sum the individual congener results on a homolog and total basis. As performed in the initial PE study, an assessment of individual congener performance will be completed; however, validation of the method will be based on a comparison to the blind spike known homolog and total PCB values. Results of these additional PE studies were delivered to USEPA via email on March 19, 2004.

B4.1.2.2 Method Reporting Limits and Reporting for Total PCBs

The MDL study conducted as part of the Low-level Green Bay Method validation study discussed above resulted in an MDL of 9.34 ng/L and 1.06 ng/L for the for the 1L and 8L sample sizes, respectively. The Reporting Limit (RL) is a value greater than the MDL where the result can be quantitatively determined. Currently, standard USEPA convention is to report values less than the RL but greater than the MDL as estimated values (a "J" qualifier code). The RL for the Low-level Green Bay Method is set to an aqueous sample concentration equivalent of the low calibration standard. The low calibration standard for this method consists of a 6.25 ng/mL standard and includes 22 peaks from the 12.5 ng/mL calibration standard that were diluted out of the 6.25 ng/mL standard and could not be used due to linearity issues. This results in a 6.36 ng/mL total PCB concentration for the low calibration standard which equates to an RL of 32.3 ng/L for the 1L Method (based on a 5 mL final extract volume) and an RL of 4.00 ng/L for the 8L Method (based on a 5 mL final extract volume).

After the initial year of data collection for the BMP water program, an evaluation will be conducted to determine Total PCB MDLs and RLs based on the congeners detected in the Hudson River. This evaluation will consist of determining the peaks/congeners that are most

frequently detected in the Hudson River and computing the Total PCB MDLs and RLs for the 1L and 8L method based on this set of peaks/congeners. This will be pursued in the off season during the winter of 2004/2005. A summary of this evaluation and any proposed changes to the Total PCB MDLs and RLs will be presented to USEPA prior to the 2005 sample collection.

The calculated PCB concentration for each PCB congener peak will be compared to its respective MDL and RL (adjusted for sample-specific weights/volumes and dilution factors). The results for PCB congener peaks with concentrations at or above the MDL but below the RL will be reported as detects and flagged as estimated ("J"). The results for PCB congener peaks with concentrations at or above the RL would be reported as unqualified numeric values. The total PCB concentration will then be calculated and reported as follows:

1) All PCB congener peak results above their respective MDL (both "J" flagged and unqualified results) will be summed and compared to the sample-specific total PCB MDL and RL (adjusted for sample-specific weights/volumes and dilution factors).
2) If no PCB congener peaks are detected above their respective MDL, the total PCB results will be reported as not detected at or above the sample-specific total PCB MDL.
3) If the sum of the PCB congener peaks from #1 above is below the sample-specific total PCB MDL the result would be reported as less than ("<") the sample-specific total PCB MDL.
4) If the sum of the PCB congener peaks from #1 above is at or above the sample-specific total PCB MDL but below the sample-specific total PCB RL, the summed result will be flagged as estimated ("J").
5) If the sum of the PCB congener peaks from #1 above is at or above the sample-specific total PCB RL, the total PCB result will be reported as the unqualified numeric value.

B4.1.2.3 Correction Factors

In order to achieve a more accurate quantification for NEA's Green Bay analysis DB-1 peak 5, congeners BZ#4 and BZ#10 that co-elute in this peak would have to be baseline separated and measured individually. PCB congener co-elution is not a problem only seen in the Green Bay method, but exists for all congener-specific based methods. Correction factors are applied by NEA to more accurately report the concentrations for BZ#4 and BZ#10 in DB-1 peak 5; BZ#5 and BZ#8 in DB-1 peak 8; and BZ#15 and BZ#18 in DB-1 peak 14. The correction factors for DB-1 peaks 5, 8, and 14 applied to data are listed in BMP QAPP Appendix 9 - SOP NE 207_02; Section 12.4. Please refer to the report "Development of Corrections for Analytical Biases in the 1991-1997 GE Hudson River PCB Database, May 1997, prepared by HydroQual for General Electric Company" for a more in-depth explanation of correction ratios applied to DB-1 peaks 5, 8, 14. The correction factors used to correct DB-1 peaks 5, 8, and 14 for Hudson River water samples analyzed prior to the BMP by the Green Bay Method were 0.65, 0.45, and 1.44, respectively. GE confirmed and updated the correction factors for DB-1 peaks 5, 8, and 14 in a manner consistent with the approach described in the above report. The results of the evaluation of the correction factors for DB-1 peaks, 5, 8, and 14 were delivered to USEPA via email on March 31, 2004 in a technical memorandum. Based on the findings summarized in the technical memorandum, upon initiation of the BMP, the correction factors developed based on the 2003 data set (0.61, 0.36, and 1.26) will be used to adjust DB-1 peaks 5, 8, and 14, respectively, for the bias identified in HydroQual 1997.

B4.2 Chemical Analysis of Fish Samples

The measurement of total PCB concentrations in fish is critical to the BMP. All fish samples will be analyzed for total PCBs according to a modification of the USEPA Method 8082 Aroclor Sum Method (NEA SOP 148, Revision 4; Appendix 25). An acceptable fish tissue

Hudson Reference Material (HRM) will be run at the rate of one per sample group of up to 50 samples that will be analyzed for Aroclor PCBs by modified Method 8082. Should this HRM material be made available and deemed a suitable substitute for the MS/MSD samples, it will replace these samples and be run at a rate of one per sample batch of 20. The Green Bay Congener Method (NEA SOP 133, Revision 1; Appendix 26) will be performed on 10% of the total number of fish samples. No validation of the Green Bay Congener Method will be required prior to sample analysis for fish tissue samples.

Mercury, dioxins and furans, and organochlorine pesticides will be analyzed one time during the BMP on 10% of the total number of adult fish samples collected. Fish samples will be analyzed for mercury according to USEPA Method 7471A (SOP, Appendix 16), for dioxins and furans according to USEPA Method 1613B (SOP, Appendix 20), and for organochlorine pesticides according to USEPA Method 8081A (SOP, Appendix 27).

Prior to analysis, fish tissue, either whole body or fillet, will be homogenized following the methods outlined NEA SOP 132 (Appendix 22). Extraction and clean-up of fish tissue will be accomplished via NEA SOP 17, Revision 3 (Appendix 23).

B4.3 Physical Analyses of Fish Samples

As lipid measurements are essential to the interpretation of spatial and temporal trends, all fish samples will be analyzed to determine the lipid contents according to the methods outlined in NEA SOP 158, Revision 3 (Appendix 24). Additionally, as fish size may also be important to the interpretation of trends, the total length and weight of the collected fish will be recorded in the field as described in the New York State General Fish Collection and Handling Procedures (Appendix 21).

B5 QUALITY CONTROL REQUIREMENTS

B5.1 Field QA/QC Samples

QA/QC samples will be collected in the field to allow evaluation of data quality. Field QA/QC samples for water column samples include equipment blanks, blind duplicates, and matrix spikes. Fish sampling does not facilitate the use of field QA/QC samples (e.g., duplicates) as part of the study design; all QA/QC samples for the fish sampling program will be generated in the laboratory (Section B5.2). The types and frequency of field QA/QC samples to be collected for each parameter are described below.

B5.1.1 Equipment Blanks

The purpose of analyzing equipment blanks is to demonstrate that sampling procedures do not result in contamination of the environmental samples and to evaluate the effectiveness of the decontamination of field equipment. Equipment blanks will be collected at the rate of 5% of the total number of environmental samples or one per sample batch of up to 20 samples. Equipment blanks will not be collected for fish tissue samples. An equipment blank for water sampling will be collected using a representative clean, individual sample container used for sub-sample collection in accordance with the water column sample collection SOP. A volume of reagent water will be obtained in the composite container equal to the Hudson River water samples to represent the entire sample collection process. If compounds/analytes of interest are detected at levels greater than the reporting limit for the parameter the sampling crew should be notified so that the source of contamination can be identified (if possible) and corrective measures taken prior to the next sampling event. If the concentration in the associated samples is less than five times the value in the equipment blank, the results for the environmental samples may be affected by contamination and should be qualified (see Section D).

B5.1.2 Field Duplicates

The purpose of analyzing field duplicates is to demonstrate the precision of sampling and analytical processes. Sample duplicates for water will be collected in the field and submitted to the analytical laboratory "blind" without any indication of the actual sample location. Because it is impossible to collect field duplicates for fish samples, duplicates for fish will be generated in the laboratory by splitting the homogenate. Duplicates will be prepared at the rate of 5% of the total number of environmental samples or one per sample batch of up to 20 samples. When the detected concentrations are greater than five-times the sample-specific RLs, the RPD of the two measurements on the sample is calculated by the following equation:

$$RPD = \frac{|D1 - D2|}{(D1 + D2)/2} \times 100\%$$

Where: DUP1 = the greater of the measured values
DUP2 = the lesser of the measured values

When at least one result is less than or equal to five-times the sample-specific RL, the absolute difference between the two measurements on the sample is calculated by the following equation:

$$Difference = D1 - D2$$

Where: D1 = the greater of the measured values
D2 = the lesser of the measured values

Note: One half the RL is used in the calculation if the analyte is "not-detected."

Percent recovery and precision criteria are listed in the DQO Tables B-7a – B-7k. If the RPD of field duplicate results is greater than the QC acceptance criteria the environmental results

for the field duplicate pair will be qualified as estimated. The Field Sampling Manager should be notified so that the source of sampling variability can be identified (if possible) and corrective action taken.

