ADDENDUM 1 (2009) TO

ONONDAGA LAKE BASELINE MONITORING BOOK 2 FISH, INVERTEBRATE, AND LITTORAL WATER MONITORING FOR 2008

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LIST OF ACRONYMS

C	Carbon
DDT	Dichlorodiphenyl trichloroethane
DUSR	Data Usability and Summary Report
NYSDEC	New York State Department of Environmental Conservation
mg/kg	Milligrams per kilogram
N	Nitrogen
ng/kg	Nanograms per kilogram (1 ng/kg equals 0.000001 mg/kg)
PCB	Polychlorinated Biphenyl
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
ROD	Record of Decision
SOPs	Standard Operating Procedures
TEF	Toxic Equivalency Factors
TEQ	Toxic Equivalents
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This addendum to the 2008 Book 2 Work Plan (Parsons et al., 2008) presents the scope for the 2009 biota monitoring in the context of the baseline monitoring program objectives, program elements, and data uses, as well as the results of the 2008 program. The 2009 work scope is the same as that for 2008 with the exception of eliminating monitoring components not considered necessary every year, adding a second technique for determining the age of adult smallmouth bass and walleye, and adding stable isotope analyses. Key components of the 2009 Book 2 work scope are: 1) fish tissue analysis, and 2) food web structure and fish community assessment; and (3) stable isotope analyses. Fish tissue analyses will include mercury in prey fish and four species of adult sport fish and PCBs, DDT, and lipids in a subset of two species of adult sport fish (smallmouth bass and walleye). An assessment of fish population and community composition, sampling and identification of fish gut contents, and stable isotope work are also part of the 2009 work scope. The rationale for the 2009 scope and modifications to the 2008 scope is presented. The work proposed in this addendum will use the 2008 Book 2 Standard Operating Procedures (SOPs) and Quality Assurance Project Plan (QAPP). Revised worksheets for the 2008 Book 2 QAPP are provided as Appendix A.

SECTION 1

INTRODUCTION

This addendum to the 2008 Book 2 Work Plan (Parsons et al., 2008) presents the scope for the 2009 biota monitoring in the context of the baseline monitoring program objectives, program elements, and data uses as well as the results of the 2008 program. The rationale for key modifications to the 2008 Book 2 Work Plan is also presented herein and in the 2008 Baseline Monitoring Data Assessment Report (Parsons, Exponent, and Anchor-QEA, 2009).. The Book 2 (Fish, Invertebrate, and Littoral Water Monitoring) baseline monitoring data collected in 2008 and 2009 will be reviewed in the context of the Baseline Monitoring Scoping Document (Parsons, 2008) in order to determine an appropriate Book 2 baseline monitoring program for 2010. The determination of a 2010 Book 2 baseline monitoring program will be made in consultation with, and ultimately, approved by NYSDEC.

The work proposed in this addendum will use the 2008 Book 2 SOPs and QAPP. Revised worksheets for the 2008 Book 2 QAPP are provided in Appendix A of this addendum.

1.1 OBJECTIVES AND DATA USES

Program objectives, program elements, and data uses for the fish, invertebrate, and littoral water monitoring previously described in the draft Baseline Monitoring Scoping Document are presented in Table 1 along with a summary of how each was addressed in 2008 and will be addressed by the work described in this addendum for 2009.

1.2 RATIONALE FOR MODIFICATIONS TO THE 2008 BOOK 2 WORK PLAN

This 2009 addendum includes five key modifications to the 2008 Book 2 Work Plan (Parsons et al., 2008) to eliminate monitoring components not considered necessary every year and add new components considered important to address the monitoring objectives. These modifications and their rationale are as follows:

- Fish tissue analytes

  A summary of the 2008 chemical data in fish tissue is presented in Table 2. In 2008, mean mercury concentrations in adult sport fish species (*i.e.*, brown bullhead, pumpkinseed, smallmouth bass, and walleye) exceeded the human health target tissue concentration range established in the Record of Decision (ROD) (NYSDEC and USEPA, 2005, Table 7). Mean 2008 mercury concentrations in smallmouth bass and walleye, but not in brown bullhead and pumpkinseed, exceeded the upper end of the ecological target tissue concentration range for large fish (the lowest observed adverse effect level of 0.341 milligrams per kilogram (mg/kg) on a wet-weight basis) using a conversion factor of 0.7 from fillet to whole fish (TAMS, 2002). Calculations to convert adult sport fish fillet concentrations to whole body fish concentrations are

presented in Table 3. The mean 2008 mercury concentration of 0.22 mg/kg in prey fish (i.e., brook silverside, golden shiner, and other minnow species) slightly exceeded the upper end of the ecological target tissue concentration range of 0.187 mg/kg for small fish.

Also in 2008, mean PCB concentrations were within the target tissue concentration ranges for ecological receptors using a conversion ratio of 2.5 from fillet to whole fish (TAMS, 2002), but exceeded the upper end human health target tissue concentration of 0.3 mg/kg in smallmouth bass and walleye. Mean DDT concentrations in smallmouth bass and walleye, but not in brown bullhead and pumpkinseed, exceeded the upper end of the ecological target tissue concentration range for large fish of 0.15 mg/kg using a conversion factor of 2.3 from fillet to whole fish (TAMS, 2002). The mean DDT concentration in prey fish were below the ecological target tissue concentration for small fish (i.e., the lowest observed adverse effect level of 0.049 mg/kg). There are no human health target tissue concentrations for DDT in the ROD. Also, there are no human health target fish tissue concentrations in the ROD for hexachlorobenzene. There is a to-be-considered fish flesh concentration in the ROD for hexachlorobenzene to protect wildlife (0.33 mg/kg as presented in Table 18 of the ROD). Mean and maximum concentrations of hexachlorobenzene measured in 2008 samples were less than 0.33 mg/kg (see Table 2)

Finally, toxic equivalents (TEQs) were calculated for the 20 fish tissue samples analyzed in 2008 for dioxins/furans using human and mammalian toxic equivalency factors (TEFs) from Van den Berg et al. (2006). A summary of these TEQs is presented in Table 4 along with the 1992-2000 TEQs and the human health target tissue concentration range. When the value for undetected congeners is set to zero, the arithmetic mean TEQ is within the target tissue concentration range and the 95% UCL (upper confidence limit) TEQ is exceeded by only 0.05 ng/kg (nanograms per kilogram or parts per trillion) compared to the ROD TEQ target tissue concentration range for fish fillets of 0.4 to 4.0 ng/kg. The standard approach of using one-half the detection limit for undetected congeners results in a doubling of the mean TEQ and a 34% increase in the 95% UCL TEQ.

For 2009, fish tissue analytes will be mercury in all fish collected for analysis and PCBs, DDT, and lipids in 12 individual smallmouth bass and walleye, consistent with the 2008 Book 2 Work Plan. Monitoring for PCBs, DDT, and lipids in other fish and monitoring of fish for hexachlorobenzene and dioxins/furans will be conducted during 2010.

- Benthic macroinvertebrate tissue collection, community composition, and abundance

  An assessment of macroinvertebrate community composition and tissue concentrations is indirectly linked to mercury concentrations in fish. As stated in the Book 2 Work Plan, the purpose of analyzing mercury levels in macroinvertebrates is to provide additional data that will aid in the future in understanding remedy effectiveness. Therefore, benthic macroinvertebrate characterization will not be conducted in 2009; however, characterization will be conducted once more during the

remedial design phase (most likely during 2010) consistent with the procedures in the 2008 Book 2 Work Plan (Parsons et al., 2008).

- Phytophilous invertebrate community surveys

  The phytophilous community was not highly abundant in 2008 and, therefore, surveys will not be repeated in 2009. Phytophilous invertebrates will be surveyed once more during the remedial design phase consistent with the procedures in the 2008 Book 2 Work Plan (Parsons et al., 2008). Consideration will be given to collecting additional information about phytophilous invertebrates during 2010 as a supplement to the 2008 work and in coordination with Onondaga County's invertebrate work being planned for 2010.

- Littoral water sampling

  Littoral water sampling was conducted in 2008 to improve understanding of the movement of mercury and methylmercury generated from the hypolimnion during and following fall turnover into the littoral surface waters of the lake for assessing exposure to biota. Analytical results for littoral surface water baseline samples collected during 2008 are summarized in Table 5. Annual measurements, however, are unnecessary as the high frequency data for total mercury and methylmercury concentrations at the 2-meter water depth at South Deep is considered representative of concentrations lake-wide. Littoral water sampling will be conducted once more during the remedial design phase consistent with the procedures in the 2008 Book 2 Work Plan (Parsons et al., 2008).

