Implementation Guidance for the Idaho Mercury Water Quality Criteria

Idaho Department of Environmental Quality

Negotiated Rulemaking Committee

April 2005

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Table of Contents

List of Appendices

List of Figures

List of Tables

List of Equations

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Abbreviations, Acronyms, and Symbols

303(d)	Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
§	Section (usually a section of federal or state rules or statutes)
ATDSR	Agency for Toxic Substances and Disease Registry
BAG	Basin Advisory Group
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
CWA	Clean Water Act
DEQ	Department of Environmental Quality
DC	Dietary Concentration
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FIR	food ingestion rate
GIS	Geographical Information Systems
HUC	Hydrologic Unit Code
IDAPA	Refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
IFCAP	Idaho Fish Consumption Advisory Program
LA	load allocation
LC	load capacity
LOAEL	Lowest Observed Adverse Effect Level
MDL	Method Detection Limit
MSGP	Multi-Sector General Permit
MOS	margin of safety
NPDES	National Pollutant Discharge Elimination System
NOI	Notice of Intent
PMP	Pollution Management Plan
P2	Pollution Prevention
QA	quality assurance
QC	quality control
RPTE	Reasonable Potential To Exceed
RSC	Relative source contribution
SFI	DEQ's Stream Fish Index
SIU	Significant Industrial User
SWP3	Storm Water Pollution Prevention Plan
TMDL	total maximum daily load
TRI	Toxics Release Inventory
U.S.	United States
U.S.C.	United States Code
USGS	United States Geological Survey
WAG	Watershed Advisory Group
WBAG	Water Body Assessment Guidance
WBID	water body identification number
WLA	wasteload allocation
WQS	water quality standard
WV	wildlife value

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1. Executive Summary

This document has been prepared by the Idaho Department of Environmental Quality (DEQ) to describe Idaho's approach for implementing a fish tissue methylmercury criterion, especially its use as a surrogate for direct measurement of mercury in water. The fish tissue criterion is presented in the context of *Total Maximum Daily Loads* (TMDLs) and *National Discharge Elimination Pollutant System* (NPDES) permits, with consideration given to *Clean Water Act* §401 certification requirements. How a methylmercury fish tissue criterion, which is based on the protection of human health, also protects aquatic life and aquatic-dependent wildlife species, is addressed as well.

This summary provides a concise overview of Idaho's fish tissue criterion, addressing the following topics:

- Mercury's health effects, its easy movement through the environment, and its tendency to accumulate within living tissue—the latter characteristic offering an alternative to costly direct detection of elemental mercury in water.
- Mercury criterion requirements, including Idaho-specific options.
- Idaho's mercury monitoring approach, including the overall program framework, monitoring protocols, analytical methods, and use of data.
- Application of the mercury criterion to the TMDL and NPDES programs.
- Implications of the mercury criterion for aquatic and aquatic-dependent wildlife species.
- Integration with other state and regional programs.

1.1 Why the Interest in Mercury?

Interest in mercury stems from health concerns, the prevalence of mercury in the environment, and the manner in which mercury accumulates in living organisms.

1.1.1 Concern About Human Health and Exposure to Mercury

Global increase in mercury in the enviromnent and rising interest by public health professionals in the environmental health risks associated with mercury has led to an increase in fish consumption advisories. Nationwide, advisories due to mercury in fish tissue have increased dramatically over the past two decades, and, as of February 2004, advisories in Idaho are in place for Brownlee Reservoir, C. J. Strike Reservoir, Lake Coeur d'Alene, Lake Lowell, and Salmon Falls Creek Reservoir.

Knowing that mercury is one of the most toxic heavy metals—a potent neurotoxin that targets the nerves and brains of living organisms—has sparked this increased interest. At relatively low doses, mercury causes dementia, cerebral palsy, deafness, blindness, and sensory and motor impairment. At higher doses, mercury can cause death.

Unlike most metals, mercury readily evaporates. As a vapor, mercury is easily distributed through the air, contaminating areas remote from man-made sources. Mercury vapors can be inhaled directly, but the most common route of exposure for humans is through a diet of fish and seafood containing the organic compound *methylmercury*—the predominant form of mercury found in fish tissue.

Methylmercury is formed as part of a complex process involving air, water, sediment, and living organisms. Elemental mercury deposited in water is readily oxidized and thus brought into solution; bacteria then convert the oxidized inorganic mercury to toxic organic forms, including methylmercury. Low dissolved oxygen levels and the presence of sulfur and organic matter—conditions common at the bottom of lakes and in wetlands—enhance the process.

1.1.2 Environmental Mercury Comes from Many Sources

Mercury is a natural component of the environment that normally occurs in very low concentrations. Natural sources include various mineral deposits, volcanic activity, and hot springs. Manmade sources are primarily coal combustion, ore roasting, and waste incineration. Mercury is used in silent light switches, flourescent lights, flat panel computer monitors, and dental almalgams—although that latter use is declining. Because of its volatility, most human release of mercury is initially to the air, thus into global circulation, ultimately depositing and entering streams and lakes everywhere.

Mercury in Idaho is present due to natural and anthropogenic sources. Mercury is a naturally occurring ore within Idaho, typically associated with high temperature (epithermal) gold deposits and hot springs. Anthropogenic sources include elevated mercury concentrations associated with historic placer mining of gold and mercury deposits throughout Idaho. Ore roasting associated with gold mining in northern Nevada is currently suspected as a significant source of atmospheric mercury loading to Idaho’s southern tier of counties.In addition to mining issues, air emissions from regional industrial sources may be contributing to anthropogenic mercury loads.

1.1.3 Mercury Concentrations Increase With Each Step Up the Food Chain

Even very low levels of mercury in water can, through a process called *bioaccumulation*, produce unhealthful levels. Bioaccumulation, in which living organisms take up contaminants more rapidly than they eliminate them, magnifies mercury contamination. At each step, or *trophic* level, in the food chain—from water to algae, algae to aquatic insects, insects to fish, fish to other fish, and fish to humans—mercury concentrations in tissue increase, reaching multiples that can be on the order of a million times the original concentration of mercury in the water column.

Because mercury is challenging to detect directly, bioaccumulation offers a cost-effective alternative to water column measurements through what is called a *fish* *tissue criterion*. Instead of directly measuring a contaminant in surface water, a fish tissue criterion assesses the accumulation of a contaminant found in the tissues of fish living in the water.

1.2 Mercury Fish Tissue Criterion Requirements and Idaho-Specific Options

The Idaho mercury criterion has evolved to be a *fish tissue only* criterion with options to ensure local applicability.

1.2.1 Evolution of Idaho approach

The Environmental Protection Agency (EPA) first recommended water quality criteria for mercury in 1976, updating the criteria in 1985, 1995, 2001, and 2002. In the near future, EPA is expected to provide final implementation guidance to the states for implementing a *mercury fish tissue criterion* into an overall water quality program.

This guidance presents methods for implementing a fish tissue criterion, the formula used to calculate the methylmercury criterion, the Idaho-specific fish tissue criterion, incorporation of local data to the extent that is both practicable and warranted, and an overview of how the fish tissue criterion can be implemented into the TMDL and NPDES programs.

Idaho has elected to use a *fish tissue only* implementation strategy, in which measurement of methylmercury in fish tissue is used as surrogate for direct measurement of mercury in water. If the measured fish tissue level is greater than the criterion, then it is assumed that the unmeasured water concentration is too high.

The criterion to be applied, based on EPA (2001) default values, is 0.3 mg of methylmercury per kg of fish, wet (fresh) weight.

DEQ believes this criterion is valid and provides human health protection against consumption of mercury-contaminated fish, as well as protection of ecological resources in the state. The assessment of mercury is an evolving science, and this number is based on the most recent human health risk methodologies and data; as methodologies continue to evolve, the criterion may need to be refined further.

1.2.2 Options to Ensure the Criterion is Locally Applicable

Three options are available to ensure that the implementation of the new mercury criterion relies on local information to the extent that is both practicable and warranted:

- Idaho may provide NPDES dischargers relief from a water quality standard by granting a temporary *variance* to that standard. Variances are typically appropriate when complying with the criteria will cause economic/social impacts, when human-caused conditions are present that cannot be remedied, or when natural conditions prevent attainment of criteria.

- *Use Attainability Assessments* (UAAs) may provide another form of relief, if it is determined that the mercury criterion cannot feasibly be attained. This site-specific modification, which applies to the entire site, typically results in a change in TMDL targets and allocations.
- *Modifying default inputs to the criterion equation* is the third option to ensure that the criterion reflects local information. Fish consumption rates can be modified to reflect local conditions.

1.3 Mercury Monitoring and Assessment

Idaho has developed a monitoring framework that provides both flexibility for stakeholders and reliable data that can be used to make informed decisions. The monitoring framework encompasses two scales: *statewide ambient monitoring* and *facility/source monitoring*. The primary advantage of relying on fish tissue monitoring only is that concentrations of mercury in fish tissue represent an integrated exposure to mercury throughout a water body over an appropriate period of time.

1.3.1 Statewide Ambient Monitoring

Because fish tissue sampling is difficult, expensive, and time consuming, and because a standardized approach provides better data, Idaho is proposing to develop a statewide cooperative fish tissue monitoring program. This approach is similar to programs that have been developed in Illinois, Massachusetts, South Carolina, and Wisconsin. While stakeholders will not be required to participate, it is envisioned that contributing to the statewide cooperative program will provide substantial economic and technical benefits. Many important details, such as allocation of costs, remain to be resolved. In the interim, and for those dischargers who opt not to participate in the cooperative program, the guidance describes requirements for facility-related ambient monitoring.

The statewide fish tissue monitoring program has been designed to dovetail as closely as possible with existing programs. Ambient water quality data will continue to be collected as specified in other sampling programs, such as the USGS/DEQ Trend Monitoring Network. Because of the tendency of methylation to occur in reservoir/lacustrine environments, the statewide cooperative program would need to fill data gaps from other programs that focus on rivers and streams.

Sampling locations will be prioritized by considering the following:

1. Potential or actual mercury contamination in the water body
2. Frequency of fishing activities
3. NPDES discharger requirements
4. Public interest in the water body

Within each regional basin, watersheds will be sampled at least once every 5 years on a rotating schedule. Higher-priority watersheds will be sampled within the first part of a 5-year cycle, with lower-priority watersheds targeted for the latter part of a 5-year cycle. As data become available over a longer time period, this monitoring framework will be adapted so that resources are shifted from lower-priority watersheds to higher-priority watersheds that contain impaired waters and/or receive larger discharges of mercury.

Deterministic monitoring will be conducted at reservoirs/lakes and large rivers. In each regional basin, two "core" stations will be identified as *annual trend sites*, to track mercury trends, in the same fish species, that are present within that region. In addition to "core" stations, other reservoirs/lakes and large rivers will be monitored using the same prioritization criteria. Probabilistic monitoring will be conducted for smaller streams.

1.3.2 Facility Monitoring

The monitoring approach for facilities is targeted toward determining what levels of mercury are being discharged and what the resulting concentration of mercury is in fish that reside in the receiving stream. Relative to the total number of dischargers, few facilities have been required to collect the data necessary to support the TMDL source characterization or NPDES processes. If reliable effluent data are not available, then effluent data will need to be collected. During the initial permit cycle, Idaho is recommending the following schedule:

- Municipal facilities: Quarterly effluent monitoring until the facility has 12 acceptable data points, and then the monitoring frequency will be reduced to semi-annually for the remainder of the permit cycle.
- Industrial facilities: Monthly effluent monitoring until the facility has 12 acceptable data points, and then the monitoring frequency will be reduced to quarterly for the remainder of the permit cycle.

If a discharger does not already have a low-level monitoring program in place, the initial permit will include a 2-year compliance period in which to set up this program prior to the collection of any mercury monitoring data.

DEQ will work with dischargers and other state agencies to establish a monitoring cooperative that dischargers may opt to participate in, in lieu of traditional ambient monitoring. Traditionally, ambient monitoring is conducted by a discharger below a facility's mixing zone, in close proximity to the point of discharge. Instead, DEQ believes the money spent on traditional discharge-related ambient monitoring would offer greater environmental and human health benefit if pooled into a statewide monitoring effort. Such a cooperative effort would also offer benefits in more consistent, thus comparable, fish tissue mercury data across the state for assessment and reporting purposes.

1.3.3 Field Sampling and Analytical Protocols

Mercury poses a specific challenge in that contamination from faulty sampling or analytical techniques is quite common. Whether data are collected on a facility-specific basis or under the proposed statewide cooperative program, field sampling protocols will help ensure that mercury data are valid for making management decisions. In addition, the availability of low-level analytical methods means that contamination can easily provide data that are not valid.

Monitoring protocols for fish tissue sampling generally follow the protocols developed by the Idaho Fish Consumption Advisory Program. The only deviations from these protocols are related to needing to apply fish tissue data to the TMDL and NPDES programs. Fish that eat other fish (Trophic Level 4) are known to bioaccumulate higher concentrations of mercury and will be targeted for monitoring purposes. Bass have been selected as the target species for fish tissue monitoring within reservoirs/lakes. For rivers and streams, although the target species will vary depending upon fishery use within each system, Trophic Level 4 fish will be priority species.

In areas where threatened and endangered fish species are present, surrogate species for analysis will be used to determine assessment of the biological community in lieu of collecting listed salmonids and anadromous species. Although subsistence harvesting usually targets specific anadromous species and is associated with more frequent consumption, targeting resident species provides a more conservative exposure assessment. In the absence of data to apportion fish consumption among trophic levels, Idaho will assume all consumption occurs at the highest trophic level in known areas where endangered species are located, so as to err on the side of protection.

Sampling and analytical methods for water/effluent samples used to determine compliance are to conform to the guidelines of 40 CFR 136 (IDAPA 58.01.02.090.01) unless otherwise specified in the NPDES permit. These include procedures referred to as “clean sampling” and “ultra-clean sampling” developed by EPA to both minimize the potential for contamination and, where contamination does occur, to enable identification and quantitation of that contamination.

1.4 Application of the Criterion in the TMDL Program

The TMDL process for mercury will follow and be as consistent as possible with existing federal and Idaho *Guidance for the Development of Total Maximum Daily Loads* (1999) and its successors. Because federal guidance on developing and implementing TMDLs for mercury based on the new fish tissue methylmercury criterion are in the process of being developed, Idaho’s approach is based on case studies elsewhere in the region and nationwide. Idaho will structure its TMDLs for mercury using a phased approach and adaptive management; as additional monitoring data become available, the process will be updated as necessary.

The phased approach recognizes that the predominant source of mercury to water bodies is likely to differ throughout the state. For example, air deposition may be the predominant source of mercury to many water bodies; air deposition of mercury in Idaho primarily comes from regional, and even global sources, and identifying the relative contribution of each of these sources is difficult.

1.4.1 303(d) Listing

Possible TMDL pathways for mercury listings include the following:

- If average mercury levels in resident fish tissue are below 0.3 mg/kg, no 303(d) listing is required. However, a 5- to 8-year fish tissue monitoring cycle will be used to confirm non-impairment. These water bodies should be placed in Category 1 or 2, depending on other pollutants that have been assessed.
- If average mercury levels in resident fish tissue are between 0.24 mg/kg and 0.3 mg/kg, affected stakeholders may elect to sponsor additional methylmercury monitoring to further assess impairment over a 2-3 year timeframe. In the interim, voluntary mercury-control *Best Management Practices* (BMPs) will be encouraged. These water bodies should be placed in Category 3 until a more complete data set is developed.
- If average mercury levels in resident fish tissue are ≥0.3 mg/kg, a 303(d) listing is required. These water bodies should be placed either in Category 4B or 5, depending on monitoring results and other available information.

If average mercury levels in all fish consumed are ≥0.3 mg/kg, coordination with the fish consumption advisory program is also required.

1.4.2 TMDL Analysis

TMDLs for mercury will be prepared using the standard three-step process: subbasin assessment, loading analysis, and implementation plan.

Subbasin Assessment

The subbasin assessment is the initial section of the TMDL that describes the elements necessary to characterize the watershed. While typical TMDLs focus on the aspects of the watershed that answer the questions of source identification and pollutant control efforts, mercury TMDLs in Idaho are expected to focus primarily, though not exclusively, on legacy mining and/or air deposition issues that will require a slightly different format.

Loading Analyses

Mercury TMDLs will be expressed as a percent reduction required to achieve 0.3 mg/kg methylmercury fish tissue values (or to whatever localized criterion has been developed). An additional 5 percent reduction in water concentrations will be required as an explicit *Margin of Safety* (MOS). The MOS accounts for the uncertainty in the relationship between the pollutant loads and the quality of the receiving water body.

Implementation Plan

Consistent with other TMDL implementation guidelines, mercury TMDL implementation plans should contain recommended elements as set forth by the most recent EPA rules:

- Expected timeframe for meeting water quality standards
- Approaches to be used to meet load and wasteload allocations
- Identification of federal, state and local governments, individuals, or entities involved in or responsible for implementing the TMDL
- A monitoring strategy to measure implementation activities and achievement of water quality standards

1.5 Application of the Criterion in the NPDES Program

Treatment of the new methylmercury criterion within the NPDES framework is complex, and because mercury monitoring data in Idaho is scarce relative to other states, NPDES permitting strategies are expected to evolve as additional monitoring data become available. In the Idaho framework, recommended permit conditions for effluent point sources depend entirely on whether the sources are considered to be *significant* or *de minimis:*

- Significant permittees are defined as having either been assigned a wasteload allocation as part of the TMDL process or have been determined to have *reasonable potential to exceed* (RPTE) the mercury criteria.
- De minimis permittees are those facilities that, although they may discharge mercury, do not discharge enough mercury to be assigned a wasteload allocation within the TMDL process nor do they have reasonable potential to exceed the mercury criteria.