B5.1.3 Matrix Spikes/Matrix Spike Duplicates

The purpose of analyzing matrix spikes (MS) and matrix spike duplicates (MSDs) is to assess analytical accuracy and recovery of analytes of interest in a particular sample matrix. Laboratory duplicates (LDs) are typically substituted for MSDs for inorganic and wet chemistry analysis. Either MSDs or LDs will be performed on fish samples, but not both.

MSs/MSDs/LDs will be analyzed at the rate of one pair per sample batch (up to 20 samples) for fish samples. The water program will include analysis of MS samples at a rate of one per sample batch (up to 20 samples) and analysis of MSDs at a rate of one per month. Each MS will consist of an aliquot of laboratory-fortified environmental sample. Preferably, a sample of low level concentration should be used so that the spike level is of sufficient concentration over the background level of the chosen sample. The MS samples are extracted and analyzed following procedures used for actual sample analysis.

The percent recovery of the MS/MSD is calculated by the following equation:

$$\%REC = (A-B)/T \times 100\%$$

Where: A = concentration of analyte in the spike sample aliquot

B = background concentration of compound or analyte in the unspiked sample aliquot

T = known true value of the spike concentration

Matrix spike recovery information is used to assess the long-term accuracy of a method. Percent recovery and precision criteria are listed in the Measurement Performance Criteria Tables B-7a – B-7k. If the percent recovery of the MS is outside the limits, all calculations should be checked and the data should be qualified (see Section D).

B5.1.4 Hudson Reference Material

If an acceptable HRM is available upon initiation of the BMP fish program, in addition to matrix spikes for fish, it will be analyzed at the rate of one per sample batch of up to 50 samples. HRM samples would be used as an accuracy performance measure for samples to be analyzed for Aroclors by SW-846 8082 (Appendix 25).

B5.2 Laboratory QA/QC Procedures

QA/QC samples prepared in the laboratory include method blanks, laboratory control spikes, and temperature blanks.

B5.2.1 Method Blanks

The purpose of analyzing method blanks is to demonstrate that the analytical procedures do not result in sample contamination from the laboratory solvents, reagents, or glassware used in processing the samples. Method blanks will be prepared and analyzed by the contract laboratory at a rate of at least one per analytical batch. Method blanks for water will consist of laboratory-prepared blank water processed along with the batch of environmental samples including all manipulations performed on actual samples. Method blanks for fish consist of

sodium sulfate processed along with the batch of environmental samples including all manipulations performed on actual samples. The method blank should be placed at the beginning of the analytical sequence, i.e., analyzed before the associated environmental samples. If the result for a single method blank is greater than the reporting limit the source of contamination should be corrected, and the associated samples should be reanalyzed. If reanalysis is not possible, the laboratory should flag the associated data and note the deviation in the case narrative.

B5.2.2 Laboratory Control Spikes

The purpose of analyzing laboratory control samples is to demonstrate the accuracy of the analytical method. LCSs will be analyzed at the rate of one per sample batch (up to 20 samples). LCSs consist of laboratory-fortified method blanks. The accuracy criteria are listed in the Measurement Performance Criteria Tables B-7a – B-7k. If the recovery is outside this range, the analytical process is not being performed adequately for that analyte. The sample batch must be re-processed and the LCS reanalyzed. If reanalysis is not possible, the associated sample results should be quantified as low or high biased. The percent recovery of the LCS is calculated by the equation shown above for MS samples.

B5.2.3 Temperature Blanks

The purpose of preparing temperature blanks and sending the temperature blanks in the sample coolers on location is to enable the laboratory to monitor the temperature of the coolers (and samples) upon receipt at the laboratory. A temperature blank will be provided in each cooler sent from the laboratory to the field.

Instrument level QC performed by the laboratory and the frequencies for these measures are presented in the applicable laboratory SOPs included as Appendices.

B6 EQUIPMENT/INSTRUMENTATION TESTING, INSPECTION, AND MAINTENANCE

B6.1 Field Equipment

Equipment failure will be minimized by inspecting all field equipment to assure that it is operational and by performing appropriate preventive maintenance activities. Field sampling equipment and associated support equipment will be inspected prior to collecting each sample and any necessary repairs will be made prior to decontaminating and reusing the equipment. Routine daily maintenance procedures of field equipment to be conducted in the field will include:

- removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems;
- storage of equipment away from the elements;
- inspections of sampling equipment and measurement systems, before mobilizing to the field, for possible problems (e.g., damage or weak batteries);
- check instrument calibrations as described in Section B7 of the QAPP; and
- charging battery packs for equipment when not in use.

Field equipment maintenance will be documented in the applicable field logs. Specific equipment that will be inspected/tested includes:

- the multiple aliquot depth integrating water samplers and winches;
- probe and data logger for measuring WQ parameters including temperature, specific-conductivity, pH, turbidity, and DO;
- sampling vessels used during fish sampling activities;
- electrofishing equipment;
- nets used during fish sampling activities;
- scale for weighing fish; and
- the Global Positioning System (GPS) on each sampling vessel.

All field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be transported to the field to minimize downtime. These items include, but are not limited to, the following:

- appropriately-sized batteries;
- extra sample containers;
- extra sample coolers, packing material, and ice;
- sufficient supply of decontamination solvents (acetone and hexane);
- distilled water;
- additional supply of health and safety equipment (e.g., gloves); and
- additional equipment, as necessary, for the field tasks.

B6.2 Laboratory Instrumentation

The primary goals of the project laboratory's preventative maintenance programs will be to prevent instrument and equipment failure as much as possible and to minimize instrument down time when failure occurs. The laboratory(ies) will maintain a complete inventory of

replacement parts needed for preventive maintenance and spare parts that routinely need replacement (septa, gauges, sources, detectors, etc.). Implementation and documentation of the preventative maintenance program will be primarily the responsibility of the technical group using the instrumentation according to the individual laboratory preventative maintenance policies in their respective Laboratory Quality Manual. If an instrument fails, the problem will be diagnosed as quickly as possible, and either replacement parts will be ordered or a service call will be placed to the manufacturer. If instrument failure impedes sample analysis, the QA Program Manger will be notified promptly so that appropriate corrective action and sample capacity management can occur. All preventative maintenance and maintenance performed as corrective action will be documented by the group leader, analyst, or contracted service representative who performed the procedure and the documentation will be maintained at the individual laboratory.

B7 CALIBRATION PROCEDURES AND FREQUENCY

B7.1 Field Instruments and Calibration

It is expected that field instruments will include, but may not be limited to GPS on sampling vessels, a probe and data logger for measuring water quality parameters, and scales for weighing fish.

To ensure that field measurements completed during field data collection have been collected with properly calibrated instruments, field personnel will follow the procedures described by the manufacturer's recommendation and as described below.

In general, field instruments will be calibrated prior to use and the instrument calibration checked after the final use on each day. Personnel performing instrument calibrations shall be trained in its proper operation and calibration. The GPS on each sampling vessel will have a daily check on a point with known coordinates. Equipment will be maintained and repaired in accordance with manufacturer's specifications (Section B6). In addition, prior to use, each major piece of equipment will be cleaned, decontaminated, checked for damage, and repaired, if needed. Field calibration activities will be noted in a field log notebook that will include, at a minimum, the following:

- entries to the instrument logbooks shall be made at least once daily whenever the instrument is in use;
- calibration records shall include:
  - calibrator's name;
  - instrument name/model;
  - date/time of calibration;
  - standard(s) used and source;
  - temperature (if it influences the measurement);
  - results of calibration (raw data and summary); and
  - corrective actions taken.

B7.2 Laboratory Analytical Instrumentation and Calibrations

Calibration of laboratory analytical instrumentation is required for the generation of appropriate data to meet project data quality objectives. Detailed calibration procedures, calibration frequency and acceptance criteria are specified in the analytical method SOPs included as Appendices to this QAPP. Each laboratory contracted for this project will be responsible for the proper calibration and maintenance of laboratory analytical equipment.

Calibration activities performed will be documented in the analytical data package (see Section A9) and will be available for review during internal and external laboratory audits.

Reference standards used will "bracket" the expected concentration of the samples. At a minimum, this generally will require the use of three to five different standard concentration levels that are used to demonstrate the instrument's linear range in quantitation. Calibration of an instrument must be performed prior to the analysis of any sample and then at periodic intervals (continuing calibration) during the sample analyses to verify that the instrument is still calibrated. Sample concentrations are often outside the instruments linear range and, therefore, need to be diluted and reanalyzed. The analytical SOPs also provide the calibration acceptance criteria and corrective actions to be employed if the acceptance criteria are not met (i.e., recalibration).

B7.2.1 Standards and Standards Records

Standards used by laboratories are described in the laboratory analytical methods. Laboratory standards will not be used if there are indications of physical deterioration (such as discoloration), or if the shelf life of the standard (as established by the manufacturer) is exceeded. Appropriate records of laboratory standards will be maintained in the laboratory, including the following:

- name and source;
- date received;
- lot number or manufacturer's tracking number;
- stock and initial concentration calculations; and
- storage requirements and storage location.

B8 INSPECTION/ACCEPTANCE REQUIREMENTS OF SUPPLIES AND CONSUMABLES

The Fish and Water Program Coordinators will be responsible for the ordering, inspection, and acceptance of all supplies and consumables used during field data collection.

