

# Susitna-Watana Hydroelectric Project Document

## ARLIS Uniform Cover Page

<p><b>Title:</b></p> <p>Mercury assessment and potential for bioaccumulation study, Study plan Section 5.7 : Initial study report -- Part C: Executive summary and Section 7</p>		<p><b>SuWa 223</b></p>
<p><b>Author(s) – Personal:</b></p>		
<p><b>Author(s) – Corporate:</b></p> <p>Tetra Tech, Inc./URS Corporation</p>		
<p><b>AEA-identified category, if specified:</b></p> <p>Initial study report</p>		
<p><b>AEA-identified series, if specified:</b></p>		
<p><b>Series (ARLIS-assigned report number):</b></p> <p>Susitna-Watana Hydroelectric Project document number 223</p>		<p><b>Existing numbers on document:</b></p>
<p><b>Published by:</b></p> <p>[Anchorage : Alaska Energy Authority, 2014]</p>		<p><b>Date published:</b></p> <p>June 2014</p>
<p><b>Published for:</b></p> <p>Alaska Energy Authority</p>		<p><b>Date or date range of report:</b></p>
<p><b>Volume and/or Part numbers:</b></p>		<p><b>Final or Draft status, as indicated:</b></p>
<p><b>Document type:</b></p>		<p><b>Pagination:</b></p> <p>iv, 6 p.</p>
<p><b>Related work(s):</b></p> <p>The following parts of Section 5.7 appear in separate files: Part A ; Part B ; Part C.</p>		<p><b>Pages added/changed by ARLIS:</b></p>
<p><b>Notes:</b></p>		

All reports in the Susitna-Watana Hydroelectric Project Document series include an ARLIS-produced cover page and an ARLIS-assigned number for uniformity and citability. All reports are posted online at <http://www.arlis.org/resources/susitna-watana/>



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

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

**Initial Study Report  
Part C: Executive Summary and Section 7**

Prepared for

Alaska Energy Authority



**SUSITNA-WATANA HYDRO**

*Clean, reliable energy for the next 100 years.*

Prepared by

Tetra Tech, Inc./URS Corporation

June 2014

## TABLE OF CONTENTS

<b>Executive Summary .....</b>	<b>ii</b>
<b>7. Completing the Study .....</b>	<b>1</b>
7.1. Proposed Methodologies and Modifications .....	1
7.1.1. Decision Points from Study Plan .....	1
7.1.2. Modifications to Study Plan.....	1
7.2 Schedule .....	5
7.3 Conclusion .....	6

## EXECUTIVE SUMMARY

Mercury Assessment and Potential for Bioaccumulation Study 5.7	
Purpose	The objective of the study is to quantify the current mercury concentrations in the proposed inundation zone of the reservoir, estimate the potential changes to mercury concentrations post-impoundment, and the impacts these changes will have on the ecosystem.
Status	This study was initiated in 2013. Available mercury information has been summarized, including data collection from the 1980s Alaska Power Authority Susitna Hydroelectric Project, and existing geologic information to determine if a mineralogical source of mercury exists within the inundation area. All of the planned vegetation and soil samples were collected. All planned water, sediment and sediment pore samples were collected except those identified below (2013 Variances). The Study Plan required feathers and fur be collected during the wildlife surveys, however none were obtained. This resulted in a modification to the Study Plan. All of the planned fish tissue sampling activities occurred except variations in the number and species of some fish indicated for collection. The data collected as part of this study is currently undergoing a quality review and modeling of the results is on-going.
Study Components	<p>This study consists of the following study components:</p> <ul style="list-style-type: none"> <li>• Summarize available information to determine if a mineralogical source of mercury exists within the inundation area.</li> <li>• Collect and analyze background concentrations for mercury in vegetation, soil, water, sediment, sediment pore water; and piscivorous birds and mammals, and fish tissue samples for mercury.</li> <li>• Use the water quality model to predict where in the reservoir conditions (pH, dissolved oxygen, turnover) are likely to promote methylmercury formation.</li> <li>• Utilize specialty models to predict potential fish methylmercury concentrations.</li> <li>• Use potential pathways results for mercury movement from different areas of methylmercury formation to the surrounding environment.</li> </ul>
2013 Variances	<p>AEA implemented the methods as described in the Study Plan with the exception of the following variances. The significance of these variances is discussed within the ISR.</p> <ul style="list-style-type: none"> <li>• 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). See subsection 4.2.3.4 in this ISR.</li> </ul>