This mercury implementation guidance does not envision that additional Idaho requirements are needed specific to mercury for municipal or industrial storm water permits above the existing general permit and individual permit programs that the EPA NPDES stormwater program already implements.

1.5.1 RPTE Process

Idaho has choosen to set aside EPA acute and chronic aquatic life criteria (1.4 µg/L and 0.77 µg/L , respectively) pending resolution of consultation between EPA, NOAA Fisheries, and the U.S. Fish and Wildlife Services on the protectiveness of these criteria. Thus, the general RPTE water quality criteria process for mercury addresses only the fish tissue criterion.

The RPTE analysis for human health criteria (expressed as the fish tissue methylmercury criterion) applies a protective factor of 20 percent to the 0.3 mg/kg fish tissue criterion to account for uncertainty. Thus, if fish tissue concentrations are >0.24 mg/kg, then RPTE exists. Because of the integrative nature of fish tissue, RPTE is assigned to all mercury dischargers to a water body with fish tissue concentrations >0.24 mg/kg.

The entire process is a marked depature from typical RPTE for water column criteria. In DEQ’s view, the departure is necessitated by the unique character of a fish tissue criterion and provides a practical means to ensure the fish tissue criterion will not be exceeded by new or increased mercury discharges.

DEQ recognizes that even if a water body meets the fish tissue criterion, RPTE may still exist because effects from current discharges may not yet be reflected in potentially elevated fish tissue concentrations. Permit conditions—including periodic effluent monitoring within the typical priority pollutant scans as might otherwise be required and continued ambient fish tissue monitoring—will be specified for those permittees with no RPTE. These conditions should dovetail to confirm this assumption and to ensure that concentrations do not exceed the criterion in the future.

1.5.2 Establishing Permit Conditions

While establishment of permit conditions will vary, there are three basic conditions specific to mercury that may be incorporated into NPDES permits for significant permittees:

- *Permit Limits*. Permit limits should encompass non-numeric restrictions on the discharge of mercury (most commonly BMPs related to source control). This approach is identical to those permitting policies used elsewhere (for example, Ohio, Michigan, and Wisconsin) that rely on imposing BMP-based source control permit conditions to provide relief to NPDES dischargers who have no feasible treatment options. Consistent with a BMP-based approach, including a narrative no-net-increase provision is also appropriate and can be tracked via periodic pollutant priority scans as otherwise required in the permit.

  If necessary, numeric permit limits will also be determined based on the feasibility of treatment technologies. That is, if a permittee is discharging mercury that can be controlled by changing industrial processes or implementing appropriate and feasible control technologies, numeric limits may be appropriate.

- *Effluent Monitoring.* Monitoring of effluent will be required of those permittees who have been determined to be significant sources of mercury (either through the RPTE or TMDL processes).

- *Ambient Fish Tissue Monitoring*. For other pollutants associated with water column criteria only, monitoring of the receiving water is appropriate for a number of technical reasons. In this case, the methylmercury fish tissue criterion is already an integrative metric (that is, fish travel throughout the subject watershed). Idaho is encouraging all permittees to enter into the proposed statewide fish tissue cooperative monitoring program in lieu of facility-specific monitoring. Until this program is developed and funded, or for those facilities that opt to not participate in the cooperative program, facility-specific fish tissue monitoring will be required.

Permit conditions for both municipal and industrial *de minimis* sources will rely on voluntary BMPs used to control or reduce the discharge of mercury, where feasible. In addition, permit conditions should include a no-net-increase provision to help ensure no future RPTE. This concept is similar to other metals that have water column criteria, where limited and periodic monitoring of the receiving stream is required, even if the facility has demonstrated no RPTE.

The issue of new or increased discharges is complex for this criterion because fish tissue concentrations are not predictive of what potential impacts new/increased discharges will have on a water body. Because Idaho is electing to not incorporate bioaccumulation factors into this framework, an alternative approach has been developed that is consistent with current antidegradation and antibacksliding regulations.

1.6 Protection of Aquatic and Aquatic-dependent Wildlife Species

Although EPA, U.S. Fish and Wildlife Service, and NOAA Fisheries have expressed concerns that the mercury criteria may not be protective of some important aquatic species in Idaho, DEQ believes the fish tissue methylmercury criterion of 0.3 mg/kg, wet(fresh) weight, is protective of aquatic life and aquatic-dependent life if applied to the highest trophic level of fish. If this value were converted to an equivalent water column concentration, using worst case (low) bioaccumulation factors, these dissolved mercury levels would still be an order of magnitude lower than EPA’s 2002 recommended chronic criterion. Thus, because the Clean Water Act requires that the most sensitive use be protected, application of the fish-tissue-based human health criterion effectively offers a greater level of protectivess than EPA’s currently recommended chronic aquatic life criteria.

The findings of a 2003 EPA Region 9 study (in collaboration with the U.S. Fish and Wildlife Service) provide the basis for Idaho’s study.

1.6.1 Protectiveness of the Bald Eagle

Among threatened and endangered aquatic-dependent wildlife species in Idaho, the bald eagle is of principal concern. The most conservative implementation strategy in Idaho would be to apply the highest trophic level approach in known eagle nesting areas. The average concentration trophic level approach, based on consumption patterns of human receptors, could be applied in wintering areas. In the absence of detailed information on nesting locations, the more conservative strategy would be to apply the highest trophic level approach statewide.

1.6.2 Protectiveness of Listed Fish Species

The available studies that have evaluated neurotoxicity and reproductive impairment associated with muscle-bound methylmercury in fish have produced mixed results. In general, the adverse effects have been subtle and have not been observed consistently in different taxa. Methylmercury muscle concentrations in Trophic Level 4 fish expected under the average concentration trophic level approach are closer to concentrations that have been associated with adverse effects in some studies. Given the uncertainty about tissue concentration thresholds for subtle toxic effects, the highest trophic level approach would increase the likelihood that the criterion is protective of listed species. However, USF&WS (2003) concluded that either approach should be sufficiently protective of listed fish in California. This is a reasonable conclusion with regard to listed fish species in Idaho as well, with the possible exception of Kootenai River white sturgeon.

1.6.3 Protectiveness of Other Species

Other listed aquatic species in Idaho are the Snake River snails: Snake River physa snail, Idaho springsnail, Bliss Rapids snail, Utah valvata, and Banbury Springs limpet. Little information is available on the effects of mercury on freshwater snails. Toxicity information that is available is on species not closely related to the listed species in the Snake River; these species may not be appropriate surrogates.

Acute toxicity tests indicate that lethal levels of mercury (LC_{50s} from 80 μg/L in an *Amnicola* sp. adult to 2,100 μg/L in an *Amnicola* sp. Embryo) are considerably higher than EPA's 2002 chronic criterion (0.77 μg/L). They are also higher than water column concentrations that would be expected with either methylmercury fish tissue criterion implementation strategy. However, in view of the high uncertainty regarding mercury toxicity to freshwater snails, it is prudent to adopt the more conservative highest trophic level approach.

1.7 Integration with Other Programs

Mercury contamination of the aquatic environment is pervasive, complex, and its sources extend beyond those controllable under Clean Water Act programs. Moreover, technology to remove mercury in wastewater is ineffective. Mercury must be controlled through pollution prevention and pollution management activities that prevent it from entering the flow of waste.

Environmental mercury contamination is truly a multi-media problem involving water, air, and waste. Thus it is prudent to integrate Clean Water Act programs, such as TMDLs and NPDES permits, with other programs, such as Fish Consumption Advisories, air quality regulation, waste incineration, and education programs to reduce use and promote proper disposal of mercury-containing waste.

1.7.1 Idaho Fish Consumption Advisory Program

Idaho's existing *Idaho Fish Consumption Advisory Program* (IFCAP) is responsible for issuing advisories to the public on consumption of locally caught fish. With the adoption of a fish tissue criterion into Idaho's water quality standards, DEQ's interest in IFCAP will become stronger, and there will be a greater need for coordination or even partnership.

1.7.2 Air Quality

The only way to deal with air deposited mercury in fish tissue is to curb it at its source—mainly fossil fuel power plants, cement/lime kilns, waste incinerators, and ore roasters. This will require DEQ working with air quality regulators and the affected facilities to bring about source reductions that will ultimately be needed to bring waters into compliance with the fish tissue water quality criterion.

1.7.3 Interstate Mercury Commission

Idaho will have to look to surrounding jurisdictions for much of the mercury load reductions needed to improve Idaho's environment. This will require government-to-government interaction at the highest level, possibly through the Western Governor's Association.

1.7.4 Pollution Prevention

Prevention of mercury release is paramount.Unlike most metals, mercury is not easily immobilized or compartmentalized as solid waste. The volatility of mercury, its transformation from inorganic to organic forms, and ready passage, into, through and concentration within the food chain make mercury perhaps the most persistent of toxins in the environment.

Other states, such as Wisconsin, have developed clear pollution prevention strategies that focus on reducing the amount of mercury released to the environment through the use of education, technical assistance, partnership development, and BMP-based source control permit conditions. This reliance on pollutant minimization programs focuses on the lack of relative ecological impact from each minor discharge. Typical waste minimization techniques for municipalities can be as straightforward as promoting water conservation, conducting waste minimization at selected industrial sites, and providing information/education to citizens and industries. Waste minimization for more complex municipal or industrial situations can include a more detailed pollution minimization plan.

Mercury is not removed through even advanced municipal wastewater treatment. While the technology for mercury treatment exists, it is not cost effective; a case study estimated treatment cost at $1/gallon. Another study by the Ohio EPA estimated that the average cost to municipalities to reduce mercury to low levels is in excess of $10 million per pound of mercury removed.

By far the more economical way to reduce mercury discharge is through preventing it from entering the waste stream in the first place. This is the essence of pollution prevention. For industrial sources, it means modification of processes to reduce mercury as a byproduct. For municipal sources, it consists of educating the public, and working with dental and medical offices and laboratories to reduce use of mercury or mercury-containing products.

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2. Introduction to the Fish Tissue Mercury Criterion

This document has been prepared by the Idaho Department of Environmental Quality (DEQ) to describe Idaho's approach to implement a fish tissue methylmercury criterion. A fish tissue criterion is a new type of water quality criterion that is an indirect measurement of water quality, which differs from the water column concentration criteria that have been the mainstay of water quality standards used to date. Instead of directly measuring a contaminant in surface water, a fish tissue criterion assesses the accumulation of a contaminant found in the tissues of fish living in the water. For contaminants that can be challenging to detect directly—such as mercury—this technique seems to offer a reliable and cost-effective alternative to direct measurement of chemicals found at low concentrations in the water column.

2.1 Role of this Document

This document serves three roles:

- First, this document describes the processes involved in using and implementing a fish tissue criterion. This discussion is placed in the context of *Total Maximum Daily Loads* (TMDLs) and *National Discharge Elimination Pollutant System* (NPDES) permits that include allocations or effluent limits, where necessary, for state water quality standards to be met.
- Second, this document also considers the state's Clean Water Act §401 certification requirements for permit compliance with state water quality standards for federal actions, such as Federal Energy Regulatory Commission (FERC) re-licensing of hydropower projects.
- Lastly, this document addresses how the methylmercury fish tissue criterion, which is based on the protection of human health, also protects aquatic life and aquatic-dependent wildlife species.

2.2 Why the Interest in Mercury in Fish?

Nationwide, the fish consumption advisories due to mercury in fish tissue have increased dramatically over the past two decades (USGS 2003a). As of February 2004, advisories in Idaho are in place for five water bodies: Brownlee Reservoir, C. J. Strike Reservoir, Lake Coeur d'Alene, Lake Lowell, and Salmon Falls Creek Reservoir (BEHI 2004).

The recent increase in fish consumption advisories reflects a greater interest by public health professionals in environmental health risks associated with mercury. Currently, 40 states have issued mercury fish consumption advisories, including 14 statewide mercury fish consumption advisories (Figure 2-1).

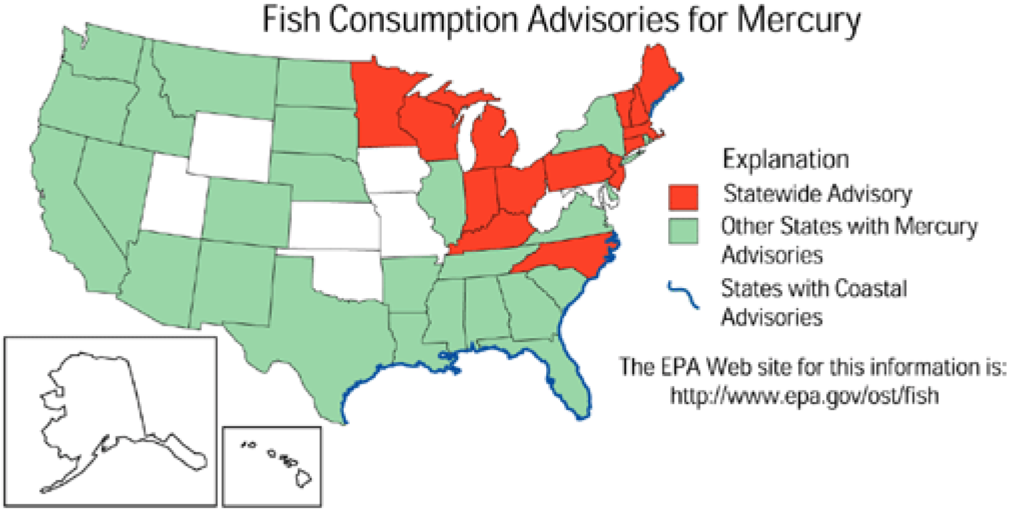


Figure 2-1. National Fish Consumption Advisories for Mercury.

2.2.1 Environmental Mercury Comes from Many Processes

Sources of global and national mercury are presented below, with Idaho-specific issues and data discussed at length in Section 2.3.

Global Scale

Mercury in the environment originates from both natural and anthropogenic sources. On a global level, natural sources of mercury include volcanoes, ore deposits, and volatilization from the oceans (USGS 1995).

Sources of geologic mercury are primarily associated with *cinnabar* deposits, epithermal gold/silver deposits, complex lead-zinc-gold ores, and copper shale deposits (Rose, Hawkes, and Webb 1979). Cinnabar contains up to 83 percent mercury and can occur as impregnation and vein-fillings in near-surface environments associated with volcanic and geothermal activities. Cinnabar can also occur as placer deposits when mercury-bearing rocks erode into creeks. In addition, granite can also contain minute quantities of mercury—typically less than 1 percent. Although mercury may be present in rocks of any geologic age, due to its volatility it is unlikely to remain in rocks older than Tertiary age (about 65 million years).

Various natural processes, including volcanic eruptions, the weathering of rocks, and the action of undersea vents can release mercury from the Earth's crust into water bodies, soils, and the atmosphere.

Despite contributions from natural sources, however, mercury from anthropogenic, or *human-caused*, sources comprises the majority of mercury emissions. Globally and nationally, mercury contamination is widespread. The fact that fish from remote lakes can contain high levels of mercury in their flesh (USGS 1995) indicates that the global and continental scale of mercury contamination is due to primarily to air pollution.

Recent work by the USGS (2003b) indicates that nearly 50 percent of global anthropogenic mercury emissions originate from Asia. Comparatively, only 6 percent of global emmissions originate from the Unites States (predominantly in the mid-west and along the East Coast). Thus, atmospheric deposition from Asian sources may have a large impact on mercury sources in Idaho.

National Scale

Based on analysis of glacial ice cores, levels of mercury in terrestrial and aquatic ecosystems have increased three- to five-fold since the industrial revolution (Schuster et al. 2002). This increase corresponds to a parallel increase in atmospheric mercury levels, primarily due to industrial sources. Nationwide, the emission of mercury to the atmosphere typically contributes over 90 percent of the anthropogenic sources of mercury in water (EPA 2001b). Over 86 percent of this atmospheric load of mercury is attributed to coal-fired power plants and other combustion of fossil fuels (EPA 1997a). Combustion of waste and other industrial activities account for the remaining 14 percent.

Regional Scale

Recent studies in Oregon, showing narrow ranges of fish tissue mercury levels throughout the state, confirm that atmospheric transport is also an important vehicle for mercury distribution within this region (Peterson et. al. 2002). Idaho National Engineering and Environmental Laboratory (INEEL) studies have also found that samples of snow collected from background locations in eastern Idaho have average total mercury concentrations of 0.0038 µg/L (Susong et al. 2003).

The complexity of mercury transport in the atmosphere makes the task of identifying sources of deposition to a water body particularly challenging. As shown in Figure 2-2, direct wet deposition to the region has been simulated to be between 0.3 to 3 µg/m^2, with a localized area of higher deposition in the Coeur d'Alene area of 3 to 10 µg/m^2 (Bullock 2000).

