

**Susitna-Watana Hydroelectric Project
(FERC No. 14241)**

**Mercury Assessment and Potential for
Bioaccumulation Study
Study Plan Section 5.7**

**Part D: Supplemental Information to
June 2014 Initial Study Report**

Prepared for

Alaska Energy Authority



SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

URS Corporation

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1. INTRODUCTION

Section 1 (Part A) of the ISR for this Mercury Assessment and Potential for Bioaccumulation Study (Study Plan 5.7) details the development of this study from the Revised Study Plan (RSP) in 2012, through the end of the 2013 study season. Section 7 of the ISR (Part C), filed in June 2014, sets forth AEA's plan and schedule, at that time, for completing this study and meeting the objectives of the RSP.

As detailed in Section 2.2 of the ISR Part D Overview, various circumstances have required AEA to extend the original timeframe for completing the Commission-approved Study Plan. However, AEA has made meaningful progress with Study 5.7 since the filing of the ISR in June 2014. As detailed below, AEA's recent activities for Study 5.7 have consisted of the following:

- Completed the Harrison and Hutchison modeling of the anticipated mercury concentrations in the proposed reservoir.
- Performed a pathway analyses for mechanisms by which the mercury could enter the terrestrial environment.

The primary purpose of this Part D Supplemental Information to the ISR is to report on the implementation of the Study Plan from the filing of the ISR in June 2014, through the 2014 Study Implementation Report. In light of this additional implementation, this Part D also identifies AEA's plans for completing Study 5.7 in a manner that meets the objectives of the Commission-approved Study Plan.

2. BACKGROUND

2.1. Purpose of Study

Previous studies have documented increased mercury concentrations in fish and wildlife following the flooding of terrestrial areas to create hydroelectric reservoirs. The purpose of this study is to assess the potential for such an occurrence in the proposed Project area.

2.2. Study Components

The study objectives as established in Study Plan (Section 5.7.1) are as follows:

- Summarize available and historic mercury information for the Susitna River basin, including data collection from the 1980s Alaska Power Authority (APA) Susitna Hydroelectric Project.
- Characterize the baseline mercury concentrations of the Susitna River and tributaries. This will include collection and analyses of vegetation, soil, water, sediment pore water, sediment, piscivorous birds and mammals, and fish tissue samples for mercury.

- Utilize available geologic information to determine if a mineralogical source of mercury exists within the inundation area.
- Map mercury concentrations of soils and vegetation within the proposed inundation area. This information will be used to develop maps of where mercury methylation may occur. Use the water quality model to predict where in the reservoir conditions (pH, dissolved oxygen [DO], turnover) are likely to be conducive to methylmercury (MeHg) formation.
- Use modeling to estimate MeHg concentrations in fish.
- Assess potential pathways for MeHg to migrate to the surrounding environment.
- Coordinate study results with other study areas, including fish, instream flow, and other piscivorous bird and mammal studies.

3. STATUS, HIGHLIGHTED RESULTS, AND ACHIEVEMENTS

The following tasks were completed in 2013 and reported in Part A of the ISR for Study 5.5:

- Historical information was researched, including data from the 1980s Alaska Power Authority (APA) Susitna Hydroelectric Project.
- Collection and analyses of baseline vegetation, soil, and water samples.
- Collection and analyses of sediment/porewater samples at four of the ten locations identified in the Study Plan.
- Survey of bird nesting and attempts to collect bird feathers for analyses.
- Review of records for trapping of piscivorous mammals.
- Collection and analyses of fish samples.
- Determination of no geological source for mercury in the inundation zone via records and geologic review.
- Coordinated with other studies to obtain information on geology, fish, birds, and mammals in the study area.

The study team has completed the following activities for Study 5.5 since the June 2014 filing of the ISR:

- Completion of collection and analyses of water samples.
- Completion of sample collection for sediment/porewater samples.
- Additional review of options for bird sampling.
- Collection and analyses of fur samples for 2 otter and 2 mink.

- Completed mapping of mercury concentrations in soils and vegetation.
- Completed QA/QC of all analytical results.
- Initiated parameterization and configuration of the water quality model.
- Completion of Harrison and Hutchison Modeling to estimate mercury concentrations in fish post inundation.
- Preliminary pathway assessments to evaluate how MeHg may migrate from the reservoir to the surrounding environment.
- Coordinated with other studies to obtain information on geology, fish, birds, and mammals in the study area.