Laboratory QA Managers are responsible for the overall documentation of inspection/acceptance activities for supplies and consumables in their lab. Each analyst verifying the quality of reagents/standards must be qualified to perform the associated instrumental analysis so that they can calibrate the instrument, use the data system to set up sequences, perform calculations, and interpret the data.

Records shall be maintained on reagent and standard preparation. These records shall indicate traceability to the purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer's initials. All containers of prepared reagents and standards must bear a unique identifier and expiration/reevaluation date and be linked to the aforementioned records. Labels that indicate the following information are to be used for reagents and standards:

- unique identifier (notebook reference indicating where the reagent preparation is documented);
- name of the material;
- concentration;
- date prepared;
- storage conditions; and
- expiration/reevaluation date.

B9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

Historical data sets will be used to supplement the data acquired under this project. These include:

- Water quality data (PCB levels and TSS) collected under GE's Hudson River Monitoring Program (HRMP) and the PCRDMP. This monitoring was performed in accordance with the requirements of a consent decree (Consent Decree 1990; 90-CV-575).
- Fish data collected through the NYSDEC Hudson River Biota Monitoring Program.

Sampling conducted under this project is designed to be consistent with these historical sampling activities to facilitate the spatial and temporal trend analyses of the DQOs (Section A7.1).

B10 DATA MANAGEMENT

The following subsections present an overview of the project information management system. This includes the field sample data collection process, the required specifications of the EDD, definitions of the EDD loading and evaluation phases, definitions of the electronic data verification process, and the storage, review, and retrieval of analytical data.

All data used for analysis, presentation, and reporting on the project are stored in a central electronic database. Specialized application modules, outlined below, are used for automated data collection, data evaluation, and data integration:

- **Field Sample Data Collection System** – Software that automates collection of field data has been developed. The system captures, manages, and maintains field data information including electronic COC creation, sample ID creation, and bottle label creation.
- **Laboratory Data Checker –** Custom computer code has been written to automate checking of the electronic deliverables. EDDs submitted to the data management system will automatically be checked to ensure data reliability by checking them against several criteria including valid values, data types, and format. A more detailed list of checks is provided in Section B10.2.1.1.
- **Data Verification Module –** Custom computer code has been written to facilitate the data evaluation process. An automated data verification module (DVM) will verify analytical data submitted by the laboratory, will review the data against the performance specifications provided for the project, will evaluate data, will produce exception reports, and will load qualified results to the permanent database.

B10.1 Purpose/Background

The information management system production will occur in the following sequence. Figure B-7 illustrates the data flow process. All field-generated data will be entered into a field database via custom-designed forms developed in Microsoft® Access®. This software will facilitate data entry and management of the collected field data for the project. These forms were developed primarily to limit the possibility of data entry/transcription errors. Valid value lists have been defined for each of the data fields thereby restricting possible entries made by the user. Additionally, several features have been programmed to occur automatically (e.g., field sample ID's are created based on the date and location of sample collection), further limiting the possibility of user error. Tables B-8 and B-9 present a summary of field information that will be recorded at the time of sample collection for water column and fish sampling, respectively.

The data entry forms discussed above will be uploaded to laptop computers that will be used by sampling personnel. As a precaution, sampling personnel will be required to print hard copy field logs at after sampling at each station is complete to limit the possibility of losing data due to power loss or computer failure. In case of inclement weather, when the use of a computer may not be possible, data collected in the field will be recorded on hard copy field logs (using waterproof paper) and later entered into the field database. After all necessary information has been entered into the field database, sample labels and COC reports are generated automatically.

At the end of each day of sampling, electronic field data will be uploaded to the file server. The file will be checked for valid values and required fields; field data will be uploaded to the data management system once analytical results are received.

Analytical laboratories will email EDDs in the 5-file format described in Appendix 37 for loading into the data management system. The EDDs will undergo checks to verify that the EDD adheres to structural requirements, and that the valid values used by the laboratory are in accordance with project standards, and that a check of 10% of each laboratory's electronic data loaded for the day compares with the hard copy without error. The automated data verification process and data validation will be performed as described in Section D of the QAPP. A manual review of the data and electronically-generated qualification flags will be performed. The resulting approved data will then be made available to the appropriate project team members for review and data analysis.

B10.2 Data Recording

As discussed above, the field sample data collection software will require data entry by the field teams. The software's data entry forms include valid value pick lists for the required fields to avoid incorrect data entry. In addition, several data fields will be populated

automatically by the program to further reduce entry/transcription errors. Figure B-8 shows the data entry form that will be used during water column sample collection; Figure B-9 shows the data entry form that will be used during fish sample collection.

Upon submittal of the files to the data management system, further checks occur by the system for valid values, population of required fields, and correct file formatting. If any errors are detected on any of the levels, the file will be corrected prior to loading into the data management system.

B10.2.1 Laboratory Data Checker Specifications

Laboratory EDDs will be automatically checked upon receipt against pre-specified criteria ensuring data reliability and consistency. A detailed list of checks is provided below:

1. File Format

- Number of fields specified for the file;
- field widths; and
- data types.

2. Valid Values

- Adherence to valid values as specified for the GE Hudson River Project (provided in Table B-10) for all fields where required.

3. Dates

- Field sample collection date (sample_date) is earlier than or equal to sent_to_lab_date;
- sample_date is earlier than analysis_date; and
- leachate_date and prep_date are earlier than analysis_date.

4. Required Tests

- Tests delivered in the analytical data match the tests requested in the field sample data deliverable.

5. Reportable Results

- Every analyte for a test (as specified by the method) performed on a sample must have exactly one reportable result; therefore, if five Aroclors are specified for a PCB method and it is run at a dilution, each of the five Aroclors may have only one reportable result chosen from the multiple runs.

6. U Qualifier

- There should be a U lab qualifier if and only if the result_value is null.

7. Parent Samples

- Samples requiring a parent sample (determined by sample_type_code) identify the sample that was the source of this sample.
- Identified parent sample exists in the database.

8. Column Number

- If any two column chromatography test results are reported, there must be corresponding one column test results present.

9. Orphans and Links

- Every field and lab sample is linked to test data.
- Every test has result data.
- Every result has batch data.
- Checks are made in reverse – batch data links to results, result data links to tests, and test data links to samples.

10. Duplicate Rows

- The combination of values in each primary key is unique within each file.
- The sample_delivery_group of an analytical deliverable does not already exist in the database.

11. Required Fields

- Fields designated as required in the EDD specification are populated.
- QC fields required, based on sample type and result type, are correctly populated; the tables below illustrate the checked requirements.

Required Fields by sample type (sample_type_code**) for result_type_code = TRG (target compounds)

Required Fields	Sample_type_code			
	MMS	**LLCS**	**LLR**	**FFD**
PARENT_SAMPLE_CODE	X		X	X
QC_ORIGINAL_CONC	X			
QC_SPIKE_ADDED	X	X		
QC_SPIKE_MEASURED	X	X		
QC_SPIKE_RECOVERY	X	X		
QC_DUP_ORIGINAL_CONC			X	
QC_DUP_SPIKE_ADDED			X	
QC_DUP_SPIKE_MEASURED			X	
QC_DUP_SPIKE_RECOVERY				
QC_RPD			X	X
QC_RPD_CL			X	X
QC_SPIKE_LCL	X	X	X	X
QC_SPIKE_UCL	X	X	X	X
QC_SPIKE_STATUS	X	X		
QC_DUP_SPIKE_STATUS				
QC_RPD_STATUS			X	X

Required fields by sample type (sample_type_code) for result_type_code = SUR (surrogate).

Required Fields	Sample_type_code			
	MS	**LCS**	**LR**	**FD**
PARENT_SAMPLE_CODE				
QC_ORIGINAL_CONC				

Required Fields	Sample_type_code			
	MS	**LCS**	**LR**	**FD**
QC_SPIKE_ADDED	X	X	X	X
QC_SPIKE_MEASURED	X	X	X	X
QC_SPIKE_RECOVERY	X	X	X	X
QC_DUP_ORIGINAL_CONC				
QC_DUP_SPIKE_ADDED				
QC_DUP_SPIKE_MEASURED				
QC_DUP_SPIKE_RECOVERY				
QC_RPD				
QC_RPD_CL				
QC_SPIKE_LCL	X	X	X	X
QC_SPIKE_UCL	X	X	X	X
QC_SPIKE_STATUS	X	X	X	X
QC_DUP_SPIKE_STATUS				
QC_RPD_STATUS				

**Note:

MS = matrix spike

LCS = laboratory control sample

LR = lab replicate

FD = field duplicate

If any of the above criteria are not met, the file will be returned to the data generator via email along with an error report detailing the errors to allow corrections.

B10.3 Data Validation

The data validation process is described in Section D2.1 of this QAPP.

B10.3.1 Automated Data Verification Process Overview

The automated DVM process is described in Section D2.2 of this QAPP.