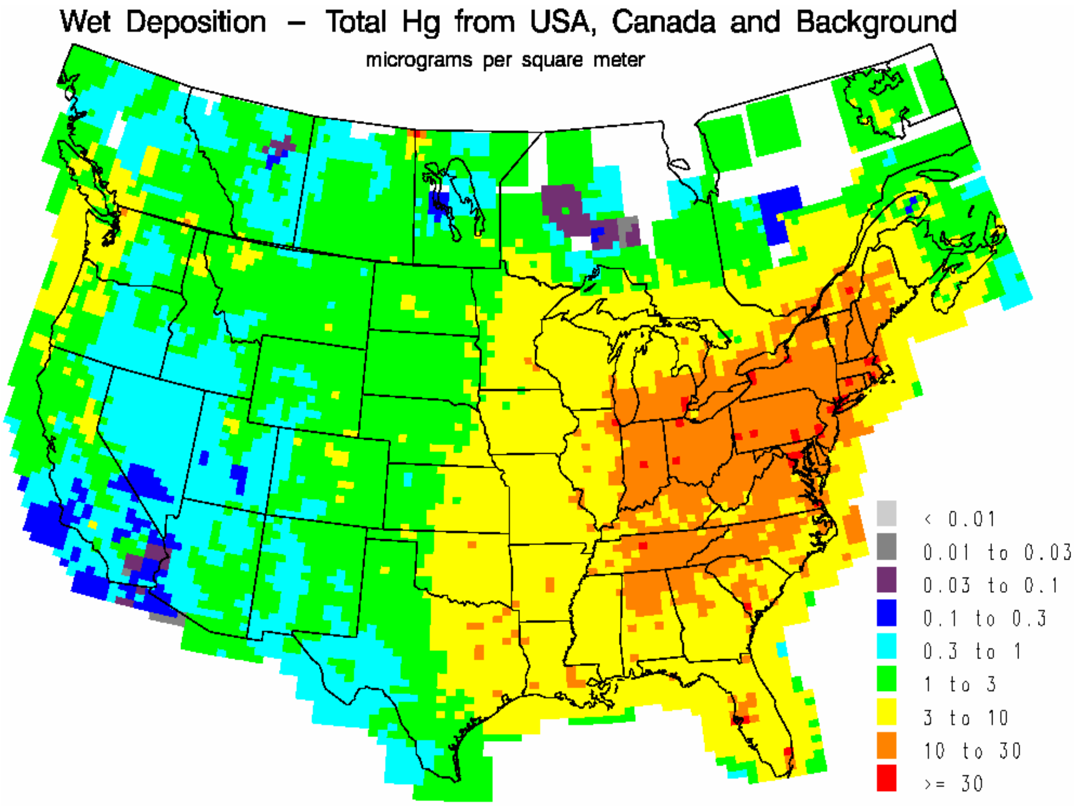
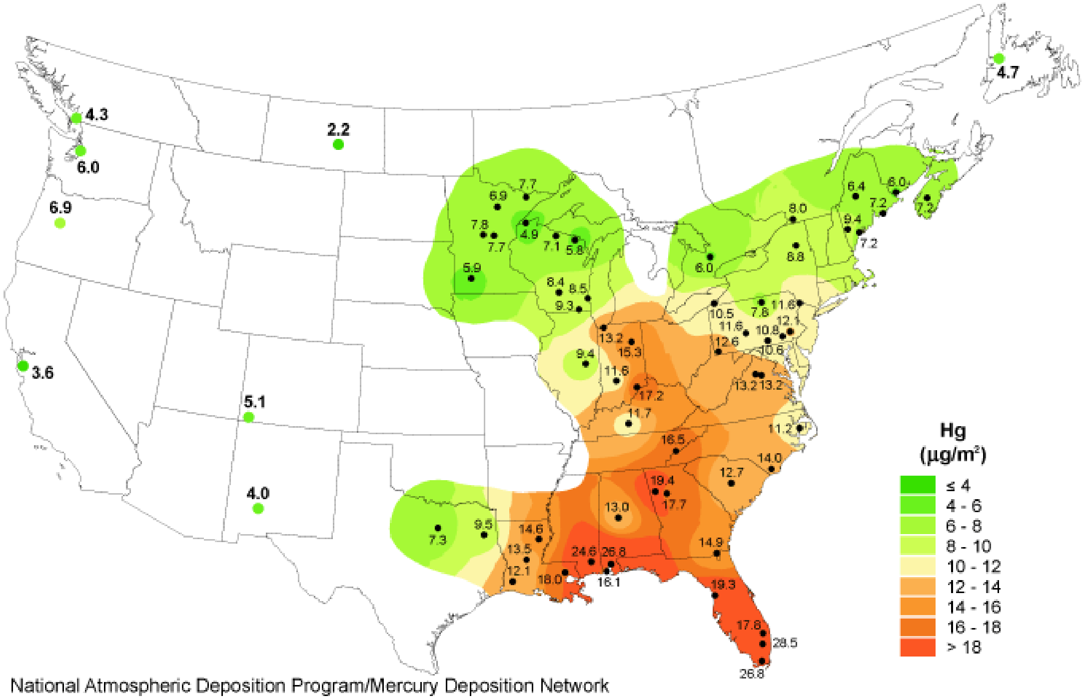


Figure 2-2. Simulated Wet Deposition of Total Mercury (Bullock 2000).

Figure 2-3 shows recent measurements of wet deposition of mercury on a national basis (http://www.epa.gov/mercury/eco.htm). Although this figure does not provide Idaho-specific deposition rates for 2003 (that is, no mercury data were collected from Idaho in 2003), the map shows that measured wet mercury deposition continues to be greatest within the southeastern states.

There appears to be relatively lower levels of atmospheric mercury deposition in the Pacific Northwest relative to the southeast; however, data from neighboring states to Idaho indicate that air deposition of mercury remains a regional issue.

Total Mercury Wet Deposition, 2003



National Atmospheric Deposition Program/Mercury Deposition Network

Figure 2-3. 2003 Wet Deposition of Total Mercury

Studies conducted by USGS on glacial ice cores (that is, in remote areas unaffected by local mercury sources) collected from western Wyoming confirm major releases of natural and anthropogenic mercury by regional and global sources (Schuster et al. 2002). In fact, mercury concentration spikes match up very well with the gold rush of the 1850s, general industrialization, WWII manufacturing, and major volcano eruptions (see Figure 2-4).

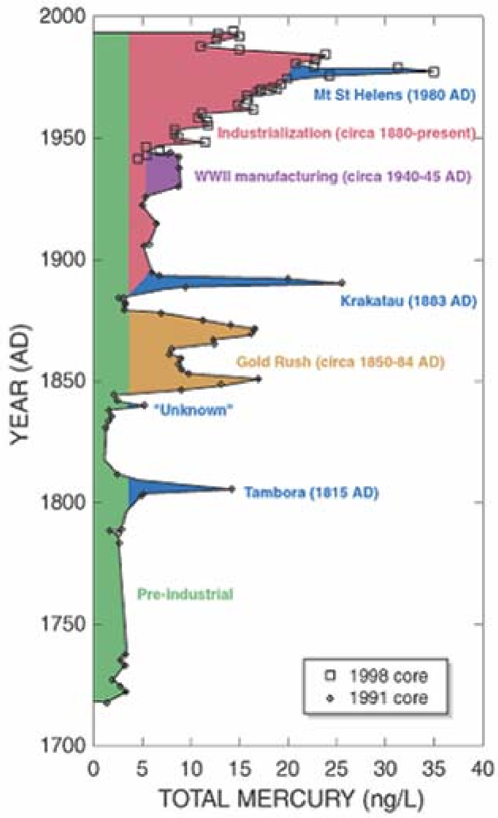


Figure 2-4. Mercury Levels in Regional Ice Cores Over the Last 300 Years (Schuster et al. 2002)

Although much remains to be learned about the fate, distribution and cycling of mercury in the environment, local and regional reduction of air emissions and significantly decreased industrial and commercial use of mercury appear to have shown positive results in air deposition. Schuster et al. (2002) characterizes the significance of the Wyoming ice core findings as:

> "This study, which represents the first effort to estimate rates of atmospheric mercury deposition using ice cores from mid-latitude regions, enabled scientists to clearly discern differences in natural and anthropogenic mercury sources over time. Scientists found that the amount of mercury deposited on the North American continent from atmospheric sources increased significantly during industrialization. In addition, analysis of ice cores indicated a dramatic decrease in atmospheric mercury deposition during the last

> 15-20 years, reflecting perhaps potential effects of the Clean Air Act and other management practices to reduce emissions. Information of this kind is necessary for establishing baseline levels of mercury in the environment, thereby providing crucial information for scientifically defensible resource-management, policy, and regulatory decisions being made now and in the future."

A local example of anthropogenic increases in mercury deposition includes sediment cores collected from two lakes in southeast Idaho (Abbott et al. 2002). These core data show present-day mercury accumulation rates (from both fallout and watershed input) of 26-43 $\mu g/m^2/yr$, as compared to deposition rates of 4-15 $\mu g/m^2/yr$ in the mid-1800s. These rates reflect a 2 to 9-fold increase in mercury accumulation since pre-industrial times, compared to the 3 to 5-fold global background increases observed in other published sediment studies such as Schuster et al. (2002).

In addition to air emission issues, legacy mining sources also contribute to mercury deposition. Many gold mining processes, including placer/dredging and milling operations, historically used mercury as part of the recovery process. As related to Idaho, these legacy sources are discussed in Section 2.3.

2.2.2 Environmental Cycling of Mercury is Complex

Elemental mercury, the silvery liquid used in old thermometers and barometers, was long considered relatively inert, and thus harmless. Unlike most metals, mercury—like water—readily evaporates. As a vapor, mercury is easily inhaled, leading to acute exposure, and the volatility of mercury allows easy distribution through the air, contaminating areas remote from man-made sources. Furthermore, the mercury bound in solid waste, ores, and fossil fuels is released easily into air during burning or heating.

As shown in Figure 2-5, the cycling of mercury is complex, involving all common environmental media—air, water, and sediment—as well as conversion from inorganic forms to organic forms and back again—mediated by bacteria.

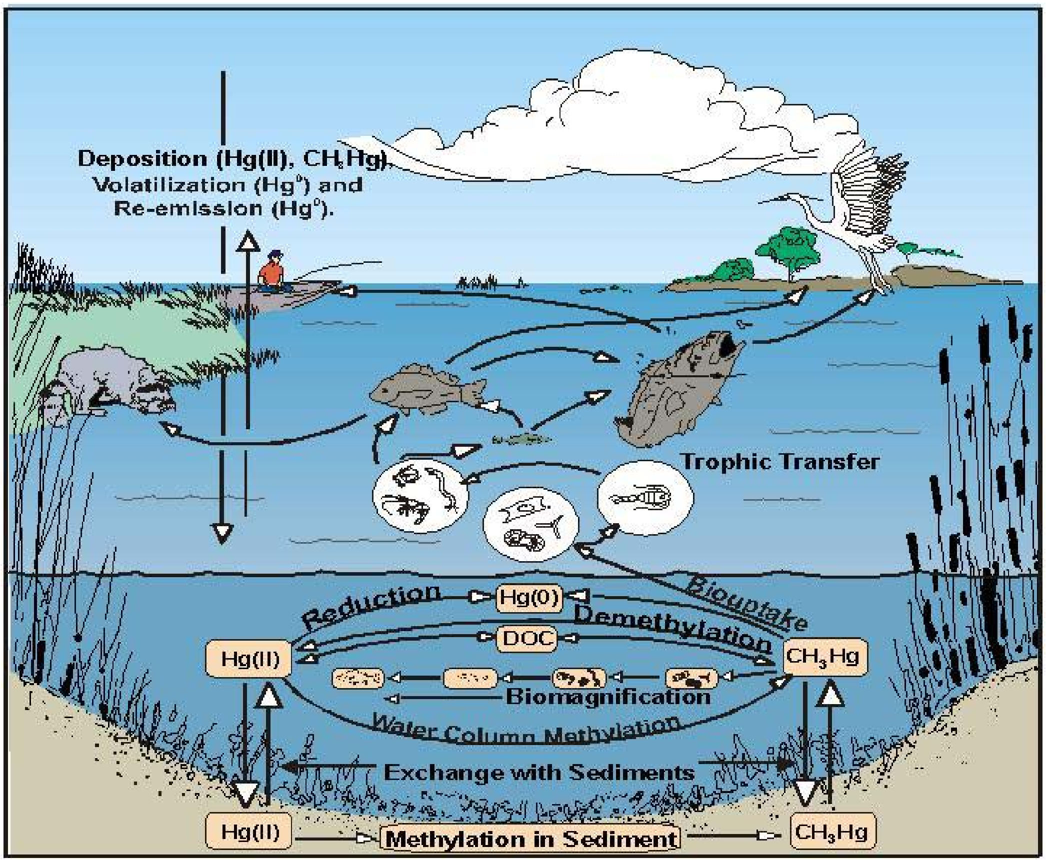


Figure 2-5. The Cycle of Mercury in the Environment

In water, elemental mercury is readily oxidized and thus brought into solution. Bacteria convert the oxidized inorganic mercury to its more toxic organic forms, particularly *methylmercury*.

Although only a small fraction of total aquatic mercury exists as methylmercury (1 to 10 percent), this fraction in very important, as it is the form of mercury that most readily enters and is concentrated in the food chain (EPA 1997a). Low dissolved oxygen levels and the presence of sulfur and organic matter—conditions common at the bottom of lakes and in wetlands—enhance the methylation processes.

Methylation is a key process that converts mercury to the form that can bioconcentrate and accumulate in fish tissue. USGS has measured methylation rates within selected National Water Quality Assessment (NAWQA) basins nationally (Figure 2-6).

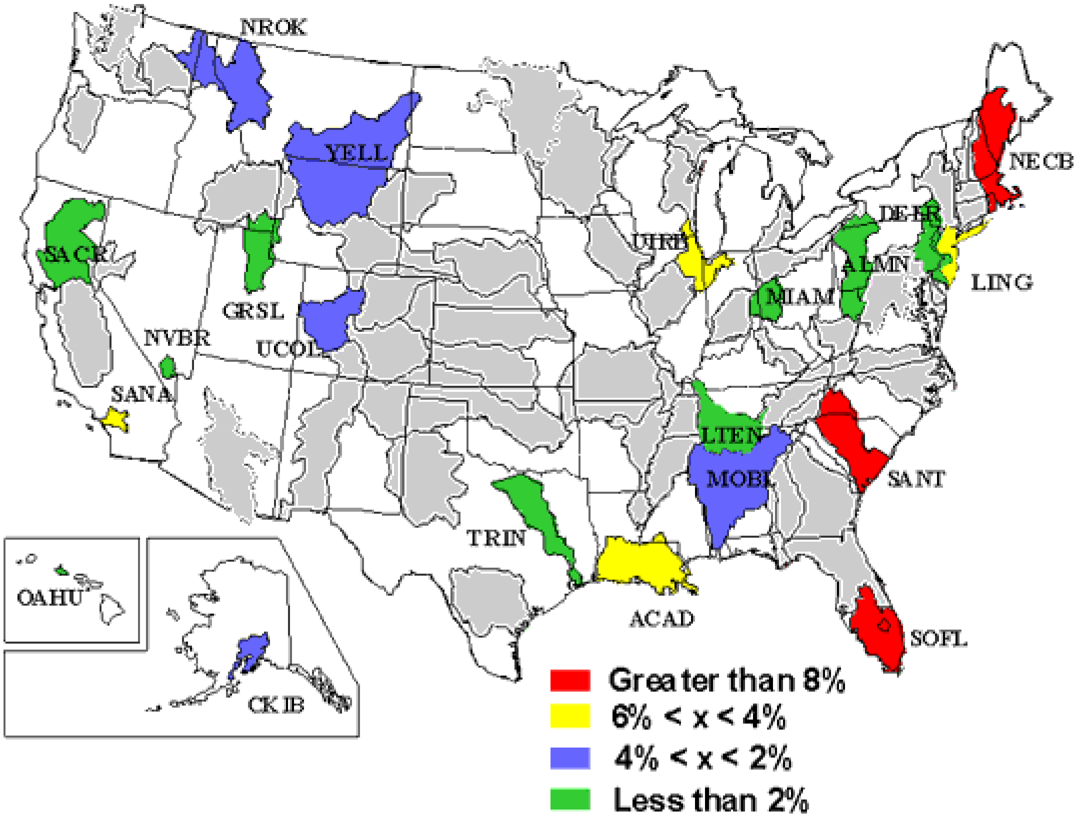


Figure 2-6. National Rates of Methylation Efficiency (USGS 2003c)

NOTE: Gray watersheds are NAWQA watersheds in which no methylation efficiency data are available and white areas are outside the NAWQA program.

Available data suggest that methylation rates generally are lowest in the west, which is an advantage, as less of the mercury that is present is converted to the toxic form and available for incorporation into the food chain. This advantage is offset somewhat in western watersheds that have high natural background (e.g. mineralized soils and deposits) levels of mercury and/or legacy mining issues.

2.2.3 Bioaccumulation Magnifies Concentrations in Living Organisms

Although mercury also can be lost from animal tissue, the removal process is much slower than the uptake of mercury, and so methylmercury becomes concentrated. These *bioaccumulation* processes, by which living organisms, including humans, take up contaminants more rapidly than they eliminate them, concentrate the mercury several fold. Each step, or trophic level, in the food chain —from water to algae,

algae to aquatic insects, insects to fish, and fish to other fish —concentrates the mercury several fold as compared to its concentration in lower trophic levels.