4. SUMMARY OF STUDY 4.5 DOCUMENTS

Since filing of the RSP in 2012, AEA and FERC have prepared several documents pertaining to this study. To aid review by FERC staff and licensing participants, each of these documents is listed below. Each of these documents is accessible on AEA's Project licensing website (<http://www.susitna-watanahydro.org/type/documents/>) by clicking on the entry in the "Link" column in the table. In addition, these documents are available on FERC's eLibrary system (<http://www.ferc.gov/docs-filing/elibrary.asp>), in Docket No. P-14241.

Title	Date	Description	Link
5.7. Mercury Assessment and Potential for Bioaccumulation Study (Revised Study Plan)	12/14/2012	This document presents the plan for this study, including goals, objectives, the study area, and proposed study methods for mercury studies.	
RSP Attachment 5-3 Mercury Assessment and Potential for Bioaccumulation Study Sampling and Analyses Plan (SAP)/Quality Assurance Project Plan (QAPP)	12/14/2012	SAP/QAPP for Study 5.7.	RSP for Study 05.07
Study 5.7 Mercury Assessment and Potential for Bioaccumulation	2/22/13	Results of the 2012 preliminary sampling effort.	Feb. 2013 TM for Study 05.07
FERC Study Plan Determination for Study 5.7	2/1/2013	This document presents FERC approval of Study 5.7, which approved AEA's Revised Study Plan with additional	FERC SPD for Study 05.07

		recommendations.	
Draft Initial Study Report for Study 5.7	2/3/2014	This draft of the ISR summarized the study methods and variances during the 2013 study season, and presented preliminary data collected for Study 5.7. This draft ISR was later republished as Part A of the final ISR.	Draft ISR for Study 05.07
Initial Study Report for Study 5.7	6/3/2014	This document is the Initial Study Report (Parts A, B and C) for Study 5.7. Part A republishes the Draft ISR. Part B identifies supplemental information and errata in Part A. Part C presents study modifications and plans for completing the study.	ISR Part A for Study 05.07 ISR Part B for Study 05.07 ISR Part C for Study 05.07
Evaluation of Continued Mercury Monitoring Beyond 2014	9/30/2014	Decision document on extending mercury study area.	Sept. 2015 TM for Study 05.07
Initial Study Report Meetings, Study 5.7 Mercury Assessment and Potential for Bioaccumulation Study	11/15/2014	Transcripts and AEA's agenda and PowerPoint presentations for the ISR meeting concerning water quality.	Transcript from ISR Meeting Materials from ISR Meeting
2014-2015 Study Implementation Report, Study 5.7 Mercury Assessment and Potential for Bioaccumulation Study	11/6/2015	AEA's 2014 Study Implementation Report describing current progress on development of mercury pathway models and how mercury data is being analyzed in proposed models.	2014 SIR for Study 05.07 (File 1) 2014 SIR for Study 05.07 (File 2)

5. NEW STUDY DOCUMENTATION SUPPLEMENTING THE ISR

The following table identifies and describes additional reports and other documents that update, refine, or otherwise supplement certain sections of the ISR pertaining to this Study 5.7, during AEA's continued implementation of the Study Plan through calendar year 2014.

ISR Reference	Description
ISR Part A: Section 5.7.1	Evaluation of Continued Mercury Monitoring Beyond 2014 Technical Memorandum (September 2014). A discussion of the need for continued monitoring of mercury data beyond 2014 and whether the existing data collection efforts are sufficient to satisfy objectives for characterizing baseline mercury conditions in the Susitna River and tributaries

ISR Part A: Section 5.7	Mercury Assessment and Potential for Bioaccumulation Study Plan Section 5.7 2014 Study Implementation Report (November 2015)
ISR Part A: Section 5.7	Mercury Assessment and Potential for Bioaccumulation Study Plan Section 5.7 Appendix A: Mercury Assessment Pathways Analysis (November 2015)
ISR Part B	Additional Errata to Evaluation of Continued Mercury Monitoring Beyond 2014 Technical Memorandum (November 2014)
ISR Part C: Section 7.0	Update Regarding Study Plan Implementation During 2014 Field Season (March 24, 2014). Update information on sampling plans.
ISR Appendix A	Appendix A: Mercury Assessment Pathways Analysis Technical Memorandum (September 2015). Provided information on the mercury pathway assessment for the project.