Mercury Assessment and Potential for Bioaccumulation Study 5.7	
	<ul style="list-style-type: none"> <li>• 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). See subsection 4.2.3.4 in this ISR.</li> <li>• 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). See subsection 4.2.4.1 in this ISR.</li> <li>• 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 HNO<sub>3</sub>/H<sub>2</sub>SO<sub>4</sub> 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> </ul>
Steps to Complete the Study	<p>2014 efforts will focus on the collection of water and sediment mercury and methylmercury to aid in the creation of a pathways analysis model and to determine the need for further mercury sampling in in other media if 2014 sampling leaves remaining questions about potential for mercury bioaccumulation. If that is the case, additional sampling will be triggered to</p>

Mercury Assessment and Potential for Bioaccumulation Study 5.7	
	<p>identify other potential sources and pathways for mercury bioaccumulation (e.g. macroinvertebrates or terrestrial organisms) in the study area. Major activities are summarized below:</p> <p>Planned 2014 Activities</p> <ul style="list-style-type: none"> <li>• Geologic studies for the inundation zone are on-going in 2014.</li> <li>• Collection of sediment samples at the six remaining sites located on CIRWG lands (RSP Section 5.7.4.2.4).</li> <li>• Limited winter water quality sampling occurred in January and March of 2014 (RSP Section 5.7.4.2.3).</li> <li>• Summer monthly water sampling from June to September 2014 (see ISR Section 5.5 for details).</li> <li>• Completion of the Predictive Risk Analyses (RSP Section 5.7.4.6) and mercury modeling (RSP Sections 5.7.4.7 and 5.7.4.8).</li> <li>• Following analysis of potential for mercury bioaccumulation in aquatic receptors using the pathways analysis tool, sampling in 2015 would be focused on collection of tissues from terrestrial receptors such as piscivorous birds (blood and feathers) and piscivorous mammals (hair) (RSP Section 5.7.4.5) if it is determined that transfer of mercury is likely from the aquatic environment to the terrestrial environment.</li> </ul>
Highlighted Results and Achievements	<p>Most of the proposed sampling for the Project was successfully completed, including fish tissue sampling for 2012-2013, and soil sampling, mercury sampling in surface water and groundwater, and vegetation sampling at accessible sites during 2013. Samples were collected from four of the proposed ten sediment and porewater sampling sites during the 2013 season. The 2013 results are under evaluation at this time; finalized data will be available and presented in the USR. Going forward it is anticipated that additional, reduced sampling will occur to extend and complete the necessary data set to model the existing mercury concentrations.</p>

## 7. COMPLETING THE STUDY

### 7.1. Proposed Methodologies and Modifications

To complete this study, AEA will implement the methods in the Study Plan, except as described in Sections 7.1.1 and 7.1.2. These activities include:

- Geologic studies for the inundation zone are on-going (ISR Section 4.5), and additional information from these studies will be incorporated into this study when available.
- Collection of the six remaining sediment samples (RSP Section 5.7.4.2.4).
- Limited winter water quality sampling occurred in January and March of 2014 (RSP Section 5.7.4.2.3).
- Summer monthly water sampling from June to September 2014 (see ISR Section 5.5 for details).
- Completion of the Predictive Risk Analyses (Section 5.7.4.6) and mercury modeling (RSP Sections 5.7.4.7 and 5.7.4.8).