- Otolith analysis to estimate ages in adult smallmouth bass and walleye

  Review of the 2008 data indicates that scale analysis was inadequate for estimating age in smallmouth bass and walleye. Otoliths (small ear bones) provide a more reliable estimate of age in larger fish including smallmouth bass and walleye. Therefore, otoliths will be collected from smallmouth bass and walleye and analyzed in 2009 to provide a more accurate assessment of the age of these fish in the lake to help understand mercury dynamics within the lake food web. Spines are typically adequate to estimate ages of brown bullhead, and scales are typically adequate to estimate ages of pumpkinseed.

SECTION 2

2009 BOOK 2 BIOTA MONITORING

The 2009 biota monitoring consists of two components: fish tissue analysis and food web structure and fish community assessment. These components are briefly described below and summarized in Table 6.

2.1 FISH TISSUE ANALYSIS

Prey fish and adult sport fish will be collected from eight locations in the lake, consistent with the 2008 Book 2 Work Plan (Parsons et al., 2008). As in 2008, 50 samples of each of the four adult sport fish species (i.e., pumpkinseed, brown bullhead, smallmouth bass, and walleye) will be targeted with approximately even distribution within each sampling location. A maximum of 40 composite samples of prey fish (minnow species) will be collected from each of the eight locations (five composites per location) as was also conducted in 2008. Reasonable attempts will be made to include at least two alewife (less than 180 mm total length) composites from each location. As part of the 2009 prey fish sampling, gillnets will be set during nighttime hours in approximately 4 to 6 meters of water depth at each prey fish location to capture alewife less than 180 mm in total length to yield two composites per location for mercury analysis. If necessary, gillnets designed to capture herring will be used to increase the likelihood of capture.

Sport fish samples will be collected starting in June and composite prey fish samples will be collected in August. The June start date for collection of adult sport fish should yield greater numbers of smallmouth bass than in 2008 when collection began in August. Prey fish will be collected in August, consistent with the 2008 sampling program. Figure 1 shows the 2008 fish sampling locations. Every reasonable effort will be made to collect fish during 2009 from the locations where fish were collected during 2008.

Age will be estimated on individual adult sport fish collected for tissue analysis. Scale samples will be collected from pumpkinseed, pectoral spines for bullhead, and otoliths will be used for walleye and smallmouth bass. Otoliths will be removed prior to submittal to the analytical laboratory. In addition to fillet samples in adult sport fish, tissue plugs will be collected and analyzed for mercury. Mercury will be analyzed in all fish samples. In addition, PCBs, DDT, and lipids will be analyzed in 12 samples each of adult smallmouth bass and walleye. Every reasonable effort will be made to collect fish for PCB, DDT, and lipid analysis during 2009 from the locations where fish were collected during 2008 and analyzed for PCB, DDT, and lipids.

2.2 FOOD WEB STRUCTURE AND FISH COMMUNITY ASSESSMENT

The 2009 biota monitoring will continue the 2008 Book 2 work on food web structure and fish community assessment. The three sampling activities are: 1) assessment of fish population, 2) assessment of fish community composition, and 3) sampling and analysis of fish gut contents.

Fish population will be evaluated in 2009 with the same mark-recapture techniques used in 2008. A particular focus will be population estimates for smallmouth bass and brown bullhead, which were not estimated in 2008 due to low catch rates.

The Onondaga Lake fish community will be assessed in 2009 at a minimum of eight locations from those sampled in 2008. Sampling at all locations will include seining, gill netting, trap netting, and electrofishing as was done during 2008. Pop netting will not be used in 2009 due to the relative inefficiency of fish capture in the lake using this technique in 2008. The vegetated littoral zone habitats will be sampled using a combination of trap netting, seining, and electrofishing. Fish community assessments will be conducted several times from June through October to account for species shifts due to changes in water temperature and dissolved oxygen concentrations, as well as fish immigration and emigration. These data also will be used to assess the reproductive success of sport fish species.

Sampling and analysis of fish gut contents will be conducted from adult sport fish samples collected for tissue sample analysis. Stomachs will be pumped by gastric lavage and preserved in buffered formalin prior to processing. Prey fish submitted for tissue analysis will not be sampled for stomach contents. In addition, sport fish collected as part of the fish community assessment will be sampled for stomach contents as time permits. This analysis will provide an estimate of the trophic structure within the lake and facilitate understanding of the lake's food web.

2.3 HEALTH AND SAFETY

The safety of field team members and the general public is the highest Honeywell priority. The Project Safety Plan for Parsons field efforts and the QEA Safety Plan prepared for previous Onondaga Lake field activities will be used for this investigation and will be strictly followed by all personnel. Any task outside of the 2009 work scope defined in the relevant safety plans will have new job safety analyses completed as warranted before the task begins. Copies of these Parsons and QEA safety plans will be maintained at the support zone along the lakeshore and on the sampling boat.

2.4 DATA MANAGEMENT AND REPORTING

Unvalidated data will be submitted to NYSDEC consistent in content and timing with submissions being provided for other pre-design investigation and baseline monitoring efforts for Onondaga Lake. Analytical data generated during this investigation will be reviewed and validated as described in detail in the QAPP associated with the 2008 Work Plan (Parsons et al. 2008). All analytes will be subject to Level III validation as described in the QAPP for the Phase I Pre-Design Investigation (Parsons, 2005). In addition, 10% of the total mercury,

methylmercury, and PCB results will be validated based on Level IV protocols. The validated results will be incorporated into the Locus Focus™ database by Parsons following validation.

Once the data validation has been completed, a Data Usability and Summary Report (DUSR) will be prepared and submitted to NYSDEC. The DUSR will present the results of data validation and data usability assessment. A data export will be provided in the DUSR on CD/DVD. Data interpretation and trend analysis will be discussed with the Baseline Monitoring Technical Work Group.

SECTION 3

STABLE ISOTOPE ANALYSES

3.1 INTRODUCTION

Stable isotopic ratios of carbon (13C/12C) and nitrogen (15N/14N) provide insight into food web patterns and contaminant bioaccumulation in aquatic systems and are therefore proposed as part of the baseline monitoring program for Onondaga Lake in 2009. This effort is intended to address the following baseline monitoring program objectives:

- provide additional data for future understanding of remedy effectiveness in achieving preliminary remediation goals (PRGs) and
- assess biological factors that may contribute to variability in fish mercury concentrations.

An important issue for the lake is to determine the relative significance of benthic or sediment-based food sources (located in littoral regions of the lake) and pelagic or plankton-based food sources (located in open waters), as this differentiation may influence the effectiveness of the remedy. To that end, 13C/12C is used to distinguish between food sources (e.g., benthic vs. pelagic) while 15N/14N is used to assess trophic position of the organisms studied. Stable isotope data are often used in conjunction with gut content analysis, as both approaches to assessing food webs have shortcomings. Examples of studies that have used stable isotope analyses to distinguish between sedimentary and pelagic sources of carbon in food webs are Power et. al., 2002 and Chumchal and Hambright, 2009.

3.2 ANALYTICAL APPROACH

The approach is to analyze 13C/12C and 15N /14N in tissue from organisms collected in 2008 as part of the baseline monitoring program. Use of 2008 tissue samples will accelerate interpretation of the results because the samples are already collected and homogenized, and mercury data and gut content data are already available for these samples. Use of 2008 tissue samples will also ensure inclusion of benthic macroinvertebrates, which were sampled in 2008 but will not be sampled in 2009.

Up to ten samples of each of the following organism types will be analyzed:

- zooplankton;
- amphipods;
- chironomids;
- zebra mussels;
- composite prey fish (by species);
- pumpkinseed;
- brown bullhead;

- smallmouth bass; and
- walleye.

Thus, a total of up to 90 tissue samples will be analyzed. Sample size may be limited for some invertebrate samples. Samples are currently in storage at Test America (homogenized and frozen). Samples will be sent to the analytical laboratory for preparation (drying, grinding to powder, and weighing) and analysis.

The analytical laboratory for this work will likely be the Cornell University Stable Isotope Laboratory (http://www.cobsil.com/index.php). While the required sample size is only a few milligrams, the lab recommends supplying at least 2 grams to allow for mass loss during sample preparation.