The process whereby mercury is found at increasingly higher concentrations in predatory species compared to the mercury concentration in prey species is known as biomagnification. The magnification effect can be large: people, along with fish-eating birds and wildlife, are at the top of the food chain, in the fourth or fifth trophic level, where bioaccumulation factors can reach more than 1,000,000 fold (1,600,000 for Trophic Level 3 fish and 6,800,000 for Trophic Level 4 fish; EPA 1997a).

Biomagnification is time dependent, varying with the duration of exposure, so that within any trophic level the older (and hence larger) organisms are expected to have the greatest mercury tissue concentrations. This strong tendency of mercury, particularly methylmercury, to bioaccumulate allows very low levels of mercury in the environment to produce unhealthful levels in fish. Bioaccumulation accounts for why very low water mercury levels can magnify—over time—to reach toxic levels in fish, humans, and other organisms.

Bioaccumulation also makes fish tissue a good integrator of aquatic mercury concentrations, which vary over time and require greater effort to measure.

Reductions in fish tissue concentrations, however, will lag behind reductions in discharges of mercury. The persistence of mercury in tissue is quite high, the biological half-life in fish tissue being 2-3 years, so a drop in water mercury levels will not immediately produce a corresponding drop in tissue concentrations. In addition, the cycling of mercury among its different chemical forms and media further slows environmental improvement. Therefore, time will be required to observe the effects of any mercury reduction actions.

2.2.4 Fish Tissue Sampling Offers an Alternative Measurement

Despite the common occurrence of detectable fish tissue mercury concentrations, corresponding mercury levels in surface waters tend to be extraordinarily low. In fact, levels of mercury in water have historically been so low that they have been difficult to detect, until recent years, as detection techniques have evolved and improved. Moreover, these low-level measurements require great care to prevent contamination during sampling and analysis, which contributes to the very high cost of monitoring mercury in water.

As an alternative to direct measurement of environmental mercury in water, fish tissue monitoring assesses the concentrations of mercury in living organisms. Bioaccumulation makes monitoring of mercury in fish tissue more cost effective than water monitoring because fish tissue sampling does not require clean techniques.

2.2.5 Mercury Contamination Presents Serious Health Risks

Mercury is one of the most toxic heavy metals. The primary target organ for mercury toxicity is the central nervous system, particularly the brain, and toxicity can occur at low doses. Other organ systems can also be damaged by exposure to mercury, but these effects occur at higher levels of exposure. Exposure to metallic, inorganic or organic forms of mercury can cause personality changes, changes in vision or hearing, and memory impairment (ATSDR 1999).

Because of differences in the ways the different forms of mercury travel through the body, exposure pathways are not equally likely to cause nervous system toxicity. Exposure to metallic or organic mercury is more likely to cause neurotoxicity than exposure to inorganic mercury. Exposure to metallic mercury occurs primarily through inhalation of mercury vapor; this route of exposure is not significant for the general public. Exposure to organic mercury through ingestion of food is the primary route of mercury exposure for most people.

Exposure to mercury is facilitated by its easy mobility in the environment and the tendency of certain forms to accumulate in the tissues of living organisms. The most common route of exposure for humans is consumption of fish and seafood that contain organic mercury. Methylmercury is the predominant form found in fish tissue, typically over 95 percent of total mercury (EPA 2000d). In this form, mercury is readily absorbed into the blood and distributed to body tissues. Unlike most organic contaminants that tend to concentrate in fatty tissue, mercury bioaccumulation occurs primarily in muscle tissue. Thus, it is nearly impossible to rely on careful food preparation to avoid introducing it into the diet.

Young children are more susceptible to methylmercury poisoning than are adults, as relatively more of the chemical passes into the brains of young children and it interferes with brain development (ATSDR 1999). Ingestion of methylmercury is a special concern for pregnant women, as it readily passes through the placenta and may cause brain damage in the developing fetus (USGS 1995). Because methylmercury is eliminated slowly from the human body, exposure to methylmercury prior to pregnancy is a concern as well. The U.S. FDA and EPA, in a joint advisory, have recommended that women of childbearing age who may become pregnant, as well as nursing mothers, limit consumption of fish known to contain high levels of methylmercury (FDA/EPA 2004).

2.2.6 Mercury Control Programs Have Been Developed Elsewhere

Recognizing the importance of reducing the amount of mercury that reaches treatment facilities and, ultimately, water bodies, other states have implemented innovative approaches to achieve mercury source control and pollution prevention programs. These approaches recognize that controlling mercury emissions using technological devices only spreads mercury to other media, while pollution prevention reduces the amount of mercury wastes that are generated in the first place. In 2001 alone, new mercury-control related bills were introduced in at least 17 states (CA, CN, IN, ME, MD, MA, MI, MN, NE, NH, NJ, NY, OR, RI, TX, VT, and WA) in addition to the six states that already have mercury-control legislation (FL, ME, MN, NJ, OH and WI).

Regionally, Oregon (ODEQ 2003b) and Washington (Ecology 2003) both have mercury control programs in place to identify sources of anthropogenic mercury and existing mercury reduction efforts, as well as to identify additional strategies for mercury control.

In other regions, Wisconsin has developed a comprehensive mercury strategy that focuses on reducing the amount of mercury released to the environment through the use of education, technical assistance, partnership development, and voluntary municipal efforts (WDNR 1997). Rule NR 106.145 recognizes that appropriate mercury source reduction activities are environmentally preferable to wastewater treatment technologies, in many cases because “wastewater treatment for mercury produces sludge or other resultant wastewater streams that can be as much or more an environmental liability than the untreated effluent.”

In conjunction with this strategy, Wisconsin set permit limits using a no-net-increase provision in conjunction with BMP-based source control permit conditions. This reliance on pollutant minimization programs focuses on the lack of relative ecological impact from each minor discharge. Typical waste minimization techniques for municipalities can be as straightforward as promoting water conservation, conducting waste minimization at selected industrial sites, and providing information/education to citizens and industries. Waste minimization for more complex municipal or industrial situations can include a more detailed pollution minimization plan.

Elsewhere, low-level mercury values for the protection of wildlife have been adopted in the Great Lakes area. In response, Ohio EPA estimated that the costs to bring discharges down to these low levels (which would be required of essentially every discharger) would cause substantial and widespread social and economic impact. In lieu of any economically-feasible treatment, Ohio EPA implements a general mercury variance program that requires developing pollution minimization programs. In Minnesota, state law requires the reduction of mercury contamination in fish through mercury release goals, contamination-reduction strategies, and voluntary reduction agreements (MPCA 2002).

Recognizing that mercury control in Minnesota is largely an issue of air emissions control that is outside the jurisdiction of water programs, the Minnesota Pollution Control Agency petitioned EPA Region 5 in December 2003 to waive potentially elaborate TMDL cleanup plans for state lakes and rivers contaminated by mercury (Duluth News Tribune, 2003). Specifically, the Minnesota Pollution Control Agency (MPCA) proposed changing the category for all mercury-impaired lakes from one that requires a TMDL to one that doesn't, provided other "pollution-control requirements are expected to attain the water-quality standard in a reasonable period of time.”

2.3 Idaho-Specific Sources of Mercury

Similar to elsewhere, mercury in Idaho is present due to natural and anthropogenic sources. In this section, both of these sources are described. Available mercury monitoring data are also presented.

2.3.1 Natural Sources

Mercury is a naturally occurring ore within Idaho, typically associated with high temperature (*epithermal*) gold deposits and hot springs. Figure 2-7 shows gold occurrence within Idaho. Two historical quicksilver (mercury) mining districts identified for Idaho include natural deposits near Weiser and deposits near Black Pine, adjacent to the Utah border (Gustfason 1987). In addition to cinnabar deposits, mercury-containing minerals also commonly occur near gold deposits that are prevalent throughout central and northern Idaho.

Hot springs are also abundant throughout the state. In 1985 the USGS analyzed 142 hot springs in the Idaho Batholith (Boise, Payette, Clearwater, and Salmon rivers) and found that mercury levels in these springs ranged from less than 0.01 to 1.4 µg/L (USGS 1985).

Although active volcanic activities in Idaho are currently limited to the central Snake River Plain area, recent preliminary research in Yellowstone National park indicates geothermally-related mercury emissions ranging between 0.20 and 0.24 $\mu g/m^2$/hr (http://newsdesk.inel.gov/press_releases/ 2003/10-21mercury_testing.htm). These levels are much higher than typical background emissions of 0-0.010 $\mu g/m^2$/hr in non-geothermal areas in the park. These rates are also much higher than typical deposition rates in Idaho (between 0.30 and 3.0 $\mu g/m^2$ on an annual basis or a maximum of 0.0003 $\mu g/m^2$ on an hourly basis, see Figure 2-2 [EPA 1997a]).

Idaho National Engineering and Environmental Laboratory (INEEL) scientists have speculated that additional data may show that Yellowstone Park could emit as much mercury as all the coal-fired power plants in Wyoming combined (http://www.montanaforum.com/rednews/2003/10/22/ build/parks/mercury.php?nnn=1). Given the prevailing weather patterns across Idaho, it is likely that Yellowstone emissions deposit mercury primarily in eastern Idaho. However, mercury emissions from similar volcanic formations in Nevada and California may be contributing to elevated mercury concentrations across other areas of southern Idaho.

Data collected by the USGS has shown snowfall concentrations of total mercury in Idaho's backcountry of around 0.002-0.005 µg/L (Susong et al. 2003). Although these appear to be very low concentrations, these low mercury levels are sufficient (if other conditions are right, for example, low pH and high dissolved organic matter) to cause bioaccumulation to toxic levels in pisciverous fish (those that eat other fish and that are considered the fourth trophic level).

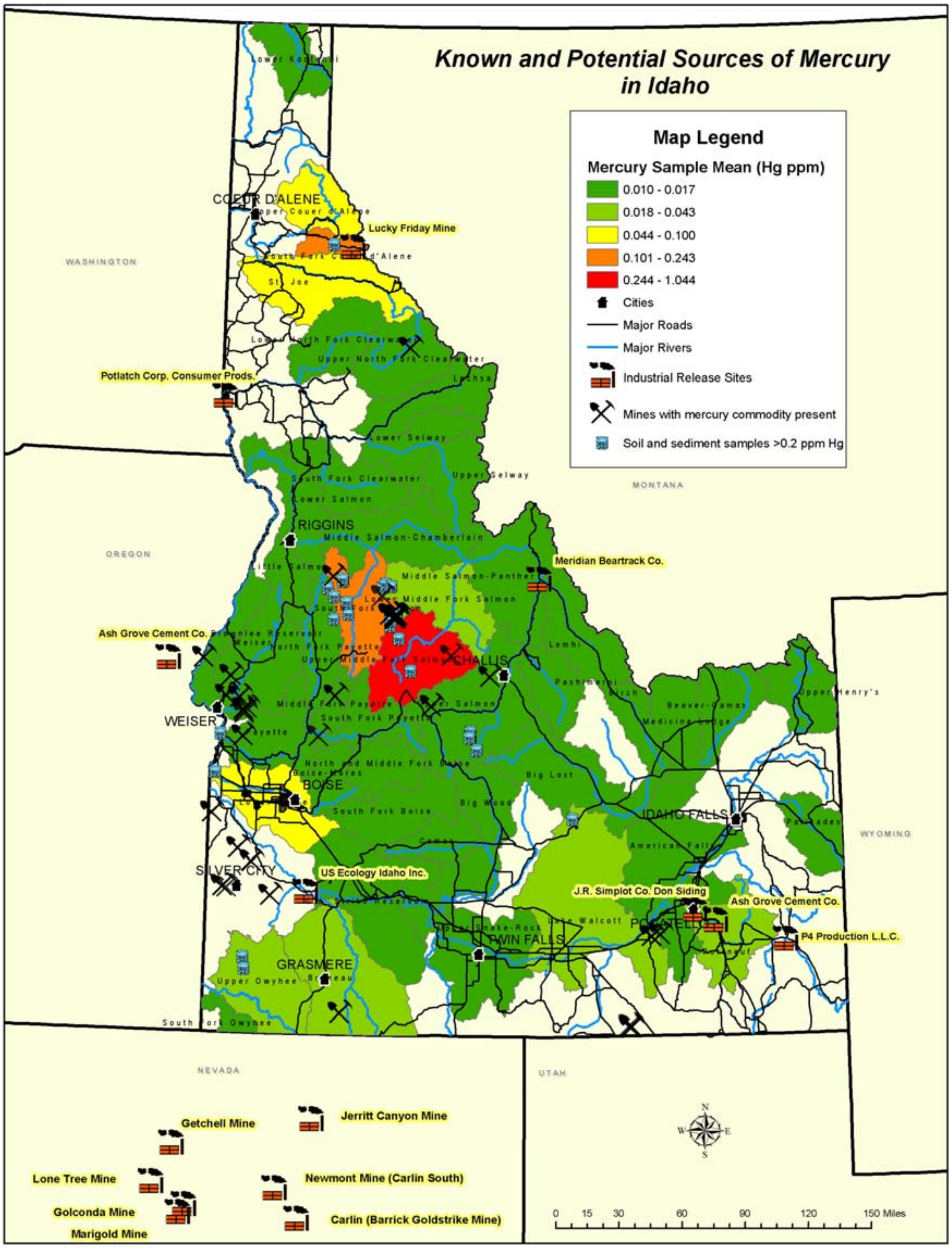


Figure 2-7. Known and Potential Sources of Mercury in Idaho

2.3.2 Anthropogenic Sources

Gold and mercury deposits exist in the Weiser area and in the Owyhee Mountains (DeLamar/Silver City) in southwest Idaho, which cause an elevated background concentration of mercury that contributes to contamination of Brownlee Reservoir (DEQ 2004). This concentration was exacerbated by use of mercury in historic placer mining activities for gold, which now is a legacy issue. All across Idaho, elemental mercury, called “liquid silver,” was used to obtain gold from alluvial or placer gold deposits (Figure 2-8).

Figure 2-8. Typical Legacy Mining of Placer Deposits in East Eagle Creek (Coeur d’Alene basin), circa 1860s

Mercury was commonly used in dredges and sluice boxes to recover fine gold from Jordan Creek (Owyhee County), Mores Creek (Boise County), Yankee Fork of the Salmon River, and Napias Creek/Jordan Creek (tributaries to the Yankee Fork).

Although using mercury to extract gold has long been abandoned as a mining practice in Idaho, rumors persist of mercury pools resting at the bottom of deep holes in Idaho’s rivers. Anecdotal information also suggests that several thousand pounds of elemental mercury were lost from mills in the Silver City area during the late 1800s and early 1900s (J. Baldwin, pers. comm., 2004).[1]

Much of the Idaho milling activity took place along Jordan Creek, or tributaries to Jordon Creek, and mercury was transported downstream along the Jordan Creek system during flood conditions. The construction of Owyhee Dam in the 1930s provided a catchment for this mercury, with methylation of mercury occurring in areas of the reservoir (J. Baldwin, pers. comm., 2004).

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[1] Although the validity of the Idaho rumors is unknown, USGS approximates that well over 3 million pounds of mercury were lost to the environment during placer mining in the Sierra Nevada mountains of California between the 1860s to the early 1990s (USGS 2000). Contaminated sediments in the area can contain as much as 30 grams of liquid mercury per kilogram of contaminated sediment.

Ore roasting associated with gold mining in northern Nevada is currently suspected as a significant source of atmospheric mercury loading to Idaho's southern tier of counties (R. Hardy, pers. comm. 2004). It is also known that gold mining to Idaho's south increased greatly in the late eighties. The forms of mercury released and its transport remains to be determined, but recent studies suggest that atmospheric residence times for mercury are long (0.5 to 2 years), and there is substantial potential for long-range transport (Steding and Flegal 2002; Lamborg et al. 2000).

In addition to mining issues, air emissions from regional industrial sources may be contributing to anthropogenic mercury loads (see Figures 2-2 and 2-3). While Idaho contains no coal-fired power generation plants, and few exist upwind in the Pacific Northwest, a recent study indicates coal-fired power generation across the Pacific Ocean contributes to elevated air deposition along the northwest coast (Steding and Flegal 2002). No solid waste combustion facilities are present in Idaho, although some are being considered for development. The City of Spokane, Washington, just across the Idaho border from Coeur d'Alene, does incinerate municipal waste.

Finally, the Snake River-Hells Canyon TMDL (DEQ 2004) provides an excellent summary of estimated loadings from legacy seed treatments. From the 1950s to the 1980s, mercury-containing seed treatments were used on grains throughout the United States. During 1970, mercurial seed treatment on winter and spring wheat in Idaho was estimated to be 720 pounds (327 kg) annually (DEQ 2004). Although residual mercury in agricultural soils may still be contributing some amount of mercury through sediment erosion and transport, it is suspected that, statewide, current management techniques that mitigate sediment transport from agricultural lands also mitigate mercury transport to canals and ditches. Thus, agriculture is likely to be a minimal source of mercury loading statewide in locations where effective erosion-control measures are in place.

2.3.3 Summary of Available Mercury Monitoring Data

Limited studies have been conducted throughout Idaho targeting mercury concentrations in fish tissues. Monitoring of fish tissue mercury concentrations in Idaho has focused on areas likely to present a health risk, such as Brownlee Reservoir and Lake Lowell. Limited monitoring of fish tissue in Idaho has occurred outside such areas.