B10.3.2 Required Fields for Automated Verification Process

The DVM process requires additional fields that are not required for EDD loading. These fields are conditionally required for various sample types and are indicated in the EDD in the summary table below:

EDD File	EDD Field	Required For	DVM
Sample	parent_sample_code	Spiked samples and duplicate/replicate samples	Ensures proper parent sample flagging
Field Sample	sample_date	All field samples	To determine times for hold samples
	sample_time	All field samples	To determine times for hold samples
	cooler_id	All field samples	To batch field samples
Test	sample_receipt_date	All field samples	To determine times for hold samples
	sample_receipt_time	All field samples	To determine times for hold samples
	prep_date	All samples that require prepping	To determine times for hold samples
	prep_time	All samples that require prepping	To determine times for hold samples

EDD File	EDD Field	Required For	DVM
	leachate_date	All leached samples	To determine times for hold samples
	leachate_time	All leached samples	To determine times for hold samples
Result	result_value	All samples that are not ND	Set usability flags
	result_unit	All applicable	Set usability flags
	detection_limit_unit	All applicable	Set usability flags
	qc_original_concentration	MS samples	Set usability flags
	qc_spike_added	MS samples, surrogate compounds, LCS samples	Set usability flags
	qc_spike_measured	MS samples, surrogate compounds, LCS samples	Set usability flags
	qc_spike_recovery	MS samples, surrogate compounds, LCS samples	Set usability flags
	qc_dup_original concentration	MSD samples, LR samples	Set usability flags
	qc_dup_spike_added	MSD samples	Set usability flags
	qc_dup_spike_measured	MSD samples, LR samples	Set usability flags
	qc_dup_spike_recovery	MSD samples, LCS duplicates, surrogate compounds	Set usability flags
	qc_rpd	All applicable	Set usability flags
	qc_spike_lcl	Spiked samples, spike duplicate samples, surrogate compounds, LCS samples	Set usability flags
	qc_spike_ucl	Spiked samples, spike duplicate samples, surrogate compounds, LCS samples	Set usability flags
	qc_rpd_cl	Duplicate samples	Set usability flags

B10.3.3 Control Limits for Automated Verification Process

In addition to the need for the correct population of fields, it is necessary to identify a list of control limits to be used when running DVM. The areas requiring limits for the GE Hudson River Project are as follows:

1) Upper and lower accuracy limits by fraction (fish and water) for:

- MS/MSD
- LCS

2) Reject limits by fraction (fish and water) for:

- MS/MSD
- LCS

3) RPD limits by fraction (fish and water) for:

- Field duplicate
- Laboratory replicate
- MSD

4) Upper and lower surrogate recovery limits for any method which requires surrogate analytes be analyzed

5) Order of flag severity

6) Holding times for all analytes for the following stages:

- from collection date to extraction date;
- from collection date to analysis date;
- from collection date to analysis preserved date; and
- from extraction date to analysis date.

B10.3.3.1 GE Hudson River Project QC Limits

WATER	ACCURACY						PRECISION
	MS			LCS			FD/LR
FRACTION	LOW	HIGH	REJECT	LOW	HIGH	REJECT	RPD
PCB CONGENERS	60	140	10	60	140	10	35
NUTRIENTS	LAB	LAB	LAB	LAB	LAB	LAB	20
METALS	70	130	30	85	115	30	20
MERCURY	75	125	30	80	120	30	20
TSS	70	130	30	LAB	LAB	LAB	20
POC/DOC	LAB	LAB	LAB	LAB	LAB	LAB	20
DIOXIN/FURAN	NA	NA	NA	LAB	LAB	LAB	20

FISH	ACCURACY						PRECISION
	MS/MSD			LCS			LR
FRACTION	LOW	HIGH	REJECT	LOW	HIGH	REJECT	RPD
PCB CONGENERS	70	130	10	70	130	10	40
PCB AROCLORS	70	130	10	LAB	LAB	LAB	40
DIOXIN/FURAN	NA	NA	NA	NA	NA	NA	40
PEST	LAB	LAB	LAB	70	130	30	40
MERCURY	75	125	30	70	130	30	40

MS = Matrix Spike
MSD = Matrix Spike Duplicate
FD = Field Duplicate
LR = Laboratory Replicate
LCS = Laboratory Control Sample
LAB = Laboratory Specified Limits

*See Appendix 35 for Dioxin/Furan LCS limits. Compounds with recoveries outside of acceptance limits (biased high or low) will result in the rejection of these compounds in the associated project samples.

B10.3.3.2 Flag Severity Order

1. U* (due to blank contamination)
2. UR (Non-Detection with Rejected Detection Limit), R (Rejected result)
3. J (estimated), UJ (Non-Detection with Estimated Detection Limit)
4. U (non-detect)
5. Unflagged

The flag severity is listed in decreasing order. Definitions of qualifier codes are provided in Section D2.1.2.

B10.3.4 Criteria for Automated Verification

The criteria for automated verification are as described in the QC limit tables above in Section B10.3.3.1, the data validation SOPs in this QAPP, and the evaluation process described in Section D.2.1.

The following evaluation procedures account for potential data evaluation out-of-criteria situations:

- Samples analyzed outside of holding time criteria will be qualified as estimated or rejected (in the event of gross exceedance).
- Samples with surrogate recoveries greater than or less than the project control limits as specified in the Analytical Method Tables will have all values greater than the sample reporting limit qualified as estimated.
- Samples with surrogate recoveries below the project control limits but greater than or equal to 10% will have all non-detected values qualified as estimated.
- Samples with surrogate recoveries below 10% will have non-detected results rejected.
- Samples for organic analysis with MS and/or MSD recoveries or RPDs outside of project control limits will have the specific out-of-criteria compound result(s) in the associated unspiked sample qualified. Qualification for matrix spike analyses follows the QC rules used for surrogates using the associated Reject QC Limit.
- The unspiked compounds detected in the MS, MSD, and field sample (for organic analysis) will be evaluated for Relative Standard Deviation (RSD). If the RSD exceeds 20% for aqueous samples or 40% for solid samples, the unspiked compounds in the field sample will be estimated.
- LCS samples with recoveries outside of criteria will have all samples in the same prep batch qualified following the same rules as for surrogates using the associated Reject QC Limit.
- Inorganic MS samples with recoveries outside of criteria will have all samples of the same matrix on the COC qualified following the same rules as for surrogates using the associated Reject QC Limit.
- Laboratory duplicates with inorganic analytes out of RPD criteria will have the analyte values greater than the sample reporting limit qualified as estimated in all similar matrix samples in the same lab prep batch on the COC using the associated Reject QC Limit.
- Field duplicate analytes with out-of-criteria RPDs will have the analyte values greater than the sample reporting limit estimated in only the field duplicate and its associated sample.

B10.4 Data Transformation

Data transformation is expected to consist of transferring test results from one unit to another unit of measure (e.g., ug/L to ng/L). This will be accomplished within the database so that transcription error does not occur. The number of significant figures will be that of the original value regardless of any data transformations so that results will not be rounded or truncated.

B10.5 Data Transmittal

The field and laboratory electronic data deliverables will be sent to the project information management system for processing via email. Once the files have been processed by the system, they are archived on the server to retain the original data files.

An electronic data export will be provided to the USEPA on a monthly basis, as defined in the RD AOC. The export will contain the most recent version of the data at the time of file creation. Additionally, a readme file documenting data additions and corrections will be provided with the database. Any changes to data in the database will therefore be present in the export provided to USEPA. Changes and/or updates to the project data will be documented by two methods. Data verification and validation changes will be detailed in the DVM and validation reports. Other significant changes to the database will be documented in corrective action memorandum as described in Section C1.3. Corrective action memoranda will be provided to USEPA and its designees.

B10.6 Data Reduction

Data reduction is addressed in Section D1.7.

B10.7 Data Analysis

Analysis of data generated during the BMP as well as historical data will be conducted to establish pre-construction conditions in the Hudson River. The primary conditions are: 1) PCB concentrations in the river water; 2) PCB mass load from the Upper Hudson River to the Lower Hudson River; and 3) PCB concentrations in fish. The use of sampling locations, methods, and analytical protocols that are consistent with the historical record allows for long-term spatial and temporal trend analysis.

B10.8 Data Tracking

The flow of data through the information management system includes loading, verification, and validation (if performed). The status of each sample will be recorded in the project database. Users will see the status as "loaded", "verified", "validated", or "final". A status of "final" indicates that all steps in the process are completed and the data is ready for analysis/reporting.

B10.9 Data Storage and Retrieval

The project database will be stored on a QEA's file server which is protected by a firewall. All electronic files are automatically backed-up to tape on a daily basis. Access to the

database is secure and will be limited to individuals approved to work on the project. Retrieval of the data will be accomplished through routine distribution of a customized data export that will be supplied to the appropriate project team members.

C ASSESSMENT AND OVERSIGHT

C1 ASSESSMENTS AND RESPONSE ACTIONS

System audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

C1.1 Field System Audits

C1.1.1 Internal Field System Audits

C1.1.1.1 Internal Field System Audit Responsibilities

Internal audits of field activities including sampling and field measurements will be conducted by the Field Sampling Manager. These audits will verify that established procedures are being followed.

C1.1.1.2 Internal Field System Audit Frequency

Internal field audits of water column and fish sampling activities will be conducted at the initiation of each sampling program and at least once per year thereafter to ensure that sampling crews employ procedures consistent with the SOPs and the QA provisions of this QAPP. The Field Sampling Manager may add additional internal field audits as deemed necessary based on routine observation of sample collection and processing activities.