3.3 DATA ANALYSIS

The C and N stable isotope ratios will be analyzed to determine the trophic position of various fish species, as well as the relative importance of benthic and pelagic food sources to fish species. This information will ultimately be combined with the gut content analysis and mercury data to better understand mercury bioaccumulation in Onondaga Lake. Stable isotope analysis has been used in other systems to distinguish between sedimentary and pelagic sources of carbon in food webs. Additional information will be provided at a later time on how the data will be analyzed. There are no plans at this time to apply these data to a food web model. If a food web model is identified to be applied for Onondaga Lake, Parsons/Honeywell will discuss model application with NYSDEC prior to development.

SECTION 4

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TABLE 1
ONONDAGA LAKE BASELINE MONITORING
PROGRAM OBJECTIVES, PROGRAM ELEMENTS, AND DATA USES
PERTAINING TO BOOK 2

Program Objective	Program Element	Data Use	2008 Work	2009 Work	Comments
Establish baseline chemical and physical conditions	**Sport and prey fish sampling**	Provide basis to measure achievement of PRG2 (fish tissue target concentrations).	Book 2 included analysis of total mercury in four sport fish species and composite prey fish. A subset of sport fish and composite prey fish samples were analyzed for hexachlorobenzene, PCBs, DDT, and PCDD/PCDFs (sport fish only). Fish age was determined by scales.	Same as 2008 except no hexachlorobenzene or dioxin-furan analyses, and PCB, DDT and lipid content are to be analyzed in smallmouth bass and walleye only. Sport fish will be aged by otoliths for more accurate age determination.	Monitoring for PCBs, DDT, and lipids in other fish and monitoring of fish for hexachlorobenzene and dioxins/furans will be conducted during 2010.
Provide additional data for future understanding of remedy effectiveness in achieving PRGs	**Other biota sampling**	**Baseline for Remedy Effectiveness**			
		Assess biological factors that may contribute to variability in fish mercury concentrations.	Book 2 included benthic macroinvertebrate community survey and analysis of tissue, co-located sediment (total mercury and methylmercury), and littoral water.	Not to be repeated in 2009.	Benthic macroinvertebrate tissue analysis and community survey and littoral zone water sampling will be conducted once more during design, most likely during 2010.
			Book 2 included fish community assessment, phytophilous macroinvertebrate community, sport fish population estimate, and fish diet assessment.	Proposed in 2009 to include fish community assessment and sport fish population estimate.	A recommendation regarding similar analyses in 2010 and/or 2011 will be made following review of the 2009 data.

TABLE 2
SUMMARY OF BOOK 2008 FISH TISSUE CHEMICAL CONCENTRATIONS MEASURED IN ONONDAGA LAKE (wet weight basis)

Parameter	Prep	Species	Sample Size	Mean (mean whole body)*	Min	Max	Standard Error
Mercury (mg/kg wet-weight)	whole body	Prey fish	40	0.22	0.03	0.79	0.03
	fillet	Brown bullhead	50	0.27 (0.19)	0.05	0.64	0.02
	fillet	Pumpkinseed	50	0.34 (0.24)	0.07	1.10	0.03
	fillet	Smallmouth bass	18	2.11 (1.48)	1.50	3.20	0.09
	fillet	Walleye	50	2.65 (1.86)	0.70	4.40	0.13
	plug	Brown bullhead	50	0.28	0.05	0.79	0.02
	plug	Pumpkinseed	50	0.37	0.08	1.20	0.03
	plug	Smallmouth bass	18	2.24	1.40	2.90	0.09
	plug	Walleye	50	2.81	0.72	4.70	0.14
Total PCBs (sum of Aroclors) (mg/kg wet-weight)	whole body	Prey fish	10	0.44	0.11	2.34	0.21
	fillet	Brown bullhead	12	0.18 (0.45)	0.05	0.33	0.03
	fillet	Pumpkinseed	12	0.14 (0.36)	0.08	0.46	0.03
	fillet	Smallmouth bass	12	2.77 (6.92)	1.62	4.19	0.22
	fillet	Walleye	12	3.01 (7.52)	1.06	9.40	0.63
Sum of DDT and metabolites (mg/kg wet-weight)	whole body	Prey fish	10	0.01	0.003	0.01	0.001
	fillet	Brown bullhead	12	0.01 (0.02)	0.002	0.01	0.001
	fillet	Pumpkinseed	12	0.004 (0.01)	*nd*	0.01	0.001
	fillet	Smallmouth bass	12	0.10 (0.24)	0.06	0.14	0.01
	fillet	Walleye	12	0.10 (0.22)	0.04	0.34	0.02
Hexachlorobenzene (mg/kg wet-weight)	whole body	Prey fish	10	0.02	0.001	0.09	0.01
	fillet	Brown bullhead	12	0.01 (0.02)	0.001	0.04	0.004
	fillet	Pumpkinseed	12	0.002 (0.01)	0.001	0.01	0.001
	fillet	Smallmouth bass	12	0.02 (0.04)	0.01	0.02	0.001
	fillet	Walleye	12	0.03 (0.07)	0.01	0.05	0.003
Percent Lipid (% by weight)	whole body	Prey fish	10	2.08	1.60	2.40	0.08
	fillet	Brown bullhead	12	0.73	0.20	1.30	0.10
	fillet	Pumpkinseed	12	0.72	0.40	1.10	0.07
	fillet	Smallmouth bass	12	3.55	1.70	5.50	0.37
	fillet	Walleye	12	4.41	3.10	5.90	0.27

*Mean whole body concentrations for brown bullhead, pumpkinseed, smallmouth bass, and walleye were calculated as appropriate by multiplying mean fillet concentrations by the appropriate conversion factor from the baseline ecological risk assessment (TAMS 2002) as described in the text.

TABLE 3
FILET AND WHOLE BODY CHEMICAL CONCENTRATIONS IN 2008 ADULT SPORT FISH AND PREY FISH (mg/kg wet weight)

Parameter	Type	Count	Mean	Minimum	Maximum	Std. Error	95% UCL
Mercury	fillet	168	1	0.05	4	0.09	1
	converted whole body		0.8	0.03	3	0.07	0.9
	forage fish	40	0.22	0.03	0.79	0.03	0.28
Total PCBs	fillet	48	2	0.1	10	0.3	2
	converted whole body		4	0.3	24	0.7	5
	forage fish	10	0.44	0.11	2.34	0.21	0.83
DDT & metabolites	fillet	48	0.05	0.003	0.34	0.009	0.07
	converted whole body		0.12	0.007	0.77	0.02	0.16
	forage fish	10	0.01	0.003	0.01	0.001	0.010
Hexachlorobenzene	fillet	48	0.01	0.001	0.05	0.002	0.02
	converted whole body		0.03	0.002	0.12	0.005	0.04
	forage fish	10	0.02	0.001	0.09	0.01	0.04

UCL - upper confidence limit
PCBs - polychlorinated biphenyls
DDT - dichlorodiphenyl trichloroethane

Conversion factors used (ratio of fillet):
DDT & metabolites - 2.3
Hexachlorobenzene - 2.4
Mercury - 0.7
Total PCBs - 2.5

TABLE 4

TEQs IN FISH TISSUE IN 1992-2000 AND 2008 WITH TARGET TISSUE CONCENTRATION RANGE (NG/KG WET WEIGHT)

Dataset	Mean	Minimum	Maximum	95% UCL
1992-2000 (1)				
ND=1/2 DL	10.1	--	46.0	19.5
2008				
ND=0	2.5	0.0	6.0	4.05
ND=1/2 DL	5.0	3.0	7.0	5.44
Target tissue concentration range	--	--	--	0.4 to 4.0

DL – Detection limit
ND – Non-detected congeners included at 0 or ½ detection limit
UCL – Upper confidence limit on the mean

(1) Source: Parsons, 2004 (Table G.1 except for the maximum values) and NYSDEC and USEPA, 2005 (Table 7)

TABLE 5

2008 TOTAL MERCURY AND METHYLMERCURY CONCENTRATIONS IN SURFACE WATER AT LITTORAL AND SOUTH DEEP STATIONS

Date	Location ID	Total Hg ng/L	Methyl Hg ng/L
8/18/2008	OL-STA-10161	3.4	0.398
	OL-STA-20160	1.4	0.061
	OL-STA-30095	0.82	0.149
	OL-STA-40124	1.1	0.183
	OL-STA-50062	0.86	0.229
	OL-STA-60226	1.2	0.213
	South Deep (2 m)	1.1	0.105
11/3/2008	OL-STA-10161	2	0.145
	OL-STA-20160	0.86	0.086
	OL-STA-30095	1.1	0.144
	OL-STA-40124	0.12 U	0.114
	OL-STA-50062	0.12 U	0.152
	OL-STA-60226	0.87	0.081
	South Deep (2 m)	1.4	0.17
11/20/2008	OL-STA-10161	1.2	0.116
	OL-STA-20160	1.1	0.131
	OL-STA-30095	0.77	0.127
	OL-STA-40124	1.4	0.158
	OL-STA-50062	0.12 U	0.124
	OL-STA-60226	1.4	0.146
	South Deep (2 m)	1.0, 1.2*	0.16, 0.11*