The USGS has, over the years, collected and analyzed fish tissue for mercury throughout the more developed areas of Idaho. Of 69 samples collected since 1992, 14 samples (20 percent) had mercury fish tissue concentrations at or above the new methylmercury criterion. (Interestingly, the USGS data also show that only 7 percent of water samples had concentrations above EPA's 2002 recommended chronic aquatic life criteria [0.77 μg/L])[2].

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[2] However, five of these "hits" were reported as the same concentration as the criterion. Because the analysis of fish tissue is for total mercury in the tissue, it is not certain that the fish tissue criterion for methylmercury was exceeded in these instances.

These data suggest that mercury levels in fish tissue will not be above the new criterion for most water bodies. As appropriate, these data will be used to prioritize watersheds within the statewide framework.

Available Idaho studies include the following:

- In the Panhandle Region, URS conducted a fish investigation at Coeur d'Alene Lake for USEPA Region 10 (URS 2003). The objective of the investigation was to collect fish tissue metal data to evaluate human health risks associated with consumption of fish from Coeur d'Alene Lake. The study targeted both recreational and tribal consumption of bass, bullhead, and kokanee and collected fillet and gutted carcass samples. The final report was drafted in May 2003 and is summarized in Figure 2-9.

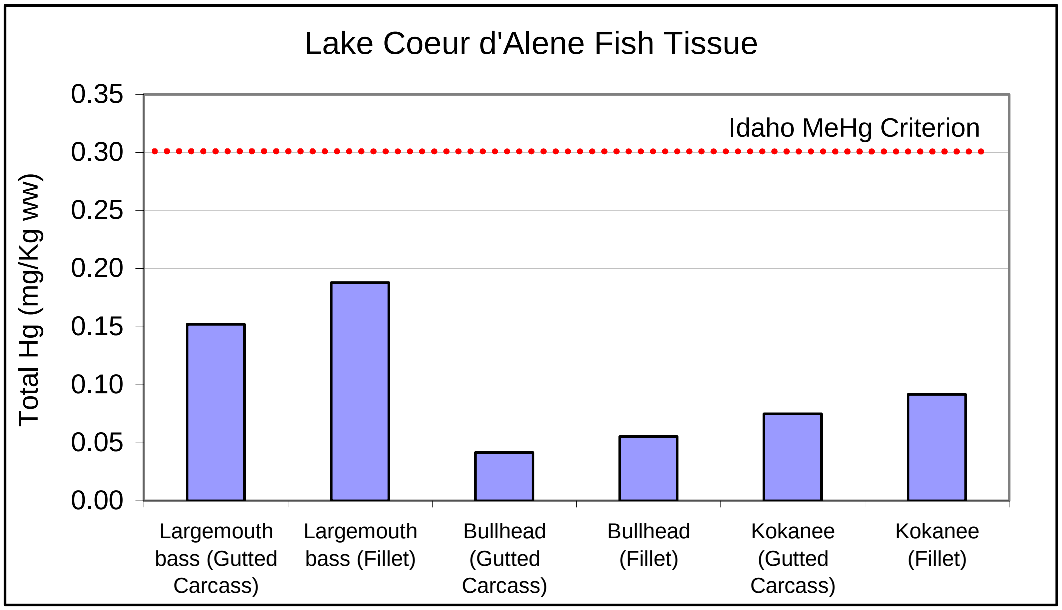

Figure 2-9. 2002 Fish Tissue Data from Lake Coeur d'Alene (URS 2003)

- In the Salmon Region, Hecla Mining has conducted long-term bioassessment monitoring on Jordan Creek and Yankee Fork. Fish tissue samples have been collected from 2000 through the present and show that average mercury concentrations in whole body samples are at the *Method Detection Limit* (MDL) (<0.04 mg/kg), with a maximum concentration of 0.12 mg/kg. These levels represent upstream and downstream samples from active mining operations and are well below the criterion of 0.3 mg/kg. These data are plotted in Figure 2-10.

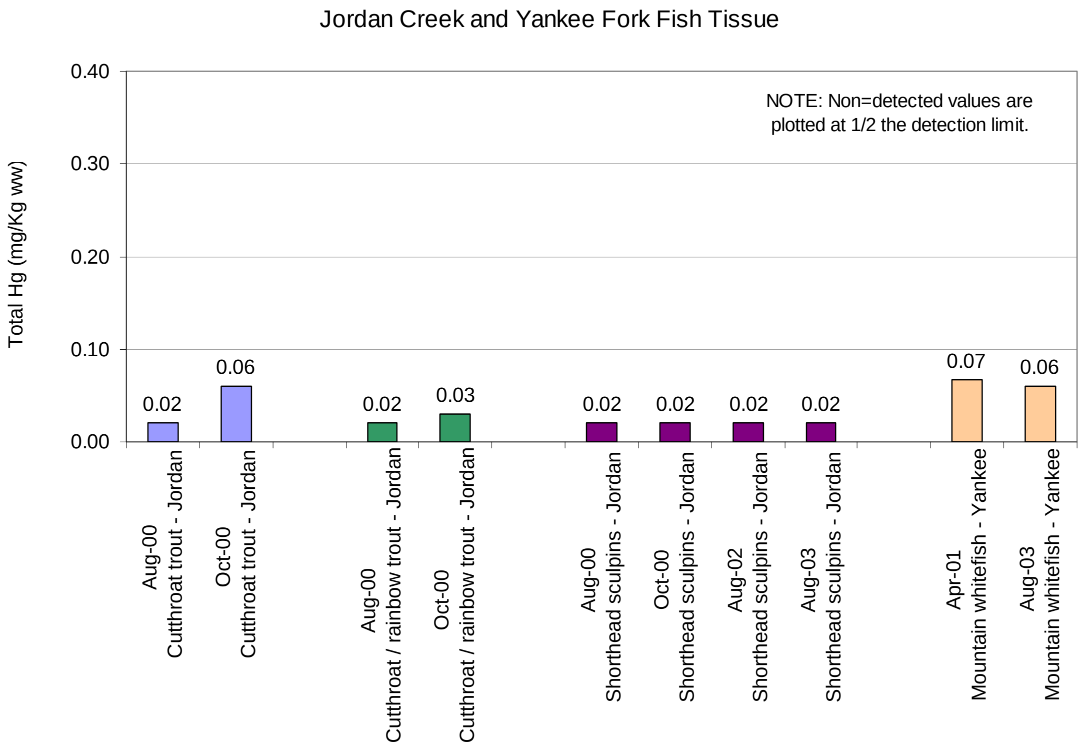

Figure 2-10. 2000-2003 Fish Tissue Data from Jordan Creek and Yankee Fork (Chadwick Ecological Consultants 2001, 2002, 2003, 2004a, 2004b)

NOTE: Concentrations represent average species concentration for each sampling event.

- In the Magic Valley Region, the Salmon Falls Creek Reservoir was sampled by the Idaho Department of Fish and Game in 2001 for the IFCAP. Average concentrations of mercury varied by species: rainbow trout[3] were lowest (0.18 mg/kg) and walleye were highest (0.56 mg/kg ww).[4]

Average concentrations in smallmouth bass (0.55 mg/kg) were higher than in Yellow perch (0.36 mg/kg), which were in turn higher than Kokanee (0.21 mg/kg). DEQ speculates that mercury contamination is due to smelting plants located upstream and outside of Idaho state boundaries.

- In the Upper Snake and Southwest Region, USGS summarized limited mercury data measured in fish tissue collected along the Snake River between Henry's Fork and Snake River at Whitebird between 1993 and 1997 (Clark and Maret 1998).

Average mercury concentrations were 0.09 mg/kg wet weight (ww) in livers (range from 0.02 to 0.32 mg/kg ww), and 0.19 mg/kg ww in fillets (range from 0.08 to

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[3] Rainbow trout are excluded from the Salmon Falls Creek Reservoir advisory.

[4] Although raw data were reported in *dry weight* (dw), which can be between 5 and 10 times greater than wet weight (ww) concentrations, these values were converted to wet weight using the measured moisture content.

0.33 mg/kg ww). These data were used to support the Brownlee TMDL source assessment for mercury. IFCAP issued a fish consumption advisory for pregnant women, children younger than six years old, and the general public.

- In the Southwest Region, USF&WS conducted a fish tissue metal study in 1998 on Lake Lowell (USF&WS 2000). Average mercury concentrations in fish tissue ranged from 0.05 mg/kg (Yellow perch and bluegill) to 0.21 mg/kg (suckers). Species included suckers, largemouth bass, smallmouth bass, bluegill, carp, and crappie, with fillets analyzed for potential human health effects and whole body analyzed for potential wildlife effects. Sampling concluded in the summer of 2001, and a health advisory was issued by IFCAP for pregnant women and children younger than six years old.
- In the Southwest Region, USGS collected fish tissue from the lower Boise River (at Glenwood Bridge in the middle of Boise City) in 2001. Average fish tissue concentrations of mercury were 0.16 mg/kg. Species collected included Mountain whitefish, brown trout, and suckers.
- In the Southwest Region, USGS collected more recent fish tissue from C.J. Strike Reservoir in 2001. Average fish tissue concentrations of mercury were 0.13 mg/kg (dry weight). Species collected included rainbow trout and smallmouth bass.

A summary of all available mercury fish tissue data in Idaho is provided in Appendix C and will be used to begin the monitoring prioritization process (see Chapter 4 and Appendix B).

Fish tissue metal studies have also been conducted in nearby states.

- Between 1996 and 1998, EPA studied contaminant levels of fish from throughout the Columbia River Basin (EPA 2002c). Average mercury levels in fish across the basin were variable as shown in Figure 2-11. These data show that salmonids tend to have lower concentrations of mercury than higher trophic species, such as sturgeon and walleye.

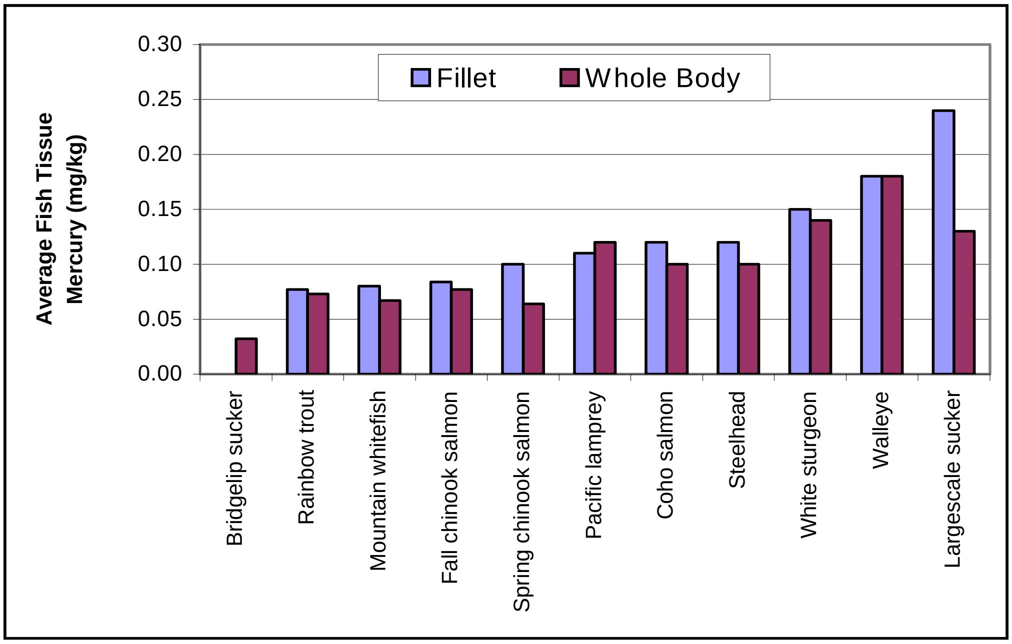

Figure 2-11. Columbia River Basin Mercury Composite Fish Samples (1996-1998; EPA 2002c)

- A statewide lakes monitoring program was conducted by Washington State Department of Ecology and focused on mercury in edible fish tissue and sediments (Ecology 2003). This study showed that the majority (>80 percent) of bass fillets from lakes/reservoirs were under the 0.3 mg/kg threshold. A statewide fish consumption advisory for bass for women of childbearing age, infants, and children under six years old was issued based on this data.

2.4 Overview of EPA Mercury Criteria Adopted by Idaho

In 1994, Idaho adopted criteria from the *National Toxics Rule* (FR 57:60848), which contained mercury criteria for the protection of both freshwater aquatic life and human health. Both the acute and chronic criteria were expressed as total recoverable mercury concentrations in the water column based on protection of aquatic life (Stephan 1985), but in a departure from typical practice, the chronic criterion of 0.012 µg/L (12 parts per trillion) was actually a human health criteria derived by EPA from a fish tissue concentration and conservative bioaccumulation factors.

EPA updated their recommended aquatic life criteria for mercury in 1995 and 1997, leading up to promulgation of criteria for toxics in California. The human health criterion was revised in 2001, following development of a new methodology for determining human health criteria published the preceding year (EPA 2002b).

2.4.1 New Criterion Raises Questions for Traditional Pollution Control

The new human health criterion for mercury is expressed as fish tissue concentration of methylmercury. Despite its direct relation to protection of human health, this criterion raises several questions for implementation of traditional pollution control activities under the Clean Water Act, including NPDES permits, TMDLs, and State §401 certification for other federal actions (for example, Federal Energy Regulatory Commission (FERC) relicensing). Although used in public health venues for years, tissue concentration represents a completely new way of expressing water quality criteria. Additionally, this criterion raises questions concerning the protection of aquatic life and endangered species, such as the following:

- How does a fish tissue concentration translate to NPDES permit limits, since these sources do not discharge contaminated fish but, rather, the contaminant that causes contaminated fish?
- How can fish tissue data be used to develop a TMDL, which requires the reduction of mercury to levels that meet state water quality standards, when the form monitored (total inorganic mercury) is not the same form found in fish tissue (methylmercury)?
- Does protection of human health also result in protection of fish and wildlife that feed on fish?
- How will the state determine if new or increased discharges of mercury to the water will result in noncompliance with the fish tissue criterion?

This guidance answers these questions. The following section provides a history of the methylmercury criterion to provide additional context for decisions integrated into this document.

2.4.2 A History of EPA's Methylmercury Criterion

Under section 304(a) of the Clean Water Act, EPA is directed to develop guidance to states and tribes on water quality criteria. EPA's initial recommendation on ambient water quality criteria for mercury dates back to 1976 and was updated in 1980 and 1985. The 1985 update forms the basis of the 1992 National Toxics Rule (NTR) that Idaho adopted in 1994.

A Derived Criterion

The 1985 freshwater aquatic life chronic criterion was not based on acute-chronic ratios, as is typical, because of insufficient data. Instead, EPA derived the criterion based on the Food and Drug Administration's action level of 1.0 mg/kg fish tissue concentration for consumption of fish and shellfish, applying a bio-concentration factor of 81,700. In taking this action, EPA assumed that all the aquatic mercury to which fish are exposed is methylmercury. In reality, data from other states indicate that less than 8 percent of the total aquatic mercury is methylmercury in most watersheds (USGS 2003b).

Updates for Specific Species of Fish

In 1995 EPA issued revised 304(a) criteria for several metals, including mercury (EPA 1996a). This update incorporated new data and new methodologies used in the

Great Lakes Initiative (EPA 1995b). The aquatic life acute criterion for mercury was reduced from 2.1 µg/L to 1.7 µg/L, and the chronic criterion was increased from 0.012 µg/L to 0.91 µg/L. Both criteria were expressed as total recoverable concentrations of mercury (II), the common inorganic state of mercury in water. However, the chronic criterion was derived to protect aquatic life instead of human health using acute-chronic ratios, as recommended in Stephan (1985). The change in method accounts for the large increase in the chronic aquatic life criterion.

The 1995 update for mercury notes that the recommended freshwater aquatic life chronic criterion "might not adequately protect such important fishes as the rainbow trout, coho salmon, and bluegill" (EPA 1996a). Earlier in the 1995 update document, estimated chronic values of 0.42 µg/L and 0.37 µg/L are given for protection of rainbow trout and coho salmon, respectively. These species-specific criteria are based on species mean acute-chronic ratios and the 5th percentile of species mean acute values, rather than the customary final acute-chronic ratio and 5th percentile of genus mean acute values used to derive criteria generally protective of all species.

Promulgation of Dissolved Criteria

In EPA's 1997 proposed promulgation of toxics criteria for California (EPA 1997), the total recoverable mercury aquatic life criteria were recalculated to be expressed as dissolved concentrations. Because the concentration of dissolved mercury was a fraction of the total recoverable mercury in the toxicity tests on which the criteria are based, the dissolved acute criterion is 1.4 µg/L and the dissolved chronic criterion is 0.77 µg/L. As of the writing of this guidance, DEQ is proposing to reserve (that is, remove) both the acute and chronic numeric aquatic life criteria pending resolution of NOAA Fisheries and U.S. Fish and Wildlife Services Section 7 consultation.