C1.1.1.3 Internal Field System Audit Procedures

The internal field audit will include examination of field sampling records, field instrument operating records, sample collection, handling, processing, and packaging in compliance with the established procedures; maintenance of QA procedures; COC; etc. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the program. The audit will involve review of field measurement records, instrumentation calibration records, and sample documentation. The findings resulting from the internal audit will be summarized by the Field Sampling Manager and provided to the QA Program Manager so that necessary corrective action can be monitored from initiation to closure.

C1.1.2 External On-Site Field System Audits

C1.1.2.1 External On-Site Field System Responsibilities

Audits of the field sample collection procedures for fish and water sampling used during the course of the Baseline Monitoring Program will be conducted by Environmental Standards Field Project Auditors. The purpose of the audits is to document the quality of the field procedures and to verify that the field procedures as described in the QAPP and SOPs are being followed.

C1.1.2.2 External On-Site Field System Audit Frequency

The on-site audit frequency for water will be one (1) audit at the beginning and end of the field season. The external field audit frequency for fish sampling will be one audit per field

season as only 2 fish sampling events will occur (conducted ~4 weeks in spring and ~3 weeks in fall).

These initial audits will be conducted early in the program to ensure that corrective action can be initiated promptly if problems are encountered.

C1.1.2.3 External On-Site Field System Audit Procedures

Separate audits will be conducted for fish and water sampling and each audit is proposed to be a day in duration. The audits will include, at a minimum, an evaluation of field documentation records, decontamination procedures, sampling/field procedures, sample packaging and shipment procedures, COC procedures, quality assurance/quality control sample collection procedures, and adherence to health and safety/personal protective equipment procedures. The field audits will be conducted according to the SOP "Performance and Reporting of Field Audits" presented in Appendix 39. Specific elements of the on-site field operations audit to be performed by the Environmental Standards Project Field Auditor include the verification of:

- Completeness and accuracy of sample COC forms including documentation of times, dates, transaction descriptions and signatures.
- Completeness and accuracy of sample identification labels including notation of time, date, location, type of sample, person collecting sample, preservation method used, and type of testing required.
- Completeness and accuracy of field notebooks or records including documentation of times, dates, sampling method used, sampling locations, number of samples taken, name of person collecting samples, types of samples, and any problems encountered during sampling.

- Adherence to health and safety guidelines outlined in the Project Health and Safety Plan (HASP), including wearing of proper personal protective equipment (PPE).
- Adherence to decontamination procedures outlined in Sections B2.1.3 and B2.2.3 of this QAPP for water and fish sampling, respectively.
- Adherence to sample collection, preparation, preservation, and storage procedures.

The Environmental Standards Project Field Auditor will develop an audit checklist as described in the field audit SOP to aid in performing each evaluation. The field audit findings will be discussed with field personnel at the conclusion of the audit and subsequently summarized in an audit report. A copy of each audit report will be submitted to the USEPA Regional Project Manager, the GE Project Manager, and the QA Program Manager. The audit report will present major findings and recommended corrective actions necessary to resolve quality control deficiencies. The impact of the deficiency(ies) will be discussed if feasible.

C1.2 Laboratory Performance and System Audits

C1.2.1 Performance Audits

On annual basis, GE will prepare PE samples to be submitted to the candidate laboratory for both the 1-liter and 8-liter Green Bay Methods. The PE samples will contain the same 64 congeners contained in the PE samples used in the independent verification of the Green Bay Method validation (refer to Section B4.1.2.1) at concentrations near the current LCS spike levels of 198 ng/L and 6 ng/L for the 1-liter and 8-liter Green Bay Methods, respectively. The 64 congeners are representative of those typically encountered in a Hudson River environmental sample. The laboratory will sum the individual congener results on a homolog and total basis. An evaluation of the method performance will be made based acceptance limits of 70-130% for the homolog and total PCB results as compared to the known values.

C1.2.2 Internal Laboratory System Audits

Each individual Laboratory QA Manager performing analytical testing services for this project will perform periodic internal systems audits to evaluate laboratory operations and quality control procedures in accordance with their individual Laboratory Quality Control Manual. These audits are intended to serve two purposes: 1) to ensure that the laboratories are complying with the procedures defined in laboratory manuals and contracts; and 2) to determine any sample flow or analytical problems. Internal audits performed by the participating laboratories will be conducted when GE sample analyses are being performed to facilitate review of associated QA/QC issues by the QA Program Manager. NEA will be required to conduct one internal system audit at the beginning of the program since a new extraction/analytical method will be used. Thereafter, internal system audits will be conducted at a frequency consistent with the laboratory's quality management plan.

C1.2.3 External Laboratory System Audits

C1.2.3.1 External Laboratory System Audit Responsibilities

An audit of the laboratory procedures used during the course of the BMP will be conducted by Data Validators under direction of the QA Program Manager.

C1.2.3.2 External Laboratory System Audit Frequency

One external audit of the laboratory procedures used by NEA (providing PCB, TSS, organic carbon and organochlorine pesticide analyses), St. Peter's Bender Laboratory (providing nutrient analyses) and STL-Pittsburgh (providing TAL metals analysis) will be conducted per

yearly field season. Additional lab audits are not necessary, as the verification and validation programs will provide additional indications of the laboratory performance. The laboratory providing dioxin/furan analysis will not be independently audited due to the small numbers of samples to be analyzed for these parameters. The audits will be conducted at a time period when actual sample analyses are being conducted. Additionally, the audits will be performed early in the program to ensure that corrective action can be initiated promptly if problems are encountered. Future audits may be performed if deemed necessary by the QA Program Manager in consultation with the GE Project Manager.

C1.2.3.3 External Laboratory System Audit Procedures

Environmental Standards project personnel will initiate frequent communications with the project laboratories to discuss and address real-time corrective action of QA/QC issues (if any) encountered by the laboratories. Additionally, Environmental Standards will provide routine feedback to the laboratories resulting from data verification and validation efforts. The purpose of the external laboratory audits will be to document the quality of the laboratory analysis procedures and verify that the procedures described in the QAPP and SOPs are being followed. The audits will be conducted according to the procedures described in "Performance and Reporting of Analytical Laboratory Audits" presented in Appendix 40. The following general areas will be evaluated during the laboratory audits to be performed by Environmental Standards project personnel:

- organization and personnel;
- sample receipt and storage area;
- sample preparation area;
- sample analysis instrumentation;
- documentation;

- quality control manual and project-specific SOPs; and
- data handling.

C1.3 Corrective Action

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or poor QC performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. All corrective action proposed and implemented will be documented in the regular quality assurance reports to management (Section C2). Corrective action will only be implemented after approval by the GE Project Manager or his designee. If immediate corrective action is required, approvals secured by telephone from the GE Project Manager should be documented in a memorandum. Written corrective action will be documented using a format equivalent to the example provided in Figure C-1.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the GE Project Manager, who in turn will notify the USEPA Project Coordinator. If the problem is analytical in nature, information on the problem will be promptly communicated to the USEPA Program Manager. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established QC procedures in the QAPP will be identified and corrected in accordance with the QAPP. The Project Manager, or his designee, will issue a nonconformance report for each nonconformance condition.

C1.3.1 Field Corrective Action

Corrective action in the field may be initiated when the sample network or rationale is changed (i.e., more/fewer samples, sampling locations other than those specified in the QAPP), or when sampling procedures and/or field analytical procedures require modification, etc., due to unexpected conditions. In general, the field team (GE Project Manager, Project Manager, QA Program Manager, Field Sampling Manager, Program Coordinator(s), or sampling technicians) may identify the need for corrective action. The field staff, in consultation with the Project Manager and GE Project Manager, will recommend a corrective action. The GE Project Manager will approve the corrective measure that will be implemented by the field team. It will be the responsibility of the Field Sampling Manager to ensure the corrective action has been implemented.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The QA Program Manager will identify deficiencies and recommended corrective action to GE Project Manager and Project Manager. The Field Sampling Manager and field team will perform implementation of corrective actions. Corrective action will be documented in quality assurance reports to the entire project management team.

C1.3.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during, and after initial analyses. Each laboratory's corrective action procedures are provided in the analytical SOPs provided in Appendices 6 to 27. The submitted SOPs specify the majority of the conditions during or after analysis that automatically trigger corrective action or optional procedures.

These conditions may include dilution of samples, additional sample extract cleanup, or automatic reinjection/reanalysis when certain QC criteria are not met. Furthermore, a number of conditions, such as broken sample containers, multiple phases, low/high pH readings, and potentially high concentration samples, may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts, it may be necessary for the laboratory QA Officer to approve the implementation of corrective action.

A member of the laboratory technical staff will identify the need for corrective action. The laboratory QA Officer, in consultation with members of the technical staff, will approve the required corrective action to be implemented by designated members of the laboratory technical staff. The laboratory QA Officer will also ensure implementation and documentation of the corrective action. If the nonconformance causes project objectives not to be achieved, it will be necessary to inform the QA Program Manager who must concur with the corrective action.

Corrective actions that are performed prior to release of the data from the laboratory will be documented in a laboratory corrective action log and in the narrative data report sent from the laboratory to the QA Program Manager. If corrective action does not rectify the situation, the laboratory will contact the QA Program Manager prior to release of the data.

C1.3.3 Corrective Action During Data Validation and Data Assessment

The need for corrective action may be identified during the data verification, data validation, or data assessment process. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory.