#### 7.1.1. Decision Points from Study Plan

RSP Section 5.7.4.2.3 stated that AEA would recommend the need for continuing surface water sampling for mercury in 2014 based on 2013 results. The 2014 water quality mercury sampling efforts are described in further detail in Section 7.1.2.1 below. Because ingestion rates of mercury in piscivores is directly correlated with fish, a determination for potential for bioaccumulation must initially be completed for aquatic receptors. Mercury bioaccumulation in aquatic fur-bearers or piscivorous birds can be acquired from areas other than the Project area and can reduce mercury body burden through loss of fur or feathers (see RSP Section 5.7.4.6). Identifying a potential source of mercury from fish in the Project area must proceed first before any conclusions can be made regarding transfer from aquatic to terrestrial receptors.

#### 7.1.2. Modifications to Study Plan

To complete this study, AEA will implement the methods described in the Study Plan except for the following modifications.

##### 7.1.2.1. *Extension of Mercury Water Quality Sampling*

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 criteria or thresholds. However, additional total mercury sampling is required in 2014 to expand on 2013 due to laboratory results that were qualified as “estimated” as referenced above in Section 7.1.1, and to further fine-tune a mercury model pathways analysis that is mentioned below in Section 7.1.2.5.

A decision was made based on the results of the water quality data collected during the 2013 study. Although no laboratory results are included in the ISR (results will be included in the

USR), laboratory data was qualified and validated as cited in the QAPP Section D.1 Data Validation and Usability.

Through the validation of laboratory data it was determined that certain parameters were either not correctly analyzed by the lab, or samples were contaminated by preservative, bottles or reagent water. A table summarizing the results of the lab data validation has been updated on GINA since the February 2014 draft ISR and is located at: <http://gis.suhydro.org/isr>.

The parameters affected were total metals (except for Ca and Mg), total mercury, total phosphorus, total Kjeldahl nitrogen, total nitrate+nitrite-nitrogen, and dissolved aluminum. These parameter results were either qualified as “rejected” or “estimated” throughout the 2013 study and will be sampled again in 2014.

#### **7.1.2.2. *In-Accessible Sediment Sampling Locations***

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 will be sampled for mercury analysis in 2014. This is not expected to impact AEA’s ability to meet the study plan objectives.

#### **7.1.2.3. *Modifications to Sediment Sampling Methods***

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. Future sediment samples will be 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 is not expected to impact AEA’s ability to meet the study plan objectives.

#### **7.1.2.4. *Modification of Sediment, Water, and Porewater Sampling Locations***

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.). Available data (ISR Study 5.5) results from samples collected 1.5 feet from the water surface and 1.5 feet from the bottom at mainstem and tributary sampling locations (RSP Section 5.5.4.4.) indicate that the river is very well mixed. Field data indicate parameters such as temperature, pH, dissolved oxygen, and conductivity show relatively little variability in water quality vertically or laterally (ISR Study 5.5, Section 5.4.1. and Figures 5.3-2-5.3-5 and 5.3-12-5.3-13). Therefore these minor modifications to proposed sample locations in the Upper River will not impact AEA’s ability to meet the study objectives.

#### **7.1.2.5. *Modification of Fish Tissue Sampling***

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. Results from all of the 2012-2013 fish sampling in the Upper Susitna Basin conducted as part of the overall licensing effort indicate that humpback whitefish are rare and rainbow trout and

stickleback have not been found in the inundation zone. While humpback whitefish samples were not attained, the target number of samples were collected from round whitefish, which are more common. Slimy sculpin, which are also common in the study area, were chosen as an alternate species (See ISR Study 5.5, Appendix x, Section B.2.1); the target number of this species were successfully collected in 2013.

No additional fish tissue sampling is proposed. The lack of collection of humpback whitefish, rainbow trout and stickleback as target species for analysis should not impact the study, since these fish do not appear to be present in the inundation zone.

One of the goals for fish tissue sampling was to represent all age classes for each target species. This goal was satisfied for all target species available in the sampling area except for burbot. The tissue samples collected for burbot resulted in collection of only the older age class with no younger classes present. No additional sampling is proposed for younger age classes from the burbot population as this is characteristic of what is present in the sampling area. Further sampling is not likely to produce any of the younger age classes in the sampling area based on past effort.