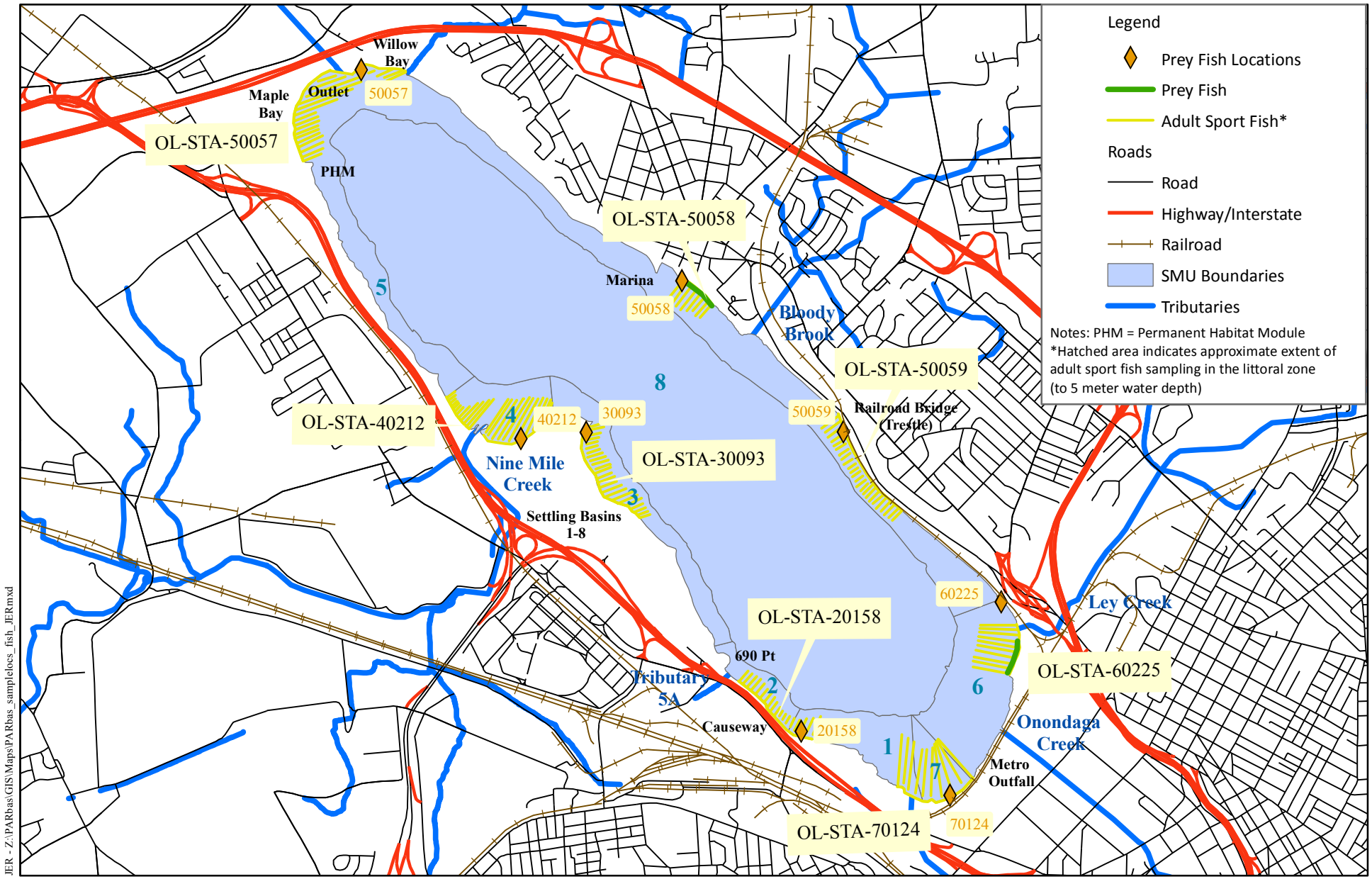
*South Deep samples collected 11/17/08 and 11/24/08 at the 2-meter water depth.

U - not detected at the reporting limit concentration indicated

TABLE 6

SUMMARY OF BOOK 2 BIOTA MONITORING ACTIVITIES FOR 2009

Activity	Number of Locations	Number of Field Matrix Samples per Location	Number of Species	Sample Preparation	Duration
Adult Sport Fish Tissue Sampling	8	6-7	4	Fillets and tissue plugs	Approximately 15 days in June
Prey Fish Tissue Sampling (minnow species, alewife)	8	5	Variable (Composites of a prey species)	Whole body composite	Approximately five days in August
Sport fish Population Estimate	Lakewide	NA	4	None	June-September
Fish Community Assessment	8	NA	NA	None	June to October
Fish Diet Assessment	Lakewide	50 per species	4	Gastric lavage	June



JER - Z:\PARbas\GIS\Maps\PARbas_samplelocs_fish_JER.mxd

ANCHOR QEA

Honeywell PARSONS

Figure 1
Fish tissue sampling locations - 2008.

APPENDIX A

REVISED WORKSHEETS FOR THE QUALITY ASSURANCE PROJECT PLAN

APPENDIX A
ADDENDUM 1 (2009)
REVISED WORKSHEETS FOR
QUALITY ASSURANCE PROJECT PLAN
ONONDAGA LAKE BASELINE MONITORING
BOOK 2
MONITORING WORK PLAN FOR 2009

Prepared for:

Honeywell

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Prepared by:

PARSONS
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AUGUST 2009

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Organization: QEA

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Margaret H. Murphy	Program Oversight	315-453-9009		

Organization: QEA

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Margaret H. Murphy	Program Oversight	315-453-9009		

Organization: Parsons

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Maryanne Kosciewicz	Quality Assurance Officer	315-451-9560		

Organization: TestAmerica

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Christina Kovitch	Lab Project Manager	(412) 963-2429		
Nasreen DeRubeis	Lab Quality Assurance Officer	412-963-2425		
Larry Matko	Lab Director	412-963-2439		

Organization: Accutest

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Martin Vitanza	Project Manager	732- 355-4551		
David Speis	Laboratory Director			

Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Point of contact with data users	Lead Organization and Project Manager	Ed Glaza	315-451-9560	All materials and information about the project will be forwarded to the data users by Ed Glaza or his designee.
Manage all project phases	Lead Organization and Project Manager	Ed Glaza	315-451-9560	Ed Glaza will be the liaison with data users.
Manage field collection	Program Oversight Manager	Margaret H. Murphy	315-453-9009 ext. 29	Notify Ed Glaza of field-related problems by phone, email, or fax by COB the next business day.
QAPP changes in the field	Program Oversight Manager	Margaret H. Murphy	315-453-9009 ext. 29	Notify Maryanne Kosciewicz by phone or email of changes to QAPP made in the field and the reasons within one business day. Any major changes to the QAPP must be approved by Maryanne Kosciewicz.
Daily field progress reports	Field Team Leader	Neil Ringler Joseph Mastriano	315-470-6609 315-435-2260	Notify Margaret Murphy of any problems or issues.
Field corrective actions	Program Oversight Manager/Quality Assurance Officer	Margaret H. Murphy	315-453-9009	The need for corrective action for field issues will be determined by Margaret Murphy.
Reporting lab data quality issues to Parsons	Laboratory Project Manager – TestAmerica / Accutest	Christina Kovitch / Martin Vitanza	412-963-2429 / (732) 355-4551	Notify when problems occur, report data and supporting quality assurance information as specified in this QAPP.
Laboratory analytical corrective actions	Laboratory Quality Assurance Manager – TestAmerica / Accutest	Nasreen DeRubeis	412-963-2425	The need for corrective action for TestAmerica analytical issues will be determined by the Project Manager and the Quality Assurance Manager.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Release of laboratory analytical data to Parsons	Laboratory Project Manager – TestAmerica / Accutest	Christina Kovitch / Martin Vitanza	412-963-2429 / (732) 355-4551	No laboratory analytical data can be released until laboratory project manager has approved the release.
Reporting lab data quality issues to Parsons	Laboratory Project Manager – TestAmerica / Accutest	Christina Kovitch / Martin Vitanza	412-963-2429 / (732) 355-4551	No laboratory analytical data can be released until laboratory project manager has approved the release.
Release of laboratory analytical data to project team	Parsons Quality Assurance Officer	Maryanne Kosciewicz	315-451-9560	No laboratory analytical data can be released until Maryanne Kosciewicz has approved the release.
QAPP amendments	Parsons Quality Assurance Officer	Maryanne Kosciewicz	315-451-9560	Any major changes to the QAPP must be approved by Maryanne Kosciewicz before changes can be implemented.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Margaret H. Murphy	Program Oversight Manager	QEA, LLC	Oversight of daily project activities to ensure compliance with project objectives. Provide technical oversight and consultation on major technical and scientific issues, and oversight of field progress. Authorize and document minor adjustments to the field program in response to changing field conditions.	Ph.D Fisheries Biology/Aquatic Ecology, 15 years experience
Neil H. Ringler	Field Staff Coordination	SUNY-ESF	Coordinate and supervise SUNY-ESF field activities; ensure that field procedures are completed in accordance with the work plan and QAPP.	Ph.D Fisheries Biology, 33 years experience
Joseph Mastriano	Field Staff Coordination	OCDWEP	Coordinate and supervise OCDWEP field activities; ensure that field procedures are completed in accordance with the work plan and QAPP.	30 years experience
Maryanne Kosciewicz	Quality Assurance Officer	Parsons	Provide technical quality assurance assistance, oversee quality assurance activities to ensure compliance with QAPP, review and submit quality assurance reports as required, supervise data validation. Maintain the official, approved QAPP.	B.S. Mathematics and Chemistry, 19 years experience