As previously stated in Section A7.3.5, the percent completeness will be used to determine whether the data quality meets the objectives for the project. If the completeness

objectives are not met for individual parameters, the QA Program Manager will review the reasons for the invalid data with the GE Project Manager. Depending on the ability to mobilize the field team, the reasons for the incomplete data (e.g., holding time exceeded), and the effect of the incomplete data on the accomplishment of the project objectives, additional samples may be collected and analyzed. An evaluation will also be conducted if a sample does not generate data for a parameter category (e.g., PCB congeners, TSS). Such a data gap could result from sample container breakage or sample loss during analysis. If GE determines that the missing results are critical to accomplishing the work plan objectives, additional sampling will be conducted to obtain the missing data. The GE Project Manager and Project Manager will be responsible for approving the implementation of corrective action, including resampling, during data assessment. The QA Program Manager will document all corrective actions of this type.

C2 REPORTS TO MANAGEMENT

GE will provide monthly progress reports that will be delivered to USEPA by the 15th day of every month. These reports will: (1) include the results of all sampling, tests, and other verified or validated data received or generated during the previous month in the implementation of the BMP; (2) describe all actions, data and plans which are scheduled for the next two months; and (3) include information regarding all problems encountered or anticipated that may affect completion of the work, and a description of all efforts made to resolve those problems.

GE will provide annual Data Summary Reports (DSRs) that document the data collected in the previous calendar year. These reports will be submitted April 1st of the following year. The DSR will fully document the calendar year's work including a summary of the work performed, a tabulation of results, field notes, processing data, COC forms, copies of laboratory audits, data validation results, copies of laboratory reports, and a CD version of the project database.

C2.1 Contents of the QA Section of Reports

The QA section of the monthly progress reports will contain results of field and laboratory audits performed during the reporting period, information generated during the reporting period reflecting on the achievement of specific DQO measurement performance criteria (including data validation and assessment results), and a summary of corrective action that was implemented and the corrective action's immediate results on the project. The status of analytical, data verification, and data validation tasks will be summarized for the project with respect to the project schedule. In addition, whenever necessary, updates on training provided, changes in key personnel, and anticipated problems in the field or laboratory for the coming reporting period that could bear on data quality along with proposed solutions will be reported. Furthermore, detailed references to QAPP modifications will also be highlighted. QAPP modifications will be reviewed and approved by USEPA. Monthly progress reports will be prepared in written, final format by the GE Project Manager or his designee. To the extent possible, assessment of the project should also be performed on the basis of available QC data and overall results in relation to originally targeted objectives.

C2.2 Frequency of QA Reports

The QA reports will be prepared as part of the monthly progress report and will be delivered to recipients by the 15th day of each month. The reports will continue without interruption until the project has been completed.

In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the Corrective Action sections of this QAPP. These events and their resolution will be addressed thoroughly in the next issue of the monthly progress report.

C2.3 Individual Receiving/Reviewing QA Reports

Those individuals identified in the AOC will receive copies of the monthly report containing the summary of QA activities. Additional project team members will receive the monthly progress report as deemed appropriate by the GE Project Manager.

D DATA VALIDATION AND USABILITY

The QA procedures that will occur after data collection are described in this section.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

The field, laboratory, and data management activities described in this QAPP will be reviewed to assess whether these activities were performed in a manner that is appropriate for accomplishing the project objectives. This assessment will include electronic verification of the data, followed by validation of 10% of the data. Verification of the data is performed to determine whether the data have been generated in accordance with the procedures identified in this QAPP. Data validation involves identifying the technical usability of the data for making decisions pertaining to satisfying the project objectives identified in Section A7.

D1.1 Review of Sampling Design

The ability of the collected samples to conform to the sampling design specifications in Section B1 will be reviewed by the GE Project Manager, QEA Project Manger, and Field Sampling Manager during each field sampling season. Those samples that deviate from the sampling design and the impact to project objectives, if any, will be discussed in the final report prepared at the end of each field season.

D1.2 Review of Sample Collection Procedures

The sample collection procedures employed by field personnel will be reviewed on a routine basis during each field season to confirm that the samples are collected in accordance with Section B2 of this QAPP. This review will note unacceptable departures, if any, from sample collection procedures described in the QAPP and identify sample data (analytical or field) that should be excluded from incorporation into the project database or data evaluation process. The external field audits will necessarily enable the data quality to be assessed with regard to the sample collection and field operations. In addition, the Field Sampling Manager or his designee will review project logbooks or records on a routine basis during sampling activities.

To assure that all field data are collected accurately and correctly, field audit(s) as described in Section C1.1 will be performed during sample collection to document that the appropriate procedures are being followed with respect to sample (and QC sample) collection. These audits will include a thorough review of the field books and standard data collection forms used by the project personnel to ensure that tasks are performed as specified in the QAPP.

The evaluation (data review) of equipment blanks and other field QC samples will provide definitive indications of the data quality. If a problem arises, it should be able to be isolated via the complete sample tracking and documentation procedures that will be performed. If such a problem does arise, corrective action can be instituted and documented. If data are compromised due to a problem, appropriate data qualifications will be used to identify the data.

The labeling and identification of samples will also be reviewed to ensure samples properly represent the location they were intended to represent.

D1.3 Review of Sample Handling

The handling, preservation, and storage of samples collected during the sampling program will be monitored on an on-going basis. The field audits described in Section C1.1 will provide documentation on proper handling of samples during collection and processing for shipment or delivery to the analytical laboratories. These audits will be reviewed by the Project Manger and Field Sampling Manager to determine if sample representativeness was maintained during collection and processing. Additionally, the project laboratories will document sample receipt including proper containers and preservation at the time samples are logged into their individual laboratory. The sample receipt records (a required data package deliverable) as well as COC documentation will be routinely assessed by the Data Validators during data validation. Sample handling, storage, or preservation problems identified during data validation will result in appropriate qualification of data to warn the data user to data quality deficiencies.

D1.4 Review of Analytical Procedures

The use of the proper analytical procedures described in Section B4 of the QAPP will be reviewed primarily through the data verification and data validation methods discussed in Section D2 of this QAPP. Qualification of data that does not conform to criteria is also discussed in Section D2 of this QAPP. The QA Program Manger will review data generated by analytical procedures other than those identified in this QAPP, if any, and make a determination if the data meets the quantitative objectives specified in this QAPP and if it will be included in the project analytical database.

Confirmation that samples were analyzed for the proper analyses will be performed through tracking mechanisms in the project analytical database. The tracking mechanisms will determine if samples submitted for analysis actually had the analyses performed. If analyses that

were identified to be performed were not actually performed (e.g., due to loss of sample or improper log in at the laboratory) then a determination should have been made at the time the missing data was discovered and appropriate corrective action documented. The GE Project Manager, Project Manager, and Field Sampling Manager will review the impact of incomplete analyses and identify impacts to the project objectives, if any, in the final project report for each field season.

D1.5 Review of Quality Control

The quality control checks described in Section B5 of the QAPP will be reviewed primarily through the data verification and data validation methods discussed in Section D2 of this QAPP. Qualification of data that does not conform to criteria is also discussed in Section D2 of this QAPP.

D1.6 Review of Calibration

The calibration of instruments and equipment described in Section B7 of the QAPP will be reviewed primarily through the data verification and data validation methods discussed in Section D2 of this QAPP. Qualification of data that does not conform to criteria is also discussed in Section D2 of this QAPP.

The Field Sampling Manager will review records of field equipment calibration and identify any impacts to non-analytical data that may exist.

D1.7 Data Reduction and Processing

Data generated through field activities or by laboratory operations shall be reduced and validated prior to reporting. Field and laboratory personnel shall not disseminate data until it has been subjected to these reduction and internal validation procedures that are summarized in subsections below:

D1.7.1 Data Reduction

Data reduction involves the process of generating qualitative and quantitative sample information through observations, field procedures, analytical measurements, and calculations. Data reduction occurs with:

- the QAPP through sample locations and naming conventions;
- the field sampling process through use of field logs and field measurements;
- communications with the laboratory in sample analysis requests;
- field operations with collection, preservation, and COC documentation;
- laboratory operations with sample receipt and handling, sample preparation and analysis, collation of raw data, and generation of laboratory results; and
- post-laboratory operations with collation of analytical results in a format suitable for documents such as reports, maps, and trend plots.

Data reduction steps include field operations, laboratory operations, and report preparation operations.

Specific QC measures developed to ensure accuracy throughout the data reduction process are described throughout this QAPP.

D1.7.1.1 Field Data Reduction Procedures

Data will be managed in the field using a laptop computer and portable printer. Field data will be recorded electronically on a laptop computer at the time of water column and fish sample collection. The laptop has the capability to generate and print field log forms and COC forms in the field. Hard copies of the field logs will be printed after sampling at each station is complete to limit the possibility of losing data in case the computerized system fails. Entry of field data directly into computer files allows for the electronic transfer into the BMP database. This procedure will minimize the potential for transcription errors.

Water Sampling

Field data collected during the weekly water column monitoring includes:

- location ID;
- QA/QC samples collected, including the location of blind duplicate samples;
- sample location, date, time, and method;
- sample ID;
- general description (comments);
- sampler initials and crew ID;
- water depth and temperature;
- depth of sample collection; and
- DO, pH, turbidity, and specific conductivity.

Figure B-1 summarizes the field information recorded during water sampling. Figure B-8 shows the data entry form for water sampling.