6. VARIANCES

6.1. 2013 Study Season

The following variances are reported in the Study 5.5 ISR, Part A:

- Table 5.7-5 in Study Plan Section 5.7.4.2.3 summarizes the proposed water sampling locations for mercury analysis in water. PRM 225.5 (Susitna near Cantwell) could not be sampled due to limited access by helicopter. The sample site was relocated to PRM 235.2 (Susitna River adjacent to Oshetna Creek) (ISR Part A, Section 4.2.3.4).
- RSP Section 5.5.4.4.2 indicated that water samples would be collected at three locations along each transect for mainstem samples. Water samples were collected from just one position in the river due to limited access by wading at PRM 235.2 (Susitna River adjacent to Oshetna Creek) and 187.2 (Susitna at Watana Dam site) (ISR Part A, Section 4.2.3.4).
- Study Plan Attachment 5-1 indicated that an Ekman dredge or modified Van Veen grab sampler would be deployed from a boat; however, this approach was impractical and other approaches (wading) were employed (as identified in the QAPP) (ISR Part A, Section 4.2.4.1).
- EPA Method 1631 recommends digestion of mineral soil with aqua regia and oxidized with bromine monochloride (BrCl) to extract mercury from samples for analyses. The soil samples collected in 2013 contained a significant fraction of peat and organic material mixed with soil. For these types of organic soils, EPA recommends digestion with HNO₃/H₂SO₄ digestion before using BrCl. Given the soil was a mix of organic and inorganic components, each sample was split and analyzed them using both digestion methods, giving two analytical results for each sample.

- RSP Section 5.7.4.6.1 indicated seven to ten of each target species of fish would be collected; however, additional fish were collected for some species (Arctic grayling and round whitefish). The Study Plan also indicated that only adult fish would be collected; however, some juvenile specimens were incidentally collected. While most were released, if a juvenile fish was captured accidentally and died, it was analyzed.
- The Study Plan indicated that all fish would be speciated; however, two fish could not be successfully speciated. Also, it was not possible to successfully extract otoliths from all fish captured; however, sufficient otolith data is available from other studies.
- The Study Plan required determination of the sex and sexual maturity of the fish, however, determination of gender for the fish proved to be problematic in the field, and the sex of only 12 fish was determined. The proposed field collection period for fish was from August to September; however, the sample period was extended into October to obtain sufficient samples. Polyethylene sheets rather than Teflon sheets were used for the fish when placed in the sample bag. See subsection 4.2.6.1

6.2. 2014 Study Season

The following study plan modifications are reported in the June 2014 Study 5.7 ISR, Part C, Section 7.1.2; the modifications were implemented in the 2014 season, so are reported here as variances:

- Per Section 5.7.4.2.3 of the RSP, water quality sampling for mercury was supposed to be discontinued after the March 2014 sampling if mercury concentrations did not exceed regulatory criteria or thresholds. However, additional total mercury sampling was performed in 2014 due to laboratory results that were qualified as “estimated”, and to further fine-tune a mercury model pathways analysis.
- Sample locations for sediment, and sediment porewater sites in the Upper River were modified slightly due to lack of access (landing access for helicopters, river stage levels, property ownership, and boat availability) (ISR Section 4.2.4.1.). These minor modifications to proposed sample locations in the Upper River did not impact AEA’s ability to meet the study objectives.
- The decision to collect additional samples from piscivorous mammals has been deferred until the pathways analysis has been completed and a determination made as to the potential for mercury to bioaccumulate in aquatic receptors. If there is a potential for mercury transfer from aquatic to the terrestrial environment, additional sampling may be performed.

As noted in Section 4 of the Study Implementation Report for this study, the following variances occurred following the filing of the June 2014 ISR.

- Sediment in the upper Susitna River was generally very coarse at accessible sample locations. At each sample location several test pits were dug to attempt to locate the finest grained sediment for sampling, however, only 30% of the samples had more than 5% fines as required in the Study Plan. This does not appear to have adversely impacted

the study results because mercury concentrations in the sediments appear to be only poorly correlated with grain size, and sites with few fines had similar mercury concentrations to those with more fines.

- The RSP Section 5.7.4.5 stated hair-snag “traps” would be placed at or near the mouths of tributaries near the proposed dam site, including Fog, Deadman, Watana, Tsusena, Kosina, Jay, and Goose creeks, and the Oshetna River. During the aquatic furbearers study (Study 10.11) evidence of aquatic furbearers (tracks) was only observed on Kosina and Deadman Creeks. Hair snags were not placed at the remaining creeks.
- Study Plan Modifications

6.3. Modifications Identified in ISR

Section 7.1.2 of Study 5.7 ISR (Part C) details modifications for this study following the 2013 study season. These modifications are summarized as follows:

- Per Section 5.7.4.2.3 of the RSP, water quality sampling for mercury was supposed to be discontinued after the March 2014 if mercury concentrations did not exceed criteria or thresholds. However, additional total mercury sampling was required in 2014 due to laboratory results that were qualified as “estimated”. This did not impact AEA’s ability to meet the study plan objectives.
- All sediment samples were planned to be collected during 2013. Six of the sediment sample locations specified in the RSP (5.7.4.2.4) were inaccessible in 2013 since they were located on CIRWG lands (ISR Section 4.2.4.1.). These locations were sampled in 2014. This did not impact AEA’s ability to meet the study plan objectives.
- RSP section 5.7.4.2.4 specified that sediment sampling would be conducted with a Van Veen sampler lowered from a boat by a power winch. Utilizing a boat on the upper river has proven impractical. Sediment samples were instead collected using the same methods used in 2013 (ISR 5.5; Section 4.5) as described in Section B.2.3 of the QAPP. This did not impact AEA’s ability to meet the study plan objectives.
- Sample locations for water, sediment, and sediment porewater sites in the Upper River were modified slightly due to lack of access (landing access for helicopters, river stage levels, property ownership, and boat availability) (ISR Section 4.2.4.1.). These minor modifications to sample locations in the Upper River do not appear to have impacted AEA’s ability to meet the study objectives.
- Dolly Varden, Arctic grayling, whitefish, burbot, longnose sucker, lake trout, rainbow trout and stickleback were considered “target fish species” for fish tissue sampling as reported in the RSP Section 5.7.4.6.1. The target collection effort as described in the RSP Section 5.5.4.7 is seven filets from adult fish of each species. The sampling goals were achieved for all but 3 species: humpback whitefish are rare, and rainbow trout and stickleback have not been found in the inundation zone. Slimy sculpin, which are also common in the study area, were chosen as an alternate species. These changes should not impact the study.

- Initial evaluation of the potential for bioaccumulation focused on the aquatic environment. Because construction of the reservoir and riverine models will proceed first and are not yet complete, results from mercury analysis of wildlife tissues will not be required until that time. Evaluating the need for additional information will be based on the availability of predictive modeling results (reservoir and riverine models) and on evaluation of the potential for transfer from the aquatic environment to the terrestrial environment using the pathway analyses. The results of this work will help to determine the need (if any) for additional mercury sample collection.
- For simplicity and greater efficiency, collection of tissue samples from piscivorous wildlife for mercury analysis, as described for various species groups in Study 10.11 (Aquatic Furbearers; RSP Section 10.11.4.3), Study 10.14 (Eagles and Other Raptors; RSP Section 10.14.4.1), Study 10.15 (Waterbirds; RSP Section 10.15.4.3) and Study 10.16 (Landbirds and Shorebirds; RSP Section 10.16.4.), was consolidated under the Mercury Assessment and Potential for Bioaccumulation Study (Study 5.7).
- For piscivorous mammals, RSP Sections 5.7.4.5 and 10.11.4.3 indicated that hair samples from river otters and mink would first be sought from animals harvested by trappers in the study area, and then by using hair-snag “traps” (nonlethal, breakaway cable snares) on tributary streams draining into the proposed Watana reservoir inundation zone. No hair samples were obtained using these methods. Therefore the method was modified in winter 2014 to use hair-snag traps during winter track surveys (RSP Section 10.11.4.3). For piscivorous birds, the intent of the Study Plan was to collect feathers from target species after active nests had been vacated for the 2013 nesting season, but those efforts were unproductive. Alternative approaches for tissue sampling of piscivorous birds may be pursued, pending identification of data needs to complete the mercury pathways analysis.
- Opportunistic collection of feathers from the single target species of piscivorous landbird (Belted Kingfisher) for mercury analysis, as described in Study 10.16 (RSP Section 10.16.4.6), was unsuccessful in 2013 because the species is rare in the study area and no nests were found. Hence, this species is no longer considered a suitable target species for mercury analysis.

6.4. Modifications Identified Since the June 2014 ISR

As detailed in the 2014 SIR, AEA plans no additional modifications of the methods for this study.

7. STEPS TO COMPLETE THE STUDY

In light of the variances and modifications described above, the steps necessary for AEA complete this study are summarized below. As necessary and appropriate, these steps have been updated from those appearing in Section 7 of the ISR (Part C).

- Phosphorous release modeling for evaluating potential mercury concentrations in fish after reservoir development. Completion of this modeling is dependent on completion of the EFDC modeling (Study 5.6) for the surface water.
- Update of the pathways assessment to include information generated from EFDC modeling (Study 5.6) for the surface water.
- A decision on additional terrestrial biological sampling (mammals and birds) will be made based on the results of the two previous bullet items. Based on the results of the Harris and Hutchison modeling, as well as all the currently available information, additional sampling of terrestrial tissues is unlikely to be necessary, given the concentrations of mercury in fish are unlikely to exceed levels of concern.