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Larry Matko / David Speis	Laboratory Director	TestAmerica / Accutest	Oversee all TestAmerica's laboratory personnel at the Burlington facility, the activities, equipment, and records; track submittal and receipt of samples to the laboratory; retain all chain-of-custody records; ensure that samples receipt and custody records are properly handled and data are reported within the specified turnaround times. Ensure that laboratory staff maintain and calibrate instruments as necessary, perform internal quality control measures and analytical methods as required, take appropriate corrective actions as necessary, notify QA/QC officer when problems occur, and report data and supporting quality assurance information as specified in this QAPP.	B.S. in Chemical Engineering, 21 years experience /
Christina Kovitch / Martin Vitanza	Laboratory Project Manager	TestAmerica / Accutest	Primary point of contact for TestAmerica, Burlington. Oversee daily project activities to ensure compliance with project objectives. Provide technical oversight and consultation on major technical and scientific issues; oversee field and laboratory progress; deliver data to project participants; organize and maintain project database. Authorize and document minor adjustments to the field/laboratory program in response to changing field conditions.	A.S. Business, 19 years experience /

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Nasreen DeRubeis /	Quality Assurance Officer	TestAmerica / Accutest	Provide technical quality assurance assistance, oversee quality assurance activities to ensure compliance with QAPP, review and submit quality assurance reports as required. Maintain the official, approved QAPP.	B.S. Biology, 22 years of experience /

Project Name Onondaga Lake Baseline Monitoring Projected Date(s) of Sampling June to November, 2009 annually Project Manager: Ed Glaza, Parsons	Site Name Onondaga Lake Site Location Syracuse, NY

Date of Session: several (see comments below)
Scoping Session Purpose: to discuss baseline monitoring needs

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Margaret H. Murphy	Scientist	Anchor QEA	315-453-9009	mmurphy@anchorqea.com	Technical Support to Honeywell
Mark LaRue	Scientist	Anchor QEA	315-453-9009	mlarue@anchorqea.com	Technical Support to Honeywell
John McAuliffe	Project Manager	Honeywell	315-431-4443	John.mcauliffe@honeywell.com	Overall Project Manager
Betsy Henry	Technical Oversight	Exponent	518-370-5132	henryb@exponent.com	Technical support to Honeywell
Ed Glaza	Project Manager	Parsons	315-451-9560	edward.glaza@parsons.com	Technical support to Honeywell
Tim Larson	Project Manager	NYSDEC	518-402-9767	tjlarson@gw.dec.state.ny.us	NYSDEC Project Manager
Robert Montione	Senior Scientist	AECOM	518-951-2226	robert.montione@earthtech.com	Technical support to NYSDEC
Michael Spera	Senior Project Director	AECOM	212-798-8577	michael.spera@earthtech.com	Technical support to NYSDEC

Comments/Decisions: The Baseline and Long-Term Monitoring Technical Work Group met on June 6 and October 25, 2007 and on January 17, 2008 to discuss baseline monitoring needs. Participants varied, but included representatives from Syracuse University, Upstate Freshwater Institute, Exponent, Parsons, NYSDEC, USEPA, EarthTech, and USFWS. Minutes of these meetings are on file. Honeywell presented the work scope to NYSDEC by conference call on April 23, 2008. The Technical Work Group met again on January 29, 2009 to discuss baseline monitoring needs for 2009.

Action Items: Revised and finalized work plan to address NYSDEC's May 16, 2008 and June 27, 2008 comments on the draft Book 2 Work Plan. Parsons submitted the 2009 addendum to 2008 work plan on March 10, 2009..

Consensus Decisions: _____

_____

Problem Definition and Background

The purpose and background for the remediation of the Onondaga Lake Bottom Subsite are summarized in the ROD (NYSDEC and USEPA, 2005) and presented in detail in the Feasibility Study Report (Parsons, 2004).

The overall goal of baseline monitoring is to document the condition of the lake prior to remedial action. This monitoring will permit evaluation of changes that result from remedial action and verification of remedy effectiveness in achieving the remedial action objectives and preliminary remedial goals. As described in the Baseline Monitoring Scoping Document (Parsons 2008), the Baseline Monitoring Program for Onondaga Lake has three program objectives:

- Establish a comprehensive description of baseline chemical and physical conditions prior to remediation to assess remedy effectiveness and to facilitate remedy design;
- Provide additional data for future understanding of remedy effectiveness in achieving preliminary remediation goals (PRGs); and
- Provide habitat-related information.

Specific objectives for the biota baseline monitoring include:

- Provide basis to measure achievement of PRG 2 (fish tissue target concentrations); and
- Assess biological factors that may contribute to variability in fish mercury concentrations.

Project Description

The monitoring program described in this QAPP was developed to establish baseline chemical concentrations in fish, and provide a basis to measure achievement of fish tissue target concentrations (PRG 2). The primary task will be to collect sport fish fillets (and tissue plugs) and whole body composites of prey fish to assess human health and ecological exposure. In addition, the monitoring program will include an assessment of biological factors that contribute to variability in fish mercury concentrations to assist in understanding the future effectiveness of the remedy in achieving fish tissue target concentrations. Toward this end, baseline biota monitoring will include analysis of the food web and an assessment of fish population and community composition. See Figure 1 in the Book 2 work plan for fish sampling locations.

UFI and SU. 2008. Onondaga Lake Baseline Monitoring Book 1: Deep Basin Water and Zooplankton Monitoring Work Plan for 2008. Prepared for Honeywell, Morristown, NJ. Upstate Freshwater Institute and Syracuse University, Syracuse, NY.

Who will use the data?

Data collected through the Biota Baseline Monitoring Program will be used by the Baseline/Long-Term Monitoring Technical Working Group, NYSDEC, USEPA, and OCDWEP.

What will the data be used for?

The primary data uses for biota monitoring are:

- to provide a basis to measure achievement of PRG2 (fish tissue concentrations); and
- to assess biological factors that may contribute to variability in fish mercury concentrations.

What type of data are needed?

Biota monitoring includes fish and invertebrate samples collected for laboratory analysis and measurements made for community assessments. The target analytes for laboratory analysis of tissue are as follows:

- Total mercury (USEPA Method 7471A)
- Polychlorinated biphenyls (PCBs) (Aroclors) (subset of adult smallmouth bass and walleye only)
- DDT and metabolites (subset of adult smallmouth bass and walleye only)
-
- Lipid content (subset of adult smallmouth bass and walleye only).

Additional parameters measured on fish include:

- Age
- Sex
- Weight (in grams)
- Total length (in mm).

Field measurements for water quality will also be made for:

- Temperature
- Dissolved oxygen
- Conductivity
- pH.