Human Health Focus

Because the environmental concern with mercury is primarily protection of human health, and the route of exposure is primarily through eating of fish and seafood, EPA published a fish tissue methylmercury criterion for the protection of human health (EPA 2001a). This criterion was developed using updated human health risk assessment methods (EPA 2000d). These new methods included updated approaches for determining dose-response curves, updated information for determining exposure factors, and new procedures for deriving bioaccumulation factors. An updated fish consumption rate of 17.5 g/day was used in the development of the fish tissue mercury criterion. The 17.5 g/day consumption rate is a substantial increase over the previous 6.5 g/day consumption rate, and represents the 90th percentile of fish consumption for the US population. (This issue is discussed in more detail in Chapters 3 and 4.)

2.4.3 Methods for Implementing a Methylmercury Fish Criterion

In many respects, a fish tissue criterion is an important advance in environmental protection. It directly relates to the protection of human health, integrates complex spatial and temporal variability in aquatic systems, and is easier and less costly to measure than very low concentrations of mercury in water. Because the fish tissue mercury criterion breaks new ground, it does require explanation of its implementation for various Clean Water Act programs that have traditionally relied upon use of water column concentrations to control pollution.

EPA and interested stakeholders have identified at least four methods for implementing the methylmercury fish tissue criterion, including the following:

- Default bioaccumulation factors
- Site-specific bioaccumulation factors
- Modeling of bioaccumulation
- Fish tissue only

It is expected that EPA's final implementation guidance to states will include all four approaches when it is completed.

The first three methods translate the fish tissue concentration to a water column number for meeting the purposes of the Clean Water Act—principally development of TMDLs to clean up waters and NPDES discharge permits to minimize degradation. The pros and cons of each of these methods are discussed in the following.

Default Bioaccumulation Factors

Default bioaccumulation factors are based on an average or selected percentile of national data on rates of mercury bioaccumulation in fish tissue. The default approach is easy to apply, but it results in over- or under-protective targets, depending on how well the default factor matches local conditions. The appropriate use of the default factors cannot be known unless substantial expense and monitoring are conducted in each water body of concern.

Site-specific Bioaccumulation Factors

Site-specific bioaccumulation factors can be more specific, but their calculation requires a year or more of local monitoring to obtain sufficient data. Necessary data includes low-level total mercury and methylmercury concentrations in water, along with data on fish tissue mercury levels. This is an expensive endeavor, which local entities may be unable to afford. Furthermore, this effort and expense must be undertaken for each new area in question.

Modeling of Bioaccumulation

Modeling of bioaccumulation is a theoretically promising option that may provide a cost-effective alternative to the default or site-specific approaches. Models can use more easily-measured water conditions to predict the level of bioaccumulation of mercury that will occur in a water body. However, the data required for this option are still significant, and validation of the modeled results is necessary to build confidence in the modeled results.

Fish Tissue Only

The fourth methylmercury method, *fish tissue only*, requires no translation to water column concentration, relying instead on direct measurement of methylmercury fish tissue levels to protect human health. Aquatic life uses are also protected by fish tissue values, because the resulting methylmercury concentrations in the water column have typically been shown to be 2-3 orders of magnitude lower than aquatic life criteria (USEPA 2001c, EPA Region 6 and Louisiana DEQ 2001, FTN 2002, Parsons 2003).

The fish tissue only approach assumes that changes in fish tissue concentrations are proportional to changes in aquatic concentrations for a given area. That is, it assumes the rate of bioaccumulation is characteristic of the area, even though this rate is site-specific.

2.5 Idaho’s Approach: Fish Tissue Only

Idaho has elected to use the fourth method for implementing a methylmercury criterion, which uses fish tissue concentrations as an indirect measure of water quality. If the measured fish tissue level is greater than the criterion, then the unmeasured water concentration is too high, and vice versa. The necessary reduction in aquatic mercury is obtained by the ratio of measured fish tissue levels to the criterion.

This approach and Idaho’s rationale for using this approach are described in more detail in the remainder of this document. Because human health and recreational criteria apply to all waters in Idaho, the methylmercury fish tissue criterion covers all waters that support aquatic life and recreation, as well. This means that all waters in Idaho are subject to the methylmercury criterion.

Because of these and other questions surrounding the implementation of this new and unique criterion, EPA will approve Idaho’s adoption of a methylmercury criterion only with concurrent implementation guidance[5].

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[5] A national workgroup has been working with EPA to develop national guidance to the states for implementation of the methylmercury fish tissue criterion. This effort has been underway since 2001, and EPA anticipates the final guidance document will be available to states in late 2004. In the absence of national guidance, Idaho has developed this implementation guidance to support use of the fish tissue criterion. Idaho convened its own workgroup to accomplish this goal and worked in close concert with the EPA national group to ensure consistency between the two efforts.

3. Idaho Fish Tissue Mercury Criterion

This section provides an overview of the conceptual approach adopted by Idaho to meet EPA's fish tissue criterion for mercury. Information provided includes the following:

- A brief summary of Clean Water Act requirements
- A detailed discussion of the new criterion and the mechanics of how the criterion is calculated
- A framework for applying the criterion within the TMDL and NPDES programs
- A discussion of site-specific options for criterion implementation

3.1 Clean Water Act Requirements

States must adopt water quality criteria that protect designated uses (CWA 303(c)(2)(A)). As specified in EPA's *Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion* (2004):

> "Water quality criteria must be based on a sound scientific rationale and must contain sufficient parameters or components to protect the designated uses. See 40 CFR 131.11(a)… States and authorized Tribes may employ one of four approaches when adopting water quality criteria: (1) Establish numerical values based on section 304(a) recommended water quality criteria; (2) modify the section 304(a) recommended water quality criteria to reflect site-specific conditions; (3) use other scientifically defensible methods to derive protective water quality criteria; and (4) establish narrative water quality criteria where numeric criteria cannot be determined or to supplement numeric water quality criteria. See 40 CFR 131.11(b). For the protection of human health from contaminants in fish, EPA considers the 2001 methylmercury criterion a sound, scientifically based approach for meeting human health designated uses."

Idaho has elected to adopt EPA's 2001 methylmercury criterion in order to fulfill the requirements of CFR Section 131.

3.2 Methylmercury Fish Tissue Criterion Advantages

EPA's 2002 recommended water quality criterion for methylmercury is expressed as a fish tissue residue value (wet-weight methylmercury in fish tissue). Idaho has elected to adopt the fish tissue residue criterion as the state's water quality standard. The state has done this because this criterion and approach offers the following advantages:

- Directly measures environmental result. A fish tissue residue value is a direct measure of the desired environmental outcome, a direct measure of the "fishable" designated use and CWA goal, and is closely tied to fish consumption advisories.
- Eliminates the need to translate a fish tissue value into a water column value. Idaho's approach does not rely on determining appropriate bioaccumulation factors (BAFs), which are technically difficult to generate, highly variable, and expensive. The foundation of this approach is that BAFs, while site-specific, are characteristic of a given water body and that the characteristic BAF of a water body does not change with changes in mercury loading. Thus, changes in fish tissue methylmercury levels are proportional to changes in mercury loads to the water body. This relationship has been assumed to be linear in numerous other cases (EPA Region 6 and Louisiana DEQ 2001, FTN 2002, Parsons 2003). In addition, EPA models in the Florida Everglades have shown that the relationship between current atmospheric deposition rates and current fish tissue concentrations is approximately linear (Florida DEP 2003).
- Reduces monitoring costs. Water column mercury analyses are more difficult to measure than fish tissue methylmercury due to lower concentrations and significantly greater variability. Fish tissue monitoring is also considered an integrated measure of mercury exposure.
- Meets TMDL and NPDES program needs in a more cost-effective manner. The state and affected stakeholders benefit from quicker and lower cost implementation by reducing NPDES permitting and TMDL development and monitoring costs. This approach is expected to provide more robust environmental information and improve public health information/protection because of its coordination with the existing fish advisory program.
- Incorporates current understanding of mercury sources and distribution. As discussed in Section 2, the fate and distribution of mercury in the environment is highly variable, which is one of the reasons that EPA recommends a fish tissue criterion. This variability is particularly important in Idaho, where mercury from air deposition is expected to dominate in most water bodies. Because Idaho has relatively few municipal solid or medical waste combustors, coal fired power plants, or coal fired boilers, controllable point sources are generally *de minimis* contributors with limited ability to cost effectively control mercury.
- Retains flexibility. This approach also retains the ability to apply site-specific modifications to the fish tissue criterion to reflect local environmental conditions and human exposure patterns, consistent with EPA's most recent human health risk methodology (EPA 2000d).

3.3 Methylmercury Criterion Formula

In its most basic form, the fish tissue criterion is expressed as Equation 3-1:

$$TissueCriterion = \frac{\left[BodyWeight * \left(RfDose - RSC\right)\right]}{FishIntake}$$

Equation 3-1. Calculation of Tissue Criterion Based on Body Weight, Reference Dose, and Fish Intake

Where:

TissueCriterion = Fish tissue residue criterion (mg methylmercury/kg fish tissue per day)

BodyWeight = Human body weight. The default value is 70 kg for adults.

RfDose = Reference dose. The default value, based on non-cancer-causing human health effects, is 0.0001 mg/kg of body weight per day.

RSC = Relative source contribution to for mercury entering the body from sources other than fish. The default value is 2.7×10^{-5} mg/kg of body weight per day.

FishIntake = Consumption rate of fish. The default value is 0.0175 kg/day to protect 90 percent of the general nationwide population.

3.3.1 Idaho Value for Tissue Criterion: 0.3 mg/kg

Using EPA (2001) default values in the Equation 3-1, TissueCriterion equals 0.3 mg/kg of methylmercury in fish (rounded to one significant digit from 0.292 mg methylmercury/kg fish tissue). This value is the technical basis for the new methylmercury criterion that has been adopted in Idaho.

DEQ believes this criterion is valid and provides protection against human health consumption of mercury-affected fish, as well as protection of ecological resources in the state. The assessment of mercury is an evolving science and this number is based on the most recent human health risk methodologies and data (EPA 2000d). As these methodologies continue to evolve, the criterion will probably be refined further.

3.3.2 A Value that Protects Human Health and Wildlife

As discussed in more detail in Chapter 7, from an ecological perspective EPA's consultation on mercury with the U.S. Fish and Wildlife Service and the U.S. National Marine Fisheries Services in California focused on nine wildlife species, including the bald eagle, California least tern, and California clapper rail (USF&WS 2003). This study concluded that the current 0.3 mg/kg fish tissue criterion provides adequate protection for between 4 to 7 of the 9 aquatic and wildlife species, depending on the analytical method used. This report and its conclusions are discussed in more detail in *Implications of Criterion Implementation for Aquatic*

Species and Aquatic-dependent Wildlife Species (page 107), recognizing that adopting and implementing a revised criterion must also be protective of aquatic species and fish-eating wildlife (particularly those listed under the Endangered Species Act [ESA]). In order to ensure the continued protection of federally-listed threatened and endangered species and to protect their critical habitat, EPA agreed to reserve the aquatic life criteria for mercury[6].

3.4 Implementing the Mercury Criterion in the TMDL and NPDES Programs

Because Idaho has no other water quality criteria that are expressed as a fish tissue value, this guidance document provides considerable detail on how the mercury criterion will be implemented through the TMDL and NDPES programs. To balance environmental protection with economic cost, implementation will be accomplished using a tiered framework.

An overview of the framework is presented in the following, with a more detailed implementation discussion presented in the following chapters. A flowchart of the framework is provided in Figure 3-1[7]. (Text in parentheses shows the related chapters in this document where detailed descriptions are provided.)

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[6] While the new criterion is based on EPA default values, there is flexibility in the standard to incorporate site-specific conditions, such as subsistence fishing consumption conditions and varied trophic level fishing rates. This flexibility is discussed in detail in Chapter 4.

[7] The framework uses a mercury tissue concentration of 0.24 mg/kg, which represents a 20 percent margin of safety below the 0.3 mg/kg.

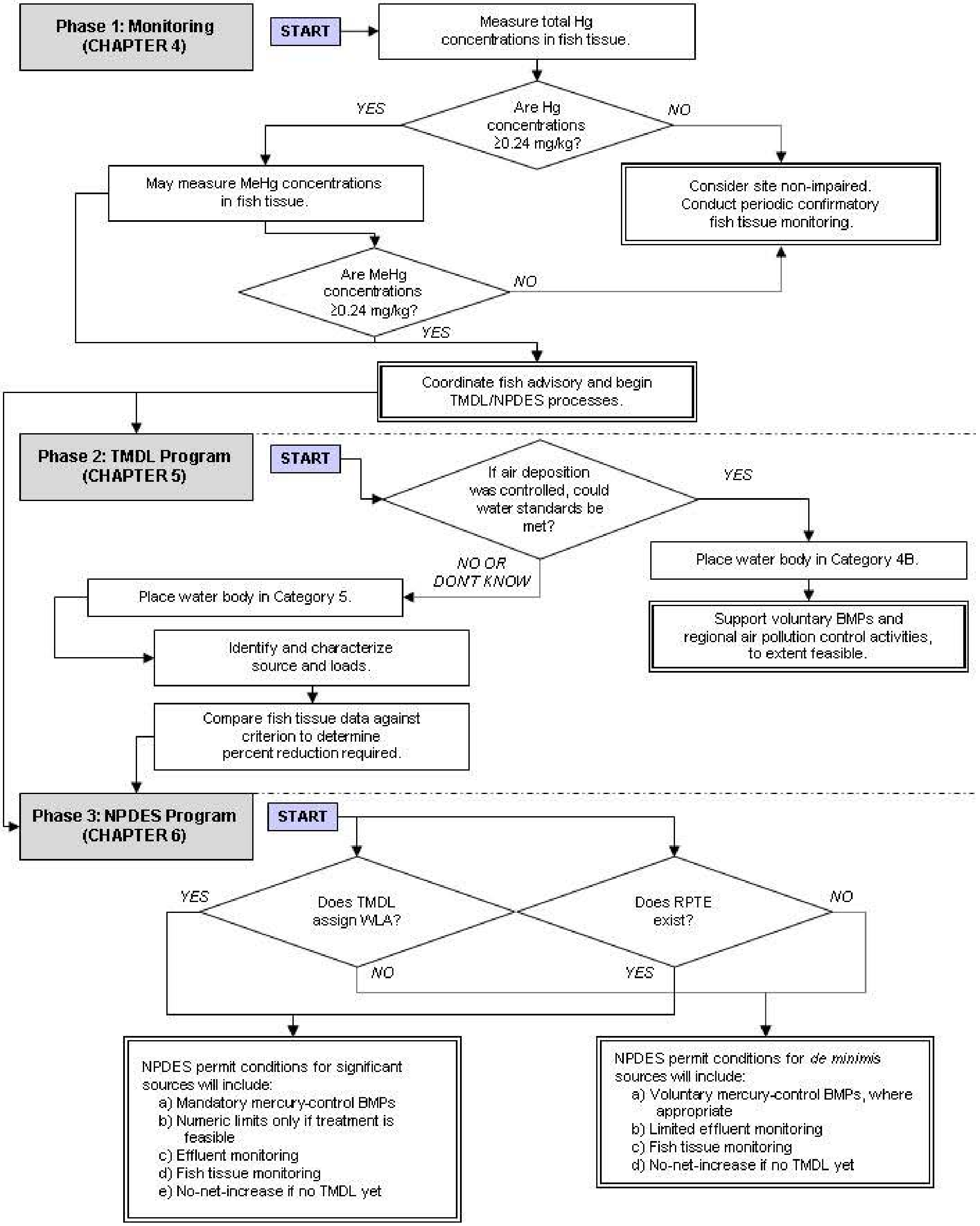

Figure 3-1. Overview of Idaho Mercury Criterion Implementation Framework

3.4.1 Phase 1: Monitoring (Chapter 4: Monitoring and Assessment, page 53)

Steps to be taken for Phase 1 implementation are as follows:

Step 1a: Define geographic scope[8].

Step 1b: Monitor total mercury in resident fish tissue via the statewide fish tissue monitoring program[9].

- ° If total mercury tissue concentrations in fish are ≥ 0.24 mg/kg, coordinate fish advisory with the Idaho Department of Health and Welfare and begin TMDL and NPDES processes (see Phases 2 and 3).
- ° Stakeholders may elect to conduct additional monitoring of methylmercury in fish tissue if the total mercury concentrations are within 20 percent of 0.3 mg/kg (that is, 0.24 to 0.36 mg/kg).
- ° If methylmercury concentrations are ≥ 0.24 mg/kg, then coordinate fish advisory with the Idaho Department of Health and Welfare and begin TMDL and NPDES processes (see Phases 2 and 3).
- ° If total mercury (or methylmercury if data are available) concentrations are < 0.24 mg/kg, then the site is not impaired. Routine fish tissue monitoring will be conducted on a 5-year schedule to confirm non-impaired status of water body.

3.4.2 Phase 2: TMDL Program (Chapter 5: TMDL Program, page 75)

Steps to be taken for Phase 2 implementation are as follows:

Step 2a: Determine into which category of the integrated 305(b)/303(d) list the water body should be placed.

- ° If air deposition sources can be controlled and the mercury criterion can be attained, then the water body belongs in Category 4B (the attainment period timeframe is discussed in more detail in Chapter 5). No mercury TMDL is required, but voluntary mercury-control *Best Management Practices* (BMPs) and regional air pollution control activities should be supported.
- ° If the mercury criterion cannot be attained via other control programs, then the water body belongs in Category 5. A mercury TMDL is required.

Step 2b: Identify and characterize sources and associated loads.