#### *7.1.2.6. Modification of Piscivorous Wildlife Tissue Sampling*

Moving forward, initial evaluation of the potential for bioaccumulation will be focused on the aquatic environment. Because construction of the reservoir and riverine models will proceed first and will not be completed until the first quarter of 2015, 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.

Hence, samples for the mercury study will be collected in 2014 only from water and sediment for analysis of mercury and methylmercury. The data collected can then be used in a model to perform a pathways analysis of potential bioaccumulation of mercury and methylmercury throughout the food chain. The results of the pathways analysis will help to determine the need for additional mercury sample collection in 2015.

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.), is being 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. The Study Plan specified that if this approach did not produce hair samples in 2013, then hair would be sought by placing hair-snag “traps” (nonlethal, breakaway cable snares) on tributary streams draining into the proposed Watana reservoir inundation zone. In 2013, no river otters or mink were known to have been trapped in the study area and ADF&G records showed no

appreciable harvests of river otter or mink in the area from recent years. Hence, no hair samples were obtained from otters or mink using the primary sampling technique proposed in RSP Sections 5.7.4.5 and 10.11.4.3. Neither were samples of mink hair obtained incidentally in tube traps set for marten for the Terrestrial Furbearer Study (RSP Section 10.10.4.1). Therefore, in winter 2014, the secondary technique of deploying hair-snag traps during winter track surveys (RSP Section 10.11.4.3) was employed to obtain samples of river otter hair. From March 8 until April 23, 2014, nine hair snags were deployed at two locations (Kosina Creek and Deadman Mountain) where river otter sign was observed and where the site conditions were suitable for deploying the sampling gear. That effort produced only four hairs from a single river otter at one of the sites, however; the hair sample has been sent to the laboratory for analysis but it is not yet known whether usable results will be obtained. In addition, one river otter pelt and two mink pelts were obtained in late winter 2014 from a trapper who harvested them near Chulitna (downstream from the proposed reservoir zone), so hairs from those pelts also have been sent for laboratory analysis. If hair snags do not produce usable samples, then a third approach may become necessary, in which a dedicated trapper would be hired for lethal collection of animals in the study area to obtain tissue samples for mercury analysis, as was discussed in the wildlife technical meeting on March 7, 2014 (see [http://www.susitna-watanahydro.org/wp-content/uploads/2014/03/2014-03-07TT\\_Wildlife\\_Notes.pdf](http://www.susitna-watanahydro.org/wp-content/uploads/2014/03/2014-03-07TT_Wildlife_Notes.pdf)).

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 for several reasons: (1) nests of some target species (waterbirds, landbirds) were not found due to low abundance of the species in the study area; (2) feathers were not found or could not be collected at the few nests of those target species that were found and for which a federal salvage permit was in hand (for all species except eagles); and (3) feathers of Bald Eagles could not be collected because neither the study team nor the USFWS possessed the necessary federal permit for salvage of eagle feathers and the permit could not be obtained in time to collect samples in the 2013 season.

Because of the poor success in collecting feather samples from nests in 2013, alternative approaches for tissue sampling of piscivorous birds will be pursued in 2015, pending further data analysis and identification of data needs to complete the mercury pathways analysis. These revised sampling approaches and target species were developed with input from USFWS, ADF&G, and other licensing participants in the wildlife technical meetings on March 7, 2014 (see [http://www.susitna-watanahydro.org/wp-content/uploads/2014/03/2014-03-07TT\\_Wildlife\\_Notes.pdf](http://www.susitna-watanahydro.org/wp-content/uploads/2014/03/2014-03-07TT_Wildlife_Notes.pdf)) and April 9, 2014 (see [http://www.susitna-watanahydro.org/wp-content/uploads/2014/05/Wildlife-Technical-Meeting-Notes\\_04092014.pdf](http://www.susitna-watanahydro.org/wp-content/uploads/2014/05/Wildlife-Technical-Meeting-Notes_04092014.pdf)).