Concentration levels (i.e., project action and quantitation limits, analytical and achievable laboratory method detection and quantitation limits)

for the laboratory analytes are documented in Worksheet #15, field sampling techniques are referenced in Worksheet #21, and laboratory analytical techniques are referenced in Worksheet #23.

How "good" do the data need to be in order to support the environmental decision?
The data must support a long-term trend analysis for chemical concentrations in fish and invertebrates. The key analytes in terms of decision-making are total mercury and methylmercury. All analytes will be subject to Level III validation as described in the Pre-Design Investigation QAPP (Parsons 2005) and procedures described in Worksheet #36. In addition, ten percent of the total mercury, PCBs, and DDT and metabolites data will be validated based on Level IV protocols as described in Worksheet #36.

How much data are needed? (number of samples for each analytical group, matrix, and concentration)
See Worksheet #18

Where, when, and how should the data be collected/generated?
Samples for chemical analyses will be collected from Onondaga Lake from June through September using field sampling techniques summarized in Worksheet #21 and provided in Appendix A to the work plan.

Who will collect and generate the data?
Samples will be collected by Anchor QEA, SUNY-ESF, and Onondaga County Department of Water Environment Protection (OCDWEP)

Anchor QEA activities are as follows:

- Provide program oversight
- Collect adult sport fish (brown bullhead, pumpkinseed, smallmouth bass, and walleye) and prey fish for tissue analysis

SUNY-ESF activities are as follows:

- Conduct adult sport fish population surveys
- Assess juvenile fish abundance and distribution
- Gut content analysis
- Assist with adult sport fish collection for tissue analysis

OCDWEP activities are as follows:

- Conduct juvenile seining for prey fish tissue collection/analysis during the summer.

Laboratory analyses will be performed by TestAmerica.

How will the data be reported?
The data will be presented in the Data Summary and Usability Report referenced in the Work Plan.

How will the data be archived?
All field and laboratory data and chain of custody information will be stored in Parsons LocusFocus EIM (Locus Technologies) data management system. Additionally, field databases developed using Microsoft Access VBA used during sample collection will be archived by Parsons or Anchor QEA. The electronic data management systems will be implemented to process the information effectively without loss or alteration.

TestAmerica stores sample handling, laboratory data, and administrative records in a secure fashion. All records are stored in archived storage, and electronic records consist of hard copies, write-protected backup copies, or an electronic audit trail controlling access. All electronic records are backed up on the TestAmerica archive server on the local area network. All records are removed from the archive and disposed after 5 years, unless otherwise specified by a client or regulatory requirement.

Sampling Tasks:

1. Adult sport fish and prey fish sampling via electroshocking, netting, or angling. Fillets and tissue plugs will be taken from sport fish consistent with SOP SB-3 (see Worksheet #21) while single-species whole body composites will be collected for prey fish. Total length and weight measurements of individuals will be taken and sex will be determined if possible. Scales will be sampled from adult sport fish to estimate age; otoliths also will be removed from walleye and smallmouth bass for age estimation. Gut contents will be assessed on adult sport fish prior to processing fish using gastric lavage per SOP SB-4 (see Worksheet #21).
2. For adult individuals, eight locations will be sampled to collect 50 individuals of four species (smallmouth bass, walleye, brown bullhead, pumpkinseed sunfish). If possible, adult sport fish will be evenly distributed among the sampling locations.
3. A maximum of five composite samples will be collected from each of eight locations for prey fish during summer. Composites will consist of 10 to 15 individuals of one species. Reasonable attempts will be made to include at least two alewife composites (less than 180 mm total length) in the prey fish samples from each location.

Analysis Tasks:

1. TestAmerica will perform all chemical analyses.
2. Fish catch results will be analyzed for community composition per SOP SB-6 (see Worksheet #21) and select species will have population estimates calculated per SOP SB-5 (see Worksheet #21).

Quality Control Tasks:

1. The Anchor QEA field team leader will evaluate all samples and applicable field quality control samples for acceptability for transport/submission to the laboratory.

2. Implement SOPs for sample collection, packaging, transport, and storage prior to analysis. QC sample handling protocols are described on Worksheet #26.

Secondary Data:

1. See Worksheet #13.

Data Management Tasks:

Records generated during sample collection and analyses document the validity and authenticity of the project data. The project team will maintain a field database as a temporary repository for all sampling records generated in the field. Field and analytical data from the laboratory will later be transferred to the LocusFocus data management system maintained by Parsons for Honeywell, Inc.

Documentation and Records:

1. 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.
2. Appropriate records will be maintained to provide adequate documentation of the entire data generation process, including field sampling and laboratory analysis.
3. Field sampling records will include
   a. Electronic field logs and field notebooks to records daily activities and conditions;
   b. an electronic field data management system (database) and
   c. sample Chain-of-Custody documentation.
4. Lab documentation will include
   a. operational calibration records,
   b. maintenance records,
   c. nonconformance memos,
   d. corrective action memos, and
   e. analytical data reports.

Assessment/Audit Tasks:

1. Project oversight (field and laboratory) will consist of periodic inspection and audits of sampling and analytical techniques, as required by NELAC/ELAP (annual internal laboratory and field audit; external audit by NELAC/ELAP certified inspectors every two years). No additional field or laboratory audits are planned. Testing and calibration activities will also be reviewed. All audit and review findings and any corrective actions that arise from them will be documented. The laboratory director will ensure that corrective actions are carried out promptly. Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, immediate corrective action will be taken, and any client whose work is affected will be notified immediately in writing.
2. The following reports may be completed if a deviation from the field sample matrix or QAPP is encountered, or to document an audit:
   a. Corrective action reports documenting any problems encountered during field activities and corrective actions taken;
   b. System and performance audit reports completed during the investigation and a summary of any changes made to documented procedures, and the rationale for the changes.
3. See Worksheets #31 and #32 for explanation of project assessments, assessment findings, and corrective action responses.

Data Review Tasks:

1. The laboratories will perform data reduction as described in each test method for this project and will submit sample results and QA/QC results.
2. The laboratory quality assurance officer and/or laboratory director are responsible for reviewing the laboratory data and QA/QC reports,

and checking data reduction prior to submittal to Honeywell. The laboratory will correct any transcription or computational errors identified during this review.

3. Test results are certified to meet all requirements of the NELAC standards, or reasons are provided if they do not.

Activities	Organization	Dates (2009)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Mobilization/Demobilization	ESF/OCDWEP/ Anchor QEA	May	October	NA	NA
Fish tissue sampling	ESF/OCDWEP/ Anchor QEA	June	August	Data	March 2010
Fish community assessment	ESF/OCDWEP	May	October	Data	March 2010
Fish gut analysis	ESF	June	October	Data	March 2010
Field database	Anchor QEA	May	Late November	Field database exports	September/October 2009 and December/January 2010
Scientific oversight	Anchor QEA/Exponent	May	Late November	NA	NA
Sample analysis	TestAmerica / Accutest	August	December	Unvalidated data	Quarterly
Data Usability and Summary Report (DUSR)	Anchor QEA/Exponent	January 2010	March 2010	2009 DUSR	March 2010

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):
Fish sampling locations will be dispersed among eight locations around the lake, coinciding with historical tissue sampling locations occupied during the RI, as well as sampling locations occupied by OCDWEP.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations):

See Figures 1 and 2 in Book 2 work plan for sampling locations. See Worksheet #18 for matrices, analytical groups, concentration levels, and number of samples. The number of locations, samples per location, sampling duration within each month is presented in the table below.

Activity	Number of Locations[1]	Number of samples per location	Number of species	Sample Preparation	Duration
Adult sport fish tissue	8	6-7	4	Fillets and tissue plugs	Approximately 15 days in June
Prey fish tissue	8	5	Variable (samples are composites of a prey species)	Whole body composite	Approximately 5 days in August

[1] Adult sport fish samples will be targeted from eight locations around the lake; if sampling is difficult in some locations, a maximum of 25 adults per species will be collected from each basin.