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[8] The issue of scale, which is a critical component for implementation of the fish tissue criterion, is discussed further in Chapter 4. A flexible approach has been adopted such that how a “site” is defined could vary widely.

[9] EPA recommends analyses of total mercury rather than methylmercury in fish tissue, based on an assumption that 100 percent of total mercury in the tissue is methylmercury. In fact, EPA studies have confirmed that 95 percent of mercury in fish and seafood is methylmercury (EPA 1997b and EPA 2000d). This approach is the most conservative and protective of human health and ecological exposure. Analyses must be conducted using EPA Method 1631 or EPA Method 245.7.
As explained in detail in Chapter 4, anadromous fish will not be monitored as part of this program.

Step 2c: Compare existing fish tissue concentrations against fish tissue criterion to determine the percent reduction required for the TMDL.

3.4.3 Phase 3: NPDES Program (Chapter 6: NPDES Program, page 91)

Steps to be taken for Phase 3 implementation depend upon the contribution of mercury from the facility.

Step 3a: Assess whether a facility is required to undergo mercury analyses. If a facility is not expected to discharge mercury, then no permit conditions or permit limits are required.

Step 3b: Determine if a *Wasteload Allocation* (WLA) was assigned during TMDL development or if the facility has a *Reasonable Potential To Exceed* (RPTE) the mercury criterion.

- If reliable data (either existing effluent data or ambient fish tissue data) are not available, additional data must be collected (see Phase 1) during the initial permit cycle[10].
- If reliable data (either existing effluent data or ambient fish tissue data) are available, RPTE should be determined using these data.

Step 3c: Develop appropriate permit conditions.

- If a facility has no WLA and no RPTE (that is, it is a *de minimis* source), then permit conditions consist of non-net-increase, voluntary mercury-control BMPs, and periodic ambient fish tissue monitoring (possibly via the statewide monitoring program).
- If facility is assigned a WLA and/or has RPTE (that is, is a significant source), then permit conditions consist of a) mandatory mercury-control BMPs, b) numeric permit limits where a feasible control technology exists or a no-net-increase, otherwise, c) more frequent ambient fish tissue monitoring (possibly via the statewide monitoring program), and d) effluent monitoring (frequency depends on available data and type of facility).

Again, because the implementation of this tiered framework is complex, a more detailed implementation discussion is presented in subsequent chapters. In addition to the flexibility provided by this framework, other site-specific options may be appropriate.

3.5 Site-Specific Options

EPA’s most recent human health risk methodology (EPA 2000d) describes how states can adopt site-specific modifications of a criterion to reflect local environmental

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[10] A permitting authority can also require that data be collected via a CWA Section 308 request prior to permit issuance.

conditions and human exposure patterns. Such site-specific applications may be developed as long as the site-specific data, either toxicological or exposure-related, are justifiable.

Three options are available to ensure that the implementation of the new mercury criterion relies on local information to the extent that is both practicable and warranted:

- **Variances**. Idaho may provide NPDES dischargers temporary relief from a water quality standard by granting a temporary variance to that standard. These variances are discharge- and pollutant-specific. Typically, variances provide a bridge between when Idaho needs additional data or analyses prior to making a determination of whether the designated use is attainable. Variances are typically appropriate when complying with the criteria will cause economic/social impacts, when human-caused conditions are present that cannot be remedied, or when natural conditions prevent attainment of criteria. Variances are temporary, so if a designated use is not achievable, then the water body should be reclassified through a Use Attainability Assessment (UAA; see Option 3).
- **Use Attainability Assessments (UAAs)**. Use changes are warranted when the one or more of the factors identified at (40 CFR 131.10(g)) are present. If it is determined through a UAA that the mercury criterion cannot feasibly be attained, then the use may be able to be revised to reflect an attainable designated use. Because no use category in Idaho water quality rules carries a less stringent mercury criterion, the results of the UAA would need to be a modified use designation (MOD) and appropriate alternative, site-specific mercury criteria would need to be developed.
- **Modification of Default Inputs to Criterion Equation**. The 0.3 mg/kg value is based on EPA’s nationwide values for body weight, reference dose, relative source contribution (RSC)[11], and fish consumption rates. Of these variables, the fish consumption rate may be able to be modified to reflect local consumption conditions (e.g., sustenance fishing habits) and varied trophic level fishing rates (e.g., many of the larger fish may not be retained and consumed by local fishermen).

For each of these options, the definition of “scale” to which the modified criterion applies is critical. “Local” may refer to any appropriate geographic area where common aquatic environmental or exposure patterns exist. Thus, “local” may signify a regional area, a river reach, or an entire river basin.

Although these tools are provided to ensure implementation flexibility, stakeholders should understand that modifying the statewide criterion is a resource-intensive process that may result in site-specific targets that could be either higher or lower than the statewide criterion. Moreover, for all of the options listed above, EPA must

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[11] The RSC may also vary locally, but DEQ should be consulted prior to attempting to revise the RSC value due to level of technical complexity associated with this option.

approve all criteria that are less stringent, and this approval process is rigorous and expensive. On the other hand, criteria that are more stringent than the statewide value might be appropriate to reflect local conditions such as specific sub-population consumption rates.

EPA's forthcoming *Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion* is expected to provide a more detailed discussion of each of the options highlighted above.

3.5.1 Variances

As a first means to ensure that the mercury criterion relies on local information, DEQ may provide NPDES dischargers temporary relief from a water quality standard by granting a variance to that standard. These variances are discharge- and pollutant-specific. Typically, variances provide a bridge between when DEQ needs additional data or analyses before making a determination of whether the designated use is attainable and when DEQ adopts an alternative use. In the case of methylmercury, such a variance might also be useful where other implementation tools are not available or feasible (e.g., when a TMDL has not yet been developed).

Because the adoption of the new fish tissue methylmercury criterion will likely cause additional water bodies to be added to Idaho's 303(d) listings for mercury, variances could provide a short-term solution until a TMDL is developed. Mercury variances have been included to offer NPDES permittees an opportunity for relief from installing costly end-of-pipe treatment in order to comply with very low mercury limits. In order to receive a variance, permittees must provide information that shows meeting the state water quality standards is not feasible due to any one of the following six justifications under 40 CFR 131.10(g), and they must characterize the extent of any increased risk to human health and the environment resulting from the variance.

Justification for Variances: Mostly Likely Scenarios

Variances should be considered only after evaluating the controls necessary to implement the mercury criterion. As such, a variance cannot be granted if attainment of the standard is expected after implementation of effluent controls by the permittee. In addition, variances are temporary, so if a designated use is not attainable nor the criterion achievable, then the water body should be reclassified through a UAA.

The four most likely scenarios to prompt a variance request for mercury have been summarized in the following, which satisfy the requirements of 40 CFR 131.10(g):

- *Exceedances are created by human-caused conditions that cannot be remedied*. Under this scenario, the permittee must demonstrate that, in the short term, human-caused conditions that have resulted in mercury release and deposition cannot be addressed to levels that are capable of bringing methylmercury levels down to the criterion. This is particularly true if legal issues or differences in international regulations pose a barrier to reaching a joint effort, among multiple countries, to reduce mercury contamination at a global scale.

For example, atmospheric deposition originating overseas could be the source of elevated mercury levels in a local stream, yet the lack of an international agreement or treaty to cut mercury emissions worldwide prevents attainment of the mercury criterion, despite any local efforts of reduction. In this instance, if the atmospheric deposition was found to be from outside the United States and was a substantial cause of the impairment, a variance may be warranted.

- *Natural conditions preclude attainment*. Under this scenario, the permittee must demonstrate that mercury concentrations occur naturally in the water body itself—whether it be the soil/sediment composition, microbial community, or the aquatic biota interactions. These concentrations favor seemingly low levels of atmospheric or ambient water column levels of mercury that amplify into high concentrations in fish tissues. In other words, bioaccumulation might occur at a higher rate under certain natural conditions.
- *Achievement of criterion levels is technologically infeasible or attainment would result in substantial and widespread economic/social impacts*. Under this scenario, the permittee must demonstrate that, in the short term, none of the present technologies for improving the quality of an effluent is capable of bringing methylmercury levels down to the criterion—there is either no technological remedy currently available or achieving the criterion is simply technologically infeasible. Alternatively, the permittee can demonstrate that, in the short term, the costs of constructing controls necessary to meet the methylmercury criterion (beyond those required by sections 301(b)(1)(A) and (B) and 306 of the Clean Water Act) would result in substantial and widespread economic and social impact.

In general, the temporary standard established by a variance will be set as close as possible to the numeric fish tissue criterion and will always be retained at the best level needed to preserve the existing use. Because a variance is reflected in Idaho's water quality standards, the same requirements for public review and comment apply to a variance as to a new or revised standard.

Other Variance Issues: Timeframes and Wildlife Considerations

Two additional specific issues Idaho will take into account when considering granting a variance include applicable *timeframes* and *wildlife considerations*:

- *Timeframes*. A variance is a time-limited change in the standards, typically three to five years, with renewals possible following sufficient demonstration. Variances that extend longer than three years are traditionally revisited in the context of a triennial review to justify their continuing appropriateness. When the discharger makes this demonstration, the discharger also shows that it made reasonable progress during the period of the previous variance. Because many of the dischargers in Idaho discharge to waters that are—or will be—awaiting a TMDL, the period in which a variance applies typically extends until an associated TMDL is completed and a WLA is calculated.

- *Wildlife considerations.* EPA's *Mercury Study Report to Congress* (EPA 1997a) characterized the risk from mercury for wildlife in the United States and found that the mercury residues in fish (as a result of bioaccumulation) provide an enriched contaminant source for piscivorous avian and mammalian wildlife. Moreover, there is evidence of adverse impacts on piscivorous wildlife following point source discharges/emissions of mercury and in aquatic environments affected by urban runoff.

  Like most states, Idaho does not have wildlife criteria for mercury. Thus, a human health methylmercury criterion might affect the health of resident wildlife, some of which may be threatened and endangered. During rulemaking action for the State of California, EPA consulted with the U.S. Fish and Wildlife Service and the U.S. National Marine Fisheries Services on a multitude of pollutants, including mercury (see *Methylmercury Fish Tissue Criterion Advantages*, page 39). More information on this consultation is provided in Chapter 7.

  If, in the future, the human health criterion is determined to not be protective of threatened and endangered species, more stringent mercury limits may need to be determined and implemented. If this occurs, Idaho may find itself in a similar situation as many of the Great Lakes states. Ohio EPA has estimated that the average cost to municipalities to reduce mercury to levels close to the wildlife criterion (0.0013 μg/L) through end-of-pipe treatment is in excess of $10 million per pound of mercury removed (Ohio EPA 2000). Because this represents substantial and widespread social and economic impact, in lieu of any economically-feasible treatment, Ohio EPA implements a general mercury variance program that requires developing pollution minimization programs to mitigate releases to the environment.

3.5.2 Use Attainability Assessments

A second method to ensure that the mercury criterion relies on local information is through Use Attainability Assessments. When a state wishes to remove a designated use (specified in Section 101(a)(2) of the CWA) or to adopt subcategories of uses (specified in Section 101(a)(2) of the CWA) that require less stringent criteria, a UAA must be conducted (see 40 CFR §131.3 and 40CFR131.10(g)). As defined in 40 CFR 131.3(g), a UAA is a structured scientific assessment of the factors affecting the attainment of a use, which may include physical, chemical, biological, and economic conditions.

Although this is the framework for UAAs in theory, in practical terms a UAA for mercury would likely result in linking attainable uses to fish advisory levels and limiting the frequency of fishing that could occur. Because this potential outcome is not very politically viable, practical limitations associated with UAAs may constrain their application to mercury.

Section 101(a)(2) of the CWA establishes as a national goal "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water," wherever attainable[12].

In the case of mercury, waters could retain their "fishable" status, but on a more limited basis that would be tied to fish consumption advisories. For example, mercury-impacted waters could continue to be fished, but consumption of certain types of fish that bioaccumulate more mercury would be limited or restricted.

Thus, the applicability of a UAA to mercury-impaired waters is limited to situations where background conditions prevent full "fishable" beneficial uses. In these cases, it may be more appropriate to adopt a sub-category of use that reflects the limited fishable uses while specifying that the background is the appropriate numeric criterion. Such use changes must provide for the attainment and maintenance of the downstream uses and must be a defined category in the water quality standards.

Conditions Supportive of UAAs

The six justifications contained in 40 CFR 131.10(g) are the only factors that can be used to support the removal of a designated use or adoption of a subcategory of use that carries less stringent criteria. Of the six factors, with respect to mercury-impacted waters, it is most likely that *human-caused conditions that cannot be remedied*, *naturally-occurring pollutant concentrations*, or *substantial and widespread social and economic impacts resulting from additional controls* would be the reason cited to support a UAA.

In all cases, scientifically sound data and information must be obtained in order to make a proper assessment. Changing a use or adopting subcategories of a use effectively modifies the state's water quality standards, and the same requirements as for a new criteria would be required (e.g., public review and comment, EPA approval or disapproval).

3.5.3 Modification of Default Inputs to Criterion Equation

As a third method to ensure that the mercury criterion relies on local information, Idaho has the option to adjust its criteria for methylmercury by modifying default input values of the criterion equation. Although additional options are possible, adjustment of default daily fish consumption rate to a value that is more reflective of local consumption patterns is the most likely to be pursued.

The default fish consumption value may be modified if the target population eats, on average, a different amount of fish than the general population of fish consumers upon which the default value of 0.0175 kg/day (17.5 g/day) is based (EPA 2001a). Although EPA recommends protection at the minimum level of 17.5 g/day, higher or lower fish consumption values can be used and will result in more or less stringent fish tissue criterion values, respectively.

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[12] Uses are considered by EPA to be attainable, at a minimum, if the use can be achieved through (1) effluent limitations and (2) implementation of cost-effective and reasonable BMPs on nonpoint sources.

For example, if 90 percent of a target population eats approximately 35 g/day of fish of various trophic levels, then the fish intake value in Equation 3-1 would be 35 g/day, rather than the national default value of 17.5 g/day.

DEQ supports the development of local or regional water quality criteria for methylmercury using local or regional fish consumption data rather than the default values when such a water quality criterion would be more appropriate for the target population.

DEQ's preference and hierarchy to follow when deriving fish intake estimates includes the following:

1. Using local data when available
2. Using data reflecting similar geography/population groups
3. Using data from national surveys
4. Using EPA's default fish intake rates

Additional discussion of these four preferences is expected to be provided in EPA's implementation guidance document.

Using Local Data

DEQ's first preference is to establish fish intake rates that represent the defined populations being addressed for the particular water body. This can be accomplished by using fish intake surveys that include intake of species caught from local watersheds.[13]

Surveys of local fish intake should be consistent with EPA's *Guidance for Conducting Fish and Wildlife Consumption Surveys* (EPA 1998b). EPA also recommends the use of uncooked weight intake values.

To be consistent with the default assumptions used by EPA in developing the criterion equation, Idaho will use the 90th percentile values for an identified population (e.g., subsistence fishers, sport fishers, or the general population). If the local study targets particularly *high-end consumers* (those who consume more than the average of 17.5 g/day), these values should be compared to high-end fish intake rates for the general population to make sure that the chosen intake rates would protect the high-end consumers within the general population. This procedure is consistent with the recent *Great Lakes Water Quality Initiative*, known as the "GLI" (EPA 1995a), as well as Oregon's recent standards revisions that ensure high-intensity fish consumption rates are protective of the high-end consumers within the general population, such as sport fishers (142.4 g/day; ODEQ 2003a).

Thus, where intensive sport or subsistence fishing occurs, DEQ may elect to increase local intake rates to reflect higher consumption patterns. In these cases, the

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[13] Because anadromous wild and hatchery species return to Idaho water bodies after spending the majority of their lifecycle in the ocean, these species will not be targeted for monitoring. However, if anadromous fish are consumed legally by local populations, then they need to be accounted for in determining local intake rates.

appropriate fish tissue criterion would decrease. (The previous example shows that using EPA's default subsistence intake values of 142.4 g/day causes the fish tissue criterion to decrease to 0.04 mg/kg).

Using Similar Geography or Population Groups

If surveys conducted in the geographic area are not available, DEQ's second preference is to consider results from fish intake surveys that reflect similar geography and population groups (e.g., from a neighboring state or Tribe or a similar watershed type), following the method described earlier regarding target values to derive a fish intake rate.

Using National Surveys

If applicable consumption rates are not available from local, state, or regional surveys, DEQ's third preference is to select intake rate assumptions for different population groups from national food consumption surveys. EPA has analyzed one such national survey, the 1994-96 *Continuing Survey of Food Intakes by Individuals* (CSFII). A separate EPA report provides a detailed description of the combined 1994-96 CSFII survey, the statistical methodology, and the results and uncertainties of the EPA analyses (EPA 2000b).

Using Default Fish Intake Rates

DEQ's fourth preference is to use default rates, based on the 1994-96 CSFII data, that EPA believes are representative of fish intake for different population groups[14]:

- 17.5 g/day for the general adult population and sport fishers
- 142.4 g/day for subsistence fishers

EPA has made these risk management decisions after evaluating numerous fish intake surveys. These values represent the uncooked weight intake of freshwater/estuarine finfish and shellfish.

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[14] Intensive sport fishers and subsistence fishers will need to be identified and defined based on local harvest practices in conjunction with DEQ and Tribal staff, as appropriate.