Fish Sampling

The following data will be recorded for each location sampled:

- location ID;
- sample collection method;
- collection date and time (start and end);
- water temperature;
- conductivity;
- turbidity;
- GPS beginning and ending coordinates (northing and easting); and
- weather conditions.

The following data will be recorded for each fish collected and retained for analysis:

- sample ID;
- species identification (genus and species; in accordance with NYSDEC data dictionary format);
- sample total length (nearest mm) and weight (nearest 0.1 g);
- sample type (individual or composite);
- sample sex (if necessary; fish may be cut enough to allow sexing, but do not eviscerate);
- general description, comments (including noting any external abnormalities which are easily observed), number, length, and weight, of individuals in composite samples; and
- sampler initials and crew ID.

Table B-9 summarizes the field information recorded during fish sampling. Figures B-4a and b shows the data entry form for fish sampling.

Originals of all collection records and continuity of evidence forms will accompany delivery of fish to the laboratory where it will be entered into the project database. Copies of these records will also be directed to the Field Sampling Manager.

The field data will be transferred to a computer database at the end of each sample collection day.

D1.7.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures will be followed according to the protocol described below. Raw analytical data will be recorded in the individual laboratory's LIMS and tabular summary tables will be generated. Other pertinent information, such as the sample identification number, the analytical method used, the name of the analyst, the date of analysis, and matrix sampled will also be recorded in LIMS. At a minimum, reagent concentrations, instrument settings, and raw data will be retained by hard copy and laboratory notebooks, which shall be signed and dated by the analyst. Copies of any instrument printouts (such as gas chromatograms) will be maintained on file. Periodic review of raw data and of the computerized records by the laboratory personnel will occur prior to final data reporting according to each laboratory's Laboratory Quality Manual.

For this project, the equations that will be employed in reducing data are presented in the laboratory SOPs, which have been included in Appendices 6 to 27 of this QAPP. (In addition, several of these equations, expressing analytical accuracy and precision have been presented in Sections A7.3 and B5 of this QAPP). Such formulae make pertinent allowance for matrix type. The laboratory technical staff will check all calculations. Errors will be noted, and corrections will be made. The original notations will be crossed out legibly.

Quality control data (e.g., laboratory duplicate results, surrogate recoveries, matrix spike recoveries) will be compared to the acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the laboratory Quality Assurance Officer for review. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that was outside acceptance limits and any other anomalous conditions encountered during sample analysis. After the laboratory Quality Assurance Officer approves these data, the data are considered ready for release to the GE project team.

D1.7.2 Identification and Treatment of Outliers

Outliers are unusually large or unusually small values in a population of observations. Outliers may be the result of a variety of circumstances (field or laboratory related), including any of the following:

- sampling artifacts;
- sample integrity problem;
- sample identification incorrectly transcribed in the field or laboratory;
- unique conditions;
- faulty or defective instruments;
- inaccurate reading of meters;
- errors in recording of data;
- calculation errors; or
- analytical errors.

Procedures for the identification of outliers will be followed at both the analytical stage and at the ensuing data reduction stage.

Outliers in laboratory data can arise from errors in analysis or from site-specific conditions that are out of the control of the laboratory. Errors in the laboratory are most often detected in the data review and validation process. In the event that quality control processes detect an outlier, which directly affects only 20 percent of the samples, the statistical approach of Dixon (1953) will be used to eliminate outliers. Outliers will be reported in the project database, but may not be used for evaluation purposes (Barnett and Lewis 1984). Data will be qualified in the database in a manner that indicates the data are outliers. Justification for the qualification of data considered outliers and its use will be documented in technical memoranda or corrective action summaries.

The QA Program Manager will identify outliers at the data reduction stage. When any particular value is suspected to be an outlier, the following steps will be taken:

- Other data from the same sample will be checked to see if they are also anomalous.
- The QA Program Manager will seek input from any individuals involved in generating the anomalous value as to possible causes. This will include questioning the field crew and the analyst(s).
  - Field crew - If samplers demonstrate standard competency in the sampling procedure used at the time the sample with the anomalous value was obtained, then sampling errors will be dismissed as a possible cause of the outlier.
  - Analyst(s) - The analyst(s) will be asked to examine his/her notes and calculations and, if possible, to rerun the sample for the specific parameter in question. Results of any samples rerun outside holding time will be used for comparative purposes.

Rejection of any suspect data or outlier for the purposes of required data analysis and reporting will only be done by the GE Project Manager and Project Manager in conjunction with

the QA Program Manager. The GE Project Manager, Project Manager, and the QA Program Manager will reject the data as an unacceptable outlier if:

- a problem with equipment or an incorrect procedure used during the sampling event is identified; or
- the rerun by the analyst generates a value that significantly differs from the value being examined.

D1.7.3 Data Processing

Final decisions will be made using only verified or validated data. Preliminary decisions or judgments may be made upon data that has not been verified or validated. It is expected that summary tables, maps, and charts of verified and validated data will be prepared by various project team members. Data that is processed will be checked by an individual knowledgeable about the data type being compiled who will perform a reasonable (minimum of 10%) check of the final tabulated information to ensure transcription errors have not occurred. Further checks of the tabulated data will occur if problems are encountered or if a systematic problem is detected in the process. Systematic problems will be identified and corrected prior to processing the data again.

D2 VALIDATION AND VERIFICATION METHODS

Electronic data verification and data validation (where necessary) are conducted after samples have been collected and analyzed. Verification and validation are the "report card" at the end of data collection and analysis; they provide an understanding of the data quality. The response to data verification and data validation is critical. If correctable data quality issues are

discovered, the findings must be immediately provided to the appropriate data generator such as the field samplers or laboratories so that appropriate corrective action can be taken to prevent the problem from recurring. The data verification program utilizes the information contained in the laboratory EDDs and can provide information on data quality very quickly after the data generation. The more traditional data validation occurs after the formal laboratory reports are submitted and, although important to document data validity, does not provide timely feedback. In a program of this magnitude and duration, there is ample opportunity to correct problems by use of the QA program elements described in the QAPP, by providing real-time feed back, and by taking corrective action.

Sample analysis and batch quality control results will be delivered in an EDD (refer to QAPP Section A9) for batch loading into the project database. Analytical results for all samples will also be provided in a full data package (refer to QAPP Section A9) in a scanned electronic media (Adobe® Acrobat® .pdf).

The usability of the analytical data will be assessed by using a tiered approach. Data will initially undergo an electronic data verification, which provides the first test of the quality of the results. This automated process assesses data usability by evaluating batch quality control results. The term verification is used because criteria-based checking of the laboratory-reported QC results against the limits defined in the QAPP is used to qualify data. Full data validation, i.e., manual qualitative and quantitative checking, will be performed on 10% of all data as well as any other analytical results that are subject to question.

Automated electronic data verification will be performed on 100% of all data using the batch quality control results provided by the laboratories in the EDD. The specific measures evaluated during verification and the associated criteria are discussed in QAPP Section D.2.2. They include:

- holding times;
- accuracy (by evaluating LCS recovery; MS recovery and HRM recovery);
- precision (by evaluating laboratory duplicate results);
- field duplicate sample precision;
- blank contamination (laboratory method blanks and field generated blanks); and
- surrogate compound recoveries.

This electronic verification process will provide an understanding of the data quality based on those QC indicators that have the most influence on qualification of data. The electronic verification process will operate in an automated process so that the quality of the data can be determined soon after the laboratory reports it. In contrast, manual validation findings will not be available for three to four weeks after the data package is submitted by the laboratory because of the length of time professional validation takes.

D2.1 Data Validation

Data validation is the process of verifying that qualitative and quantitative information generated relative to a given sample is complete and accurate. Data validation procedures shall be performed for both field and laboratory operations as described below.

D2.1.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this program primarily include reviewing field logbooks to check for transcription errors by the field crewmembers. These procedures are performed to ensure that field measurements and various quality control analyses were properly performed and documented. The field data documented includes data generated during

measurement of field parameters, observations, results of any quality control sample analyses, and field instrument calibrations. This task will be the responsibility of the Field Sampling Manager or designee, who will otherwise not participate in making any of the field measurements or in adding notes, data, or other information to the logbook or record form.

D2.1.2 Procedures to Validate Laboratory Data

Ten percent of PCB as well as non-PCB data will be subject to validation on an annual basis. The first SDG of the year for each matrix (water or fish) will be selected for validation in order to identify potential issues at the beginning of the project. Subsequent SDGs will be selected randomly until the annual 10% validation goal is met for each matrix and method.

Non-PCB water data to be validated includes:

- select nutrients (nitrate, nitrite, TKN, total phosphorous);
- TAL metals;
- TSS;
- POC;
- DOC; and
- dioxins/furans.

Non-PCB fish data to be validated includes:

- mercury;
- dioxins/furans; and
- organochlorine pesticides.

Data will be validated by SDG. For example, water samples in 1 of every 10 SDGs submitted for PCB analysis will be validated. The numbers of samples analyzed for each method will be factored into the selection of the SDGs to ensure that 10% of the environmental samples are validated.

Independent validation of field-collected WQ parameters (temperature, specific conductivity, pH, turbidity, and DO) will not occur.

The data validation strategy is based upon the fact that 100% verification of the key analytical data will occur, the quantity of samples to be collected, and the ruggedness of the overall QA program. The QA program incorporates many measures to monitor QA at various points during the course of the project including: common analytical SOPs for key parameters, field audits (see QAPP Section C1.1), laboratory audits (see QAPP Section C1.2.2) and electronic data verification (see QAPP Section D2.2). These monitoring elements, together with the validation of analytical data (where necessary) as described above and in QAPP Section D2.1, will provide an overall assurance of the data quality.