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (field duplicates)[1]	Sampling SOP Reference[2]	Rationale for Sampling Location
Lakewide	Adult sport fish (4 species)	Littoral zone	Total mercury	Low	400	SB-1	See Worksheet #17
			PCBs	Low	24		
			DDT and metabolites	Low	24		
			%Lipids	Low	24		
Lakewide	Prey fish (composite samples)	Littoral zone	Total mercury	Low	40	SB-1	

[1] Field duplicates not collected for tissue.
[2] See Worksheet #21.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[1]	Sample Mass or Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Fish Tissue	Total mercury	Low	LB-1	2-10 g; 1 g for tissue plug analysis	Plastic or Teflon bottle (250-500 mL)	Cool, 4°±2°C until homogenized and sub-sampled and then freeze to <-10°C, or freeze dry	6 months (preserved)
	Total PCBs (Aroclor)	Low	LB-4	40 g	appropriate-sized wide mouth glass jar w/Teflon® lined cap[2]	Cool, 4°±2°C until homogenized and sub-sampled and then freeze to <-10°C	1 year to extraction, 40 days to analysis
	Pesticides: DDT and metabolites,	Low	LB-9	10 g	Appropriate-sized wide mouth glass jar w/Teflon® lined cap[2]	Cool, 4°±2°C until homogenized and sub-sampled and then freeze to <-10°C	1 year to extraction, 40 days to analysis
	Percent lipids	Low	LB-6	20 g	Appropriate-sized wide mouth glass jar w/Teflon® lined cap[2]	Cool, 4°±2°C until homogenized and sub-sampled and then freeze to <-10°C	1 year to extraction, 40 days to analysis

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).
[2] After homogenization of sample.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations[2]	No. of Field Duplicate Pairs	Inorganic No. of MS[3]	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Fish Tissue	Total mercury	Low	LB-1	440[4]	NA	NA	NA	NA		440
	Total PCBs (Aroclor)	Low	LB-4, LB-7	24[5]						24
	Pesticides: DDT and metabolites and	Low	LB-9							24
	Percent lipids	Low	LB-6	24[5]						24

[1]See Analytical SOP References table (Worksheet #23).
[2]If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.
[3]Matrix spike and matrix spike duplicate samples will be prepared by the laboratory at a frequency of at least one pair per 20 samples, unless otherwise noted.
[4]For adults: 8 locations, 4 species, 50 fish per species for a total of 200 fillet samples. In addition, 200 tissue plug samples (4 species, 50fish per species) will be analyzed. For prey fish, 8 locations, 5 composites per location, for a total of 40 samples.
[5]PCB DDT and metabolites, , and lipids analysis on 24 adult sport fish samples.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
SB-1	Fish Collection	Anchor QEA	Seine, gill net, trap net, electroshocking boat, balance for weighing fish, measuring board, aluminum foil, resealable plastic bags	N	Includes information on decon procedures and sample handling
SB-3	Biota Tissue Processing	Anchor QEA	Knife, scale, dermal punch	N	Includes information on decon procedures and sample handling
SB-4	Fish Stomach Sampling	Anchor QEA	Hand-pumped compression sprayer, polyethylene tubing, funnel with 500 um mesh	N	
SB-5	Adult Sport Fish Population Estimate	Anchor QEA	Dip nets, fish holding tanks or live wells, knife or scissors for fin clips, tagging gun, T-anchor tags, measuring board, marking gun	N	
SB-6	Fish Community Assessment	Anchor QEA	Fish holding tanks or live wells, measuring board, balance for weights, water quality meter	N	

Sampling SOPs are provided in Appendix A of this work plan.

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization):Margaret H. Murphy, Anchor QEA
Sample Packaging (Personnel/Organization): Margaret H. Murphy, Anchor QEA
Coordination of Shipment (Personnel/Organization): Margaret H. Murphy, Anchor QEA
Type of Shipment/Carrier: Samples for chemical analysis shipped on ice by overnight shipment to TestAmerica
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): TestAmerica
Sample Custody and Storage (Personnel/Organization Laboratory Staff/TestAmerica
Sample Preparation (Personnel/Organization): Laboratory Staff/TestAmerica
Sample Determinative Analysis (Personnel/Organization): Laboratory Staff/TestAmerica
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): See Worksheet #19
Sample Extract/Digestate Storage (No. of days from extraction/digestion): See Worksheet #19
Biological Sample Storage (No. of days from sample collection): See Worksheet #19
SAMPLE DISPOSAL
Personnel/Organization: Laboratory Staff/TestAmerica
Number of Days from Analysis: 6 months (TestAmerica)

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Standard procedures for sample collection and shipping will be followed such that samples are preserved and stored as required (Worksheet #19). All field measurements and sample collection activities will follow approved standard operating procedures. The general procedure is as follows:

- Tissue samples will be collected according to the sampling SOPs.
- Appropriate field notes will be taken throughout the sampling process or entered directly into a field database, and sample locations, depths, and types will be checked/verified against the field sampling matrix (FSM) in the project work plan.
- Samples will be kept on ice while in the field.
- Any sample-handling difficulties that are encountered in the field will be described in the field database.
- The samples will be delivered to the appropriate laboratory with a fully documented chain-of-custody form.
- Field personnel are responsible for making sure all documentation has been completed and turned over to the laboratory and/or other support personnel.
- The field log will be reviewed and sample integrity verified as part of the data validation procedures.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

On receipt, laboratory personnel will check samples, and the cooler temperature will be determined. The temperature and condition of the samples will be recorded at the laboratory, and any problems will be described in the narrative for the data report. The field log and narrative will be reviewed during the quality assurance review, and data will be flagged if the sample integrity was compromised. Data may be rejected as unusable if severe handling problems are encountered.

Sample Identification Procedures:

The laboratory will log in the samples, verify the sample containers/labels against the chain of custody, and assign a unique sample identification number to each sample, which will be attached to that sample throughout the life of the sample. Laboratory personnel are responsible for verifying that all required documentation has been completed by field personnel. Laboratory records related to sample handling and analysis are maintained through all stages of the analytical process. All laboratory processes, activities, and SOPs comply with NELAC standards and are fully documented in TestAmerica's Quality Assurance Manual.

Chain-of-custody Procedures:

A continuous record of the possession and proper handling of samples must be documented, so that sample custody and handling are traceable from the time of sample collection until the analytical data have been validated and accepted for use.

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time[1]	Laboratory/ Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/ Organization (Name and Address, Contact Person and Telephone Number)
Fish Tissue, ,	Total mercury	Low	See Worksheet #17	LB-1	28 days	TestAmerica Pittsburgh (adult sport fish) 301 Alpha Drive Pittsburgh, PA 15238 Christina Kovitch (412) 963-2429 Accutest (prey fish) Martin Vitanza (732) 355-4551	N/A
Fish Tissue	Total PCBs	Low	See Worksheet #17	LB-4	28 days		N/A
	Pesticides: DDT and metabolites,	Low	See Worksheet #17	LB-9	28 days		N/A
	Lipids	Medium	See Worksheet #17	LB-6	28 days		N/A

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. A copy of the chain-of-custody forms will be attached to the data report.	I	Laboratory Staff, TestAmerica
Field notes	Field notes will be reviewed internally and placed in the site file. A copy of the field notes will be attached to the final report. TestAmerica Project Manager will review notes as provided by Parsons with chain-of-custody documentation.	I	Laboratory Staff, TestAmerica

Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received data packages will be verified externally according to the data validation procedures specified in Worksheet #36	I, E	Laboratory Staff, TestAmerica

The laboratory analyst and group supervisor or experienced peer will perform a verification of chemical data. The laboratory will be responsible for the review and verification of all work sheets and data packages, manual entry or transcription of data, and any professional judgments made by an analyst during sample preparation, analysis, and calculation, and reporting of the final concentrations. The laboratory will also be responsible for reviewing quality control results to determine whether data are of usable quality or reanalysis is required. Any nonconformance issues identified during the laboratory's quality assurance checks will be corrected and noted by the laboratory. Close contact will be maintained between the Laboratory Director, the QA Officer, and the Scientific/Technical Manager, so that any quality issues can be resolved in a timely manner. Any data quality deviations will be discussed in the laboratory data narrative, including the direction or magnitude of any bias to the data, if possible.