To provide information for Study 5.7, Study 10.14 (RSP Section 10.14.4.1) included three tasks with regard to mercury: (1) provide information on the distribution, abundance, food habits, and diet of piscivorous (fish-eating) raptors; (2) collect feather samples from active nests after the nesting season for characterization of mercury levels; and (3) provide information on the effects of methylmercury on piscivorous raptors. Following further discussion in the wildlife technical meeting on March 7, 2014, the meeting participants agreed that it would be more efficient to shift the second and third tasks above from this study to Study 5.7 and to modify the sampling approach by engaging a specialty contractor with extensive experience in capturing live Bald Eagles to obtain blood and feather samples for mercury analysis. Rather than being involved in

collecting samples, the raptor study team would focus on providing information on nest locations and nest status to the Bald Eagle tissue-sampling contractor, who would be part of the mercury study team.

The feather collection effort for piscivorous waterbirds proposed in Study 10.15 (RSP Section 10.15.4.3) did not produce any samples in 2013 because very few nests of target species were located and no feathers were found at the few nests checked or nest locations were inaccessible due to land access constraints. Following further discussion in the wildlife technical meeting on March 7, 2014, the meeting participants agreed that it would be more efficient to undertake live capture for blood and feather sampling by a specialty contractor with extensive experience in waterbird capture and tissue sampling for mercury analysis. Based on their occurrence and abundance in the study area, loons and possibly mergansers would be targeted for this revised sampling approach. Rather than collecting samples, the waterbird study team would focus on providing information on nest locations and nest status to the tissue-sampling contractor, who would be part of the mercury study team.

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.

## 7.2 Schedule

In general, the schedule for completing the FERC-approved Study Plan is dependent upon several factors, including Project funding levels authorized by the Alaska State Legislature, availability of required data inputs from one individual study to another, unexpected weather delays, the short duration of the summer field season in Alaska, and other events outside the reasonable control of AEA. For these reasons, the Study Plan implementation schedule is subject to change, although at this time AEA expects to complete the FERC-approved Study Plan through the filing of the Updated Study Report by February 1, 2016, in accordance with the ILP schedule issued by FERC on January 28, 2014.

With regard to this specific study, AEA expects to complete remaining data collection in the aquatic environment of the proposed Project area in 2014. The decision to collect additional samples from terrestrial receptors (piscivorous birds and mammals) will be 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 via piscivory by birds and mammals, then tissue samples from selected birds (blood and feathers) and mammals (hair) will be conducted in 2015.

Activities scheduled for 2014 are as follows:

- Geologic studies for the inundation zone (ISR Study 4.5).
- Collection of the six remaining sediment samples (RSP Section 5.7.4.2.4).
- Limited winter water quality sampling will occur in January and March of 2014 (RSP Section 5.7.4.2.3).
- Summer monthly water sampling from June to September (see ISR Study 5.5 for details).

- Completion of the Predictive Risk Analyses (RSP Section 5.7.4.6) and mercury modeling (RSP Sections 5.7.4.7 and 5.7.4.8).

### **7.3 Conclusion**

Significant progress has been made in 2013 and Q1 of 2014 in meeting the objectives of the Mercury Study. Sample collection efforts in 2013 including the variances in Section 4 have met the objectives outlined in Section 2 of the ISR. The remaining field work is mostly designed to broaden the base of data available and necessary for modeling, provide additional data for identified data gaps, and complete minor field work that was not completed due to site access limitations. All mercury data collected will be used in a model to trace mercury and methylmercury pathways throughout the food chain and to determine the need for future mercury sample collection.

Given the combination of historical mercury research, 2013 and early 2014 sample collection efforts, variances (Section 4), and the plans for the remainder of 2014 with modifications (see Section 7.1.2.), AEA will achieve the objectives for the Mercury Study.