The validation results will be compared to the results of the electronic verification for the same data set to provide an indication of the accuracy of the electronic verification process. If verification or validation identifies deficiencies in data quality, the source of the deficiencies will be investigated and corrective action will be taken (QAPP Section C1.3). Additional data may be validated if deemed necessary by the GE Project Manager and QA Program Manager as part of the corrective action process.

Qualification of data resulting from the electronic verification or validation processes will be reflected by assigning the appropriate qualifier code to the sample result in the project database.

The validation of the laboratory data will be performed with guidance from the Region II, Standard Operating Procedures for the Validation of Organic and Inorganic Data Acquired Using SW-846 Method (various SOPs and issue dates), "*USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*," (October 1999), the "*US EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*," (July 2002) and the "*USEPA Guidance on Environmental Data Verification and Validation* (EPA QA/G-8)" (November 2002). These documents which provide most of the criteria by which water and fish data are accepted or rejected were used as a basis in developing the data validation SOPs as listed below:

- SOP for Data Validation of Congener PCB Data Low-Level Calibration Method (DVNE207_03).
- SOP for Data Validation of ICP Metals Data (DV200.8).
- SOP for Data Validation of CVAA Mercury Data (DV245.1/7470A/7471A).
- SOP for Data Validation of Wet Chemistry Data (DVWETCHEM).
- SOP for Data Validation of Congener PCB Data (DVNE013_07).
- SOP for Data Validation of Aroclor PCB Data (DV8082).
- SOP for Data Validation of Dioxin/Furan Data (DV1613B).
- SOP for Data Validation of Organochlorine Pesticide Data (DV8081A).

These data validation SOPs have been provided in Appendices 28-36 to this QAPP and will provide the specific criteria used to validate the data for each analytical parameter for the project. Full validation will include an evaluation of documented QA/QC measures through a review of tabulated QC summary forms and raw instrument data. Based on the results of the validation, full validation may be performed for additional data if deemed necessary by the GE

Project Manager and QEA Project Manager in conjunction with the Data Production/QA Program Manager.

A preliminary review will be performed to verify that necessary paperwork (e.g, COC records, analytical reports, and laboratory personnel signatures) and deliverables (as specified in this QAPP) for the analyses are present. At a minimum, deliverables will include sample COC records, a detailed case narrative, analytical results, calibration summaries, QC summaries, and supporting raw data from instrument printouts as specified in Section A9 of this QAPP. The QA Program Manager will contact a project laboratory to request the correction of certain deficiencies prior to the submittal of the Quality Assurance Review, if such corrections are necessary for a full evaluation of the usability of the data. Such correctable deficiencies may include missing data deliverables or calculation errors that would take a significant amount of the staff reviewer's time to correct. In addition, the QA Program Manager may contact a project laboratory to request the correction of all correctable deficiencies prior to the submittal of the Quality Assurance Review, if time allows. Any laboratory resubmittals as a result of such requests will be discussed in the appropriate "Comments" section of the Quality Assurance Review.

A detailed review will be performed by the QA Program Manager or staff reviewer to independently verify compliance to the required analytical protocols and to determine the qualitative and quantitative reliability of the data as the data are presented. Full validation will include a detailed review and interpretation of data generated by the laboratory. The primary tools that will be used by experienced data review chemists will be guidance documents, established (contractual) criteria, the data validation SOPs provided in Appendices 28-36 to the QAPP, and professional judgment.

Based upon the review of the analytical data, a Quality Assurance Review will be prepared which will summarize the qualitative and quantitative reliability of the analytical data.

During the course of the data review, a full organic, inorganic, and general chemistry support documentation package will be prepared from the deliverables provided by the laboratory; this support documentation will provide backup information that will accompany all qualifying statements presented in the quality assurance review. Table D-1 provides a summary of the Quality Assurance Review report format and details the information contained in the support documentation packages.

Based upon the quality assurance review of the analytical data, specific codes will be placed next to results in the database to provide an indication of the quantitative and qualitative reliability of the results. These defined qualifier codes will serve as an indication of qualitative and quantitative reliability. The data qualifier codes and definitions will be as follows:

U - The compound/analyte was analyzed for, but was not detected above the reported sample detection limit.

U* - This compound/analyte should be considered "not detected" since it was detected in a blank at a similar level.

J - Quantitation is approximate (estimated) due to limitations identified during the quality assurance review (data validation).

N - The analysis indicates that there is presumptive evidence to make a "tentative identification" of this compound/analyte.

R - Unusable (rejected) result – compound/analyte may or may not be present in this sample.

UR - Unusable "not-detected" result; compound may or may not be present in this sample.

UJ - This compound/analyte was not detected, but the quantitation/detection limit is probably higher than reported due to a low bias identified during the quality assurance review.

EMPC - Estimated Maximum Possible Concentration; chromatographic peaks are present in the expected retention time window, but, the peaks do not meet all of the conditions

required for a positive identification. The reported result represents the estimated maximum possible concentration if the PCDD or PCDF was present.

Once the review has been completed, the QA Program Manager will submit the report and data tables to the GE Project Manger and appropriate team members. The approved quality assurance review will be signed and dated by the QA Program Manager.

D2.2 Procedures for Data Verification

Automated electronic data verification will be performed on 100% of the Aroclor PCB, congener-specific PCB, nutrients, TAL metals, TSS, POC, DOC, dioxin/furan, mercury, and organochlorine data using the batch quality control results provided by the laboratories in the EDD. The quantitative criteria (limits) used for data verification will be consistent with the data validation quantitative criteria (limits) for the same evaluation processes. The automated data evaluation process provides consistent evaluation and qualification (flagging) of data. To accomplish the data verification process, the system completes the following phases:

Phase 1: Contamination

- Method Blank Evaluation – Determine whether the source of positive results in the field sample is attributable to laboratory processing.
- Equipment Blank Evaluation – Determine whether the source of positive results in the field sample detection is attributable to field processing.

Phase 2: Holding Times

- Holding Time Evaluation – Check whether holding times meet, slightly exceed, or grossly exceed acceptance criteria.

Phase 3: Accuracy

- MS Evaluation – Spiked field sample recoveries for the MS are compared to the acceptance criteria range.
- HRM Evaluation – Compound recoveries are compared to the acceptance criteria range.
- LCS – Spiked compound recoveries are compared to the acceptance criteria range.

Phase 4: Precision

- Laboratory Duplicate Evaluation – The relative percent differences between a field sample and its laboratory duplicate (if performed) are compared to the acceptance criteria.
- Field Duplicate Evaluation – Check whether the precision between a field sample and its field duplicate meet project criteria.

Phase 5: Surrogates

- Surrogate Evaluation (organics only) – Surrogate recoveries are compared to the acceptance criteria ranges.

The following evaluation procedures account for potential data verification out-of-criteria situations:

- Samples analyzed outside of holding time criteria will be qualified as estimated or rejected (in the event of gross exceedance).
- Samples with surrogate recoveries greater than or less than the project acceptance criteria ranges will have values greater than the sample reporting limit qualified as estimated.
- Samples with surrogate recoveries below the project control limits but greater than or equal to 10% will have all non-detected values qualified as estimated.

- Samples with surrogate recoveries below 10% will have non-detected results qualified unusable.
- Samples for organic analysis with MS recoveries outside of project control limits will have the specific out-of-criteria compound result(s) in the associated unspiked sample qualified. Qualification for matrix spike analyses follows the QC rules used for surrogates.
- LCS samples with recoveries outside of criteria will have all samples in the same preparation batch qualified following the same rules as for surrogates.
- Inorganic MS samples with recoveries outside of criteria will have samples of the same matrix in the associated batch qualified following the same rules as for surrogates.
- Laboratory duplicates with inorganic analytes out of RPD criteria will have the analyte values greater than the sample reporting limit qualified as estimated in similar matrix samples in the associated batch.
- Field duplicate analytes with out-of-criteria RPDs will have the analyte values greater than the sample reporting limit estimated in only the field duplicate and its associated sample.

A summary report detailing the out-of-control criteria and the associated sample data that are qualified is generated at the end of the data verification process. The electronic data verification qualifiers will be posted to the project analytical database. Qualifier codes will be identical to those identified above in Section D2.1.2. Data will move from an "unverified" to "verified" state in the project analytical database at the conclusion of the data verification process. Sample data that is selected for full validation will have the verification process report evaluated to provide a check on the data verification process logic.

D3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The QA Program Manager in conjunction with Overall Project Manager and Project Manager will determine whether field and analytical data or data sets meet the requirements necessary for decision making. The results of measurements will be compared to the DQO requirements set forth in this QAPP. As data are evaluated, anomalies in the data or data gaps may become apparent to the data users. Much of the data generated by this program will be used to establish baseline PCB load during the dredging season. The DQOs will be considered to be satisfied if the data are sufficient (based on the accuracy of the data and the quality of the graphic representations) to establish pre-dredging conditions for use in evaluating achievement of performance standards during the dredging project and to evaluate the long-term recovery trends of PCB levels in fish and water. Data that do not meet the data users' needs will be identified and appropriately noted in the project database so the decision-makers are aware of its limitation.

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