Responsibilities for verification of data and sampling activities

Project Personnel	Verification Activity
Compliance	
Field Manager/ Parsons QA Officer	Assign appropriate staff to perform the work and ensure that all field personnel are familiar with the field SOPs
	Verify that the proper sampling protocols, including sample preservation, handling, and storage are performed during field work
	Track the samples sent to the laboratories; verify that the chain-of-custody forms are filled out correctly and that samples were received in good condition at the appropriate laboratory
	Verify that the appropriate number of field blanks and sample duplicates/triplicates are collected
	Conduct field data collection audit to ensure that the proper field procedures are followed
Parsons QA Officer/ TestAmerica Second Level Reviewer	Verify that the laboratory instruments are calibrated, and quality control samples are analyzed (e.g., blanks, duplicates, MS/MSD, LCS)
	Verify that the laboratory conducted proper calibration and quality control sample procedures (i.e., the laboratory followed the contract scope of work)
	Confirm that the analytical data meet specified detection limits in analytical SOPs
Correctness	
	Inspect and ensure that the field and analytical equipment are calibrated and properly functioning in accordance with field instrument user manuals and laboratory QA manuals
Parsons QA Officer TestAmerica Analyst and Second Level Reviewer	Review data reduction process, examine the raw data to verify that the correct calculations of sample results were reported by the laboratory or transferred from field logs, examine the raw data for any anomalies, and verify that there are no transcription or reduction errors
Consistency (Comparability)	
Parsons QA Officer	Ensure that proper data-handling procedures were followed (e.g., the SOPs and contract scope of work are followed consistently throughout the project); recheck any handwritten data in field logs for transcription errors
	Review data transfer procedures and make all efforts to minimize data problems
Completeness	
Field Manager	Verify proper documentation of chain-of-custody and sample handling/transfer procedures, document any problems encountered during sample collection, identify any problems with damaged samples, and confirm with laboratory that all samples have been received
Field Manager Parsons QA Officer	Ensure that an accurate record was maintained during sample collection and analysis
Test America Analyst, Second Level Reviewer, and Project Manager	Document that general quality control measures were conducted (e.g., instrument calibration, routine monitoring of analytical performance, calibration verification)

Project Personnel	Verification Activity
	Ensure that a unique sample number was assigned to each sample Document deviations from scope of work (e.g., analytical procedures), document any corrective actions taken if QC checks identify a problem, ensure that the appropriate analytical method was used.

Note: LCS - laboratory control sample
MS/MSD - matrix spike/matrix spike duplicate
QA/QC - quality assurance and quality control
SOP - standard operating procedure

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	All Matrices	All Analyses	Low	QAPP Worksheets #12, #15, and #28	Parsons

Data verification and assessment will be completed by Parsons. EPA has not prepared national functional guidelines for the low-level total mercury analyses. Therefore, total mercury data will be verified and assessed following the "evaluation procedures" specified in National Functional Guidelines (e.g., assessment of holding times, accuracy, and precision data). For these data, method-specific quality control requirements and laboratory-established control limits (as presented in the QAPP), as they are applicable to the analytical methods being used, will be used to determine whether data require qualification. PCBs data will be verified and assessed according to USEPA's National Functional Guidelines for Organic Data Review (USEPA 1999). The method-specific quality control requirements and laboratory-established control limits (as presented in the QAPP) will be relied on for data evaluation and qualification when these limits differ from those presented in the National Functional Guidelines for the PCB analyses. In addition to the guidance documents cited, a primary source of validation criteria will be applicable USEPA Region 2 data review SOPs. Specifically, SOP HW-2 will be used for total mercury (with slight modification based on differences between the CLP SOW and SW-846) and HW-45 for PCBs by Method 8082A. To the extent applicable, the Region 2 SOPs will take precedence over the more generic National Functional Guidelines.

Consistent with the Pre-Design Investigation QAPP (Parsons 2005), the first phase of the data review process is contract compliance screening (CCS) and involves review of sample data deliverables for completeness. The PDI QAPP describes this process as follows:

> "Completeness is evaluated by ensuring that all required data deliverables are received in a legible format with all required information. The CCS process also includes a review of the chain-of-custody forms, case narratives, and reporting limits. Sample resubmission requests, documentation of nonconformances with respect to data deliverable completeness, and corrective actions often are initiated during the CCS review. The results of the CCS process are incorporated into the data validation process."

The second phase of data review is data validation. As discussed in Worksheet #11, EPA Level III validation protocol will be applied to all analytes except total mercury

> The EPA Level III validation protocol….includes a review of summary information to determine adherence to analytical holding times; results from analysis of field duplicates, method blanks, field blanks, surrogate spikes, MS/MSDs, LCSs, and sample temperatures during shipping and storage. Data qualifiers are applied to analytical results during the data validation process based on adherence to method protocols and laboratory-specific QA/QC limits.

For Level III validation, instrument calibrations, calculations, and transcriptions will not be checked because the laboratories will be responsible for 100-percent verification of these results and procedures. For total mercury, total PCBs, and DDT and metabolites, (i.e., the Level IV data quality objectives), ten percent of the data will undergo a Level IV validation, which incorporates the Level III validation protocol and adds calculation checks from the raw data of reported and

summarized sample data and QC results.

Data qualifiers will be applied to the results according to procedures described in the EPA Contract Laboratory Program national functional guidelines for inorganic data review (U.S. EPA 2004), as applicable, with modifications as appropriate to accommodate method-specific quality control requirements or when specific MQOs and DQIs established for this project (e.g., control limits for bias and precision) are not achieved.

Algorithms to Assess Quality Control Results

Data verification includes checking that quality control procedures were included at the required frequencies and that the quality control results meet control limits defined in the method descriptions. The equations provided below will be used to determine whether measurement targets for project requirements were met for each quality control procedure.

Duplicate and Triplicate Analyses — Precision for duplicate chemical analyses will be calculated as the relative percent difference (RPD), expressed as an absolute value, between the duplicate samples. Replicate precision will only be assessed for sample results greater than 5 times the method detection limit due to increased variability at low concentrations. When replicate results are less than 5 times the method detection limit the absolute difference of the results will be evaluated. The formula that will be used to assess precision for both laboratory and field duplicate samples is as follows:

$$\text{RPD} = \left| \frac{D_1 - D_2}{(D_1 + D_2)/2} \right| \quad 100$$

where:

D1 = sample value, and

D2 = duplicate sample value.

The percent relative standard deviation of triplicate sample data points will be calculated to evaluate replicate precision. The formula for relative standard deviation is as follows:

$$\%RSD = \frac{100 \times s}{\bar{x}}$$

where:

s = standard deviation, and

$\bar{x}$ = mean sample value.

Matrix Spike Recoveries — Spiked samples provide an indication of the bias of the analytical system. The recovery of MSs will be calculated as the ratio of the recovered spike concentration to the known spiked quantity:

$$\%R = \frac{A - B}{C} \times 100$$

where:

A = the analyte concentration determined experimentally from the spiked sample,

B = the background level determined by a separate analysis of the unspiked sample, and

C = the amount of the spike added.

Completeness — Completeness will be calculated for each sample type by dividing the number of valid measurements (all measurements except rejected data) actually obtained by the number of valid measurements that were planned:

$$\%\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100$$

To be considered complete, the data sets must also contain all quality control check analyses that verify the precision and accuracy of the results.

Sensitivity — The detection limit of the sample preparation and analysis process is defined as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte is greater than zero" (40 CFR 136B); it is the concentration at which qualitative, not quantitative, identification can be made.

Best professional judgment is used to adjust the limit of detection upward in cases where high instrument precision (i.e., low variability) results in a calculated limit of detection and equivalent instrument response that are less than the absolute sensitivity of the analytical instrument. The actual reporting limit for environmental samples is generally higher than the instrument detection limit, because the sample matrix tends to contribute to fluctuations in the instrument's background signal. Although reporting limits have been established (Worksheet #15 series), achievement of these reporting limits is based on the analysis of samples without matrix interferences. In the event that matrix interferences are encountered (on a sample-specific basis), laboratory personnel will determine whether elevated *reporting limits* are required. Whether to report elevated reporting limits will be determined based on the experience of the laboratory with samples of matrix similar to those collected for this study and on the response of each instrument to samples for this study. The MRLs will be verified during data validation.

Blanks Actions – The data will be assessed in accordance with the general guidance specified by the Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2004) since the quality control associated with these analyses are similar to the inorganic methods. With the exception of mercury, there are no published data validation procedures for these analytical methods. For this study the data validator will try to limit the negation of results due to blank action levels (U qualified) based on the judgment that imprecise low concentration results are more useful in the analysis for this

study then negated results. Sample results will be compared to the associated instrument, method, and field blank results to assess the potential for contamination. Sample results less than 5 times the associated blank concentration will be qualified as estimated and potentially biased high (J+).

Reference:

Parsons. 2005. Onondaga Lake Pre-Design Investigation Quality Assurance Project Plan, Syracuse, New York. Prepared for Honeywell, Morristown, NJ. Parsons, Liverpool, NY.

USEPA. 1999. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. EPA-540/R-99-008. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, Washington, DC.

USEPA. 2004. USEPA Contract Laboratory Program national functional guidelines for inorganic data review. EPA/540-R-04-004. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

USEPA. 2005. USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review. EPA-540-R-05-001. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.