4. Monitoring and Assessment

This chapter provides a discussion of statewide monitoring approaches, effluent monitoring, sample collection issues, analytical methods, and application of monitoring data within the context of the new fish tissue criterion. Idaho has developed a monitoring framework that provides both flexibility for stakeholders and reliable data that can be used to make informed decisions. As with any monitoring program, this framework attempts to balance the need to obtain good data against the reality of funding constraints. Mercury is currently only monitored sporadically; thus, as the mercury fish tissue criterion becomes more widely applied, this approach represents an improvement over the current situation.

The monitoring framework encompasses two scales: *statewide ambient monitoring* and *facility/source monitoring*. Reliance on two scales of monitoring is important because 1) discharges of mercury to the environment need to be tracked (facility/source), and 2) impacts of those discharges on aquatic life (statewide monitoring) directly tie into existing regulatory programs, such as the TMDL program and NPDES permitting. In fact, monitoring is so closely integrated with both of these programs that the framework was developed to specifically identify how and when mercury data should be collected to support TMDL and NPDES decisions.

In the following, an overview of the statewide approach is provided first, followed by a discussion of facility monitoring. The statewide approach is presented first because these data will be necessary to identify priority watersheds in which the TMDL and/or NPDES issues are most relevant. Facility effluent monitoring is presented next to provide insight into potential mercury discharge into the priority watersheds.

4.1 Statewide Monitoring

Because the methylmercury criterion is a number based on fish tissue measurement, the statewide approach will be focused on fish tissue. The primary advantage of relying on fish tissue monitoring only is that concentrations of mercury in fish tissue represent an integrated exposure to mercury throughout a water body and over an appropriate period of time (e.g. correct spatial and temporal scales).

USGS has collected data for mercury from many of the state’s water bodies over the last 30 years. Surface water data collected since 1995 indicate that typical total mercury concentrations in receiving waters are less than 0.025 μg/L (unpublished data from the Lower Boise River show concentrations in the 0.002-0.008 μg/L range). Because these levels are so much lower than EPA’s 2002 recommended chronic and acute aquatic life criteria (0.77 μg/L for chronic and 1.4 μg/L for acute), compliance with Idaho’s water quality standards will likely be driven by fish tissue data. This issue is particularly relevant for the NPDES program, where receiving water concentrations are used in RPTE determinations (see RPTE Process, page 94).

Because fish tissue sampling is difficult, expensive, and time consuming and because a standardized approach provides better data, Idaho is proposing to develop a statewide cooperative fish tissue monitoring program. This approach is similar to programs that have been developed in other states, such as Illinois, Massachusetts, South Carolina, and Wisconsin. While stakeholders will not be required to participate, it is envisioned that contributing to the statewide cooperative program will provide substantial economic and technical benefits.

A major advantage of this program is that more cost-effective and reliable data are produced through a standardized statewide program that relies on strict adherence to established methods for sample collection and analysis. The National Air Deposition Program for Mercury has adopted a similar approach, with all samples collected using a standard method and all analyses run within a single lab (http://nadp.sws.uiuc.edu/mdn).

The statewide approach is evolving in parallel with this guidance document – a proposed framework is provided below, with a more detailed work plan presented in Appendix B. Many important details, such as allocation of costs, remain to be resolved. In the interim, and for those dischargers who opt to not participate in the cooperative program, the guidance also describes requirements for facility-related ambient monitoring.

The statewide fish tissue monitoring program has been designed to dovetail as closely as possible with the existing programs, which are described below.

4.1.1 Existing Programs

Ambient water quality data will continue to be collected as specified in other sampling programs. Ambient water quality data are collected by USGS to support the USGS/DEQ Trend Monitoring Network. This network includes over 55 sites statewide that are sampled on a 3-year rotating basis. For example, in 2004 USGS is targeting 16 sites in the southwest and southeast portion of the state; biological samples will be collected at 9 of those sites and fish tissue will be collected at 6 of those sites. Stations for this network are shown in Figure 4-1.

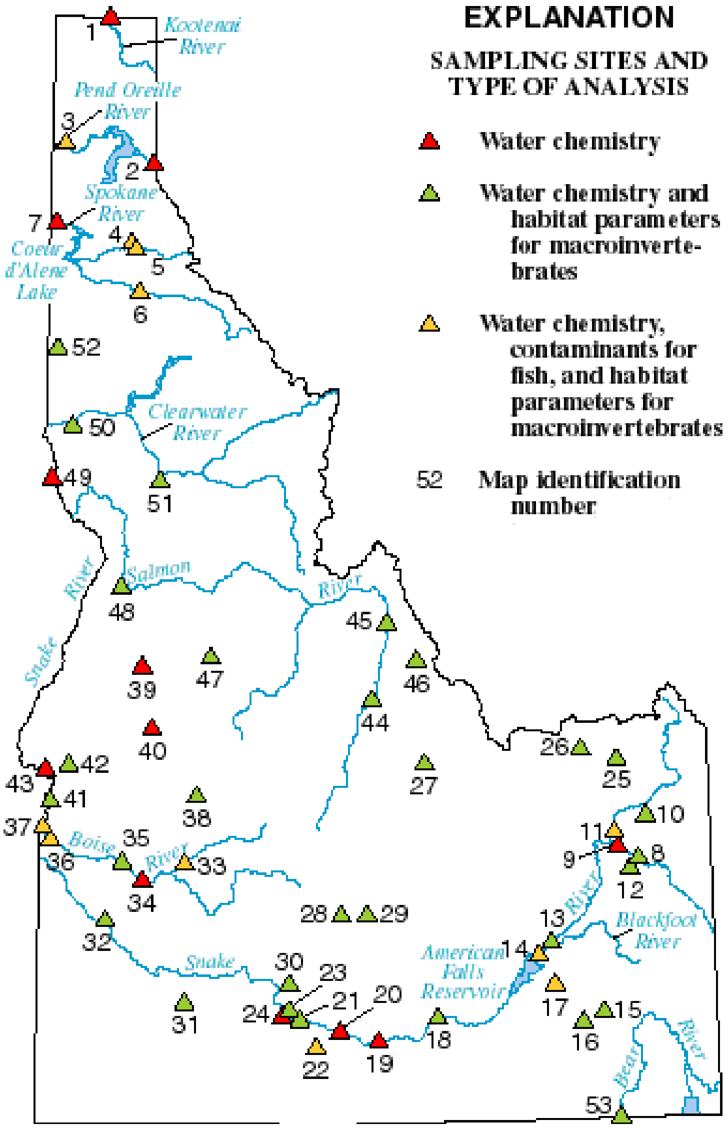


Figure 4-1. USGS Trend Monitoring Sites

In recent years, Idaho has moved toward a statewide biomonitoring approach, as outlined in the recent monitoring plans. DEQ annually monitors water bodies statewide based on assessment and data quality priorities. The WBAG process is primarily designed to assess data collected under the DEQ Beneficial Use Reconnaissance Program (BURP). Although BURP sampling provides a good representation of conditions across the state, fish tissue collection is not an element of the BURP sampling approach. In addition, similar to the USGS/DEQ Trend Monitoring Network monitoring, BURP sampling is focused on rivers and streams. Because of the tendency of methylation to occur in reservoir/lacustrine environments, the statewide cooperative program would need to fill this data gap.

Other existing programs include opportunistic fish advisory sampling through the IFCAP program. These activities are generally conducted in cooperation with IDFG and are conducted on an as-needed basis.

Finally, Tribes within Idaho also conduct fish sampling on a periodic basis. It is strongly recommended that if the receiving water body falls under Tribal jurisdiction that local stakeholders coordinate monitoring activities with any Tribal monitoring efforts that may be occurring.

4.1.2 Statewide Monitoring Cooperative Program

The Idaho statewide cooperative monitoring program is currently envisioned to rely on a tiered monitoring approach. The reason that a statewide program is critical to this implementation framework is that it will allow limited resources to be used in the most efficient manner, while still providing reliable data that can be used to prioritize control activities. If the new criterion were a water column number, a statewide collection approach might be considered to be a step backwards from the Idaho approach of biomonitoring to assess impairment.

Although ambient monitoring will not be conducted as frequently as traditional ambient receiving water monitoring, this approach has been designed to provide reliable and applicable data (that is, to avoid wasted monitoring, not to avoid monitoring waste). Although participation in the program is voluntary (facilities may elect to conduct facility-specific monitoring), the statewide program is expected to provide a substantial cost incentive to dischargers due to sample collection efficiency. Primary elements of the program include:

- **The monitoring program will include both *deterministic* (targeted) and *probabilistic* (random) monitoring**, which will vary depending upon water body type, size, and levels of fishery use. Opportunities to review and modify the structure of the fish tissue monitoring program will be available throughout the life of the program, ensuring that data remains useful for identifying impaired waters and establishing fish consumption advisories, and ensuring that the protocol is adapted as necessary to meet additional or modified goals.
- **The monitoring program will produce data from a multitude of water body types** (i.e., reservoirs/lakes, streams, rivers, warm and cold water systems, etc.), which are located across a large and varied land area (i.e., mountain, high desert, etc.).
- **The monitoring program will use Hydrologic Unit Codes (HUCs)** established by the USGS to create a manageable sampling framework that is consistent with the WBAG process, which relies on the *Idaho Water Body Identification System* (WBID). The Idaho WBID is a geo-referenced network of Idaho water bodies in which each cataloging unit (4th field HUC or 8-digit code) is numbered starting at the pour point. A more detailed monitoring plan with proposed sample locations and schedule is provided in Appendix B.

Monitoring Tier 1: Aggregating HUCs into Regional Basins and Prioritizing Watersheds

For the statewide fish tissue monitoring program, 4th field HUCs will be aggregated into regional basins to provide a regional structure (see Figure 4-2).

Within each regional basin, watersheds will be prioritized by considering the following:

1. Potential or actual mercury contamination in the water body
2. Frequency of fishing activities
3. NPDES discharger requirements
4. Public interest in the water body

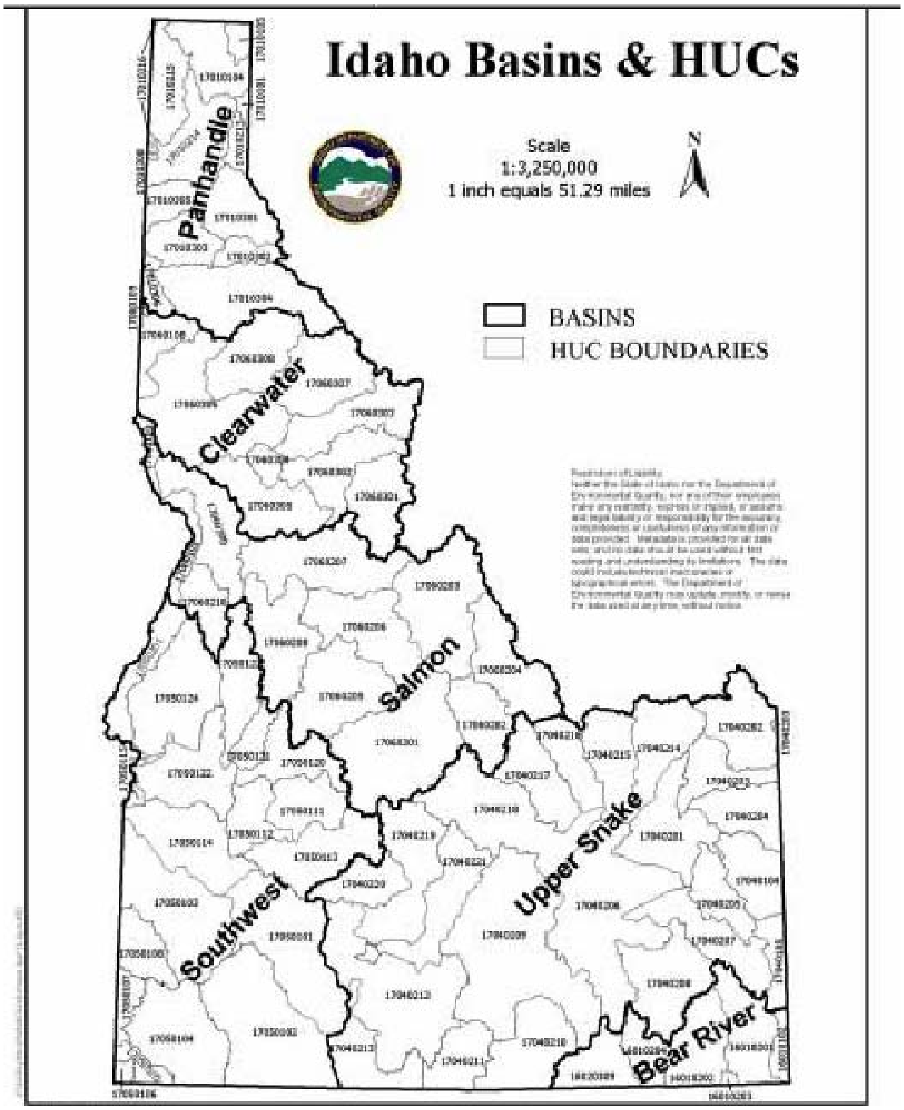


Figure 4-2. Idaho Basins and Hydrologic Unit Codes.

Sampling locations will also be identified to support multiple programs based on the needs of the water body (e.g. coordination with statewide chemical and biological monitoring), in addition to sampling in waters of known or suspected mercury contamination (e.g. historical gold placer mined waters; lakes and reservoirs with previously observed elevated mercury concentrations; lakes and reservoirs with significant sport fisheries).

Within each regional basin, watersheds will be sampled at least once every 5 years on a rotating schedule. According to available monitoring data collected within Idaho, more frequent monitoring does not appear to be warranted. Figure 2-10 (page 32) presents data collected from sites within the Salmon River basin and includes monitoring data for three species collected at the same sites at frequencies of 3 months to 2 years. These data show that fish tissue data are an integrative measure over time, as within-year variability and year-to-year variability is minimal (largest variability is 0.02 mg/Kg within a given species over a 3-month period). In addition, sampling at these frequencies is consistent with other state monitoring programs.

Within the first part of a 5-year cycle, higher-priority watersheds will be sampled, while lower-priority watersheds will be targeted for the latter part of a 5-year cycle. As data become available over a longer time period, this monitoring framework will be adapted so that resources are shifted from lower-priority watersheds to higher-priority watersheds that contain impaired waters and/or receive larger discharges of mercury. This means that following the initial 5-year monitoring cycle some watersheds will be monitored more frequently than every 5 years and others will be monitored less frequently than every 5 years.

Initially (prior to the development of a statewide monitoring database), the number of sites sampled per 4th level HUC watershed will be between 1 and 3, depending upon the size of the watershed and number of potential mercury sources. Within each watershed, water bodies will be further prioritized, with reservoirs/lakes having highest priority, then large rivers (5th order and higher), and lastly streams (4th order and lower unless intensive fishing uses are present).

Monitoring Tier 2: Deterministic and Probabilistic Monitoring

Both deterministic and probabilistic monitoring will be conducted.

Monitoring Tier 2a: Deterministic Monitoring

Deterministic monitoring will be conducted at reservoirs/lakes and large rivers. These stations have been prioritized based on whether elevated fish tissue mercury concentrations have been observed or are suspected, whether NPDES discharges that are currently required to monitor for mercury are present, whether the waterbodies have particular public interest or fisheries uses (e.g, Henry's Fork and heavily-used reservoir fisheries), and whether the sites correspond to USGS biomonitoring stattions. Lower scores were assigned to those waterbodies that have been monitored for fish tissue mercury concentrations within the last five years.

In each regional basin, two "core" stations have also been identified as annual trend sites. These core stations will be monitored every year to track mercury trends in the same fish species that are present within that region.

Monitoring Tier 2b: Probabilistic Monitoring

Probabilistic monitoring will be conducted in those HUCs that do not contain deterministic sites and in other smaller streams. The streams to be sampled have been selected randomly to be representative of varied conditions (for example, natural geologic background, pristine areas subject to regional air deposition, etc.). Within each sampling year, more than 20 probabilistic statewide sites have been selected on a random basis. Although BURP monitoring activities are not conducive to fish tissue monitoring, these probabilistic sites consider BURP monitoring stations so that the use of available information is maximized. For example, confirming that low mercury concentrations coincide with high biological integrity indices may provide useful information for future prioritization of monitoring efforts.

4.2 Facility Monitoring

The monitoring approach for facilities to comply with the new fish tissue criterion represents a departure from the traditional approach that exclusively targets water chemistry monitoring. In this case, the monitoring approach is targeted toward determining what levels of mercury are being discharged and what the resulting concentration of mercury is in fish that reside in the receiving stream.

4.2.1 Effluent Monitoring

Current Conditions

Effluent monitoring for mercury with Idaho is currently highly variable. Based on available public data (as of December 2003), EPA has required mercury monitoring for facilities in Idaho as shown in Table 4-1.

Table 4-1. Current Idaho Mercury Monitoring Frequency and Method Detection Limits by Facility Type.

	Frequency over Permit Cycle (n)			**MDL (ng/L)**		
	Min	**Max**	**Average**	**Min**	**Max**	**Sample Type**
Municipal WWTFs	2	36	18	5	200	Grab and 24-hour composite
Mining	10	700	294	0.5	200	Grab and 24-hour composite

MDL : Method Detection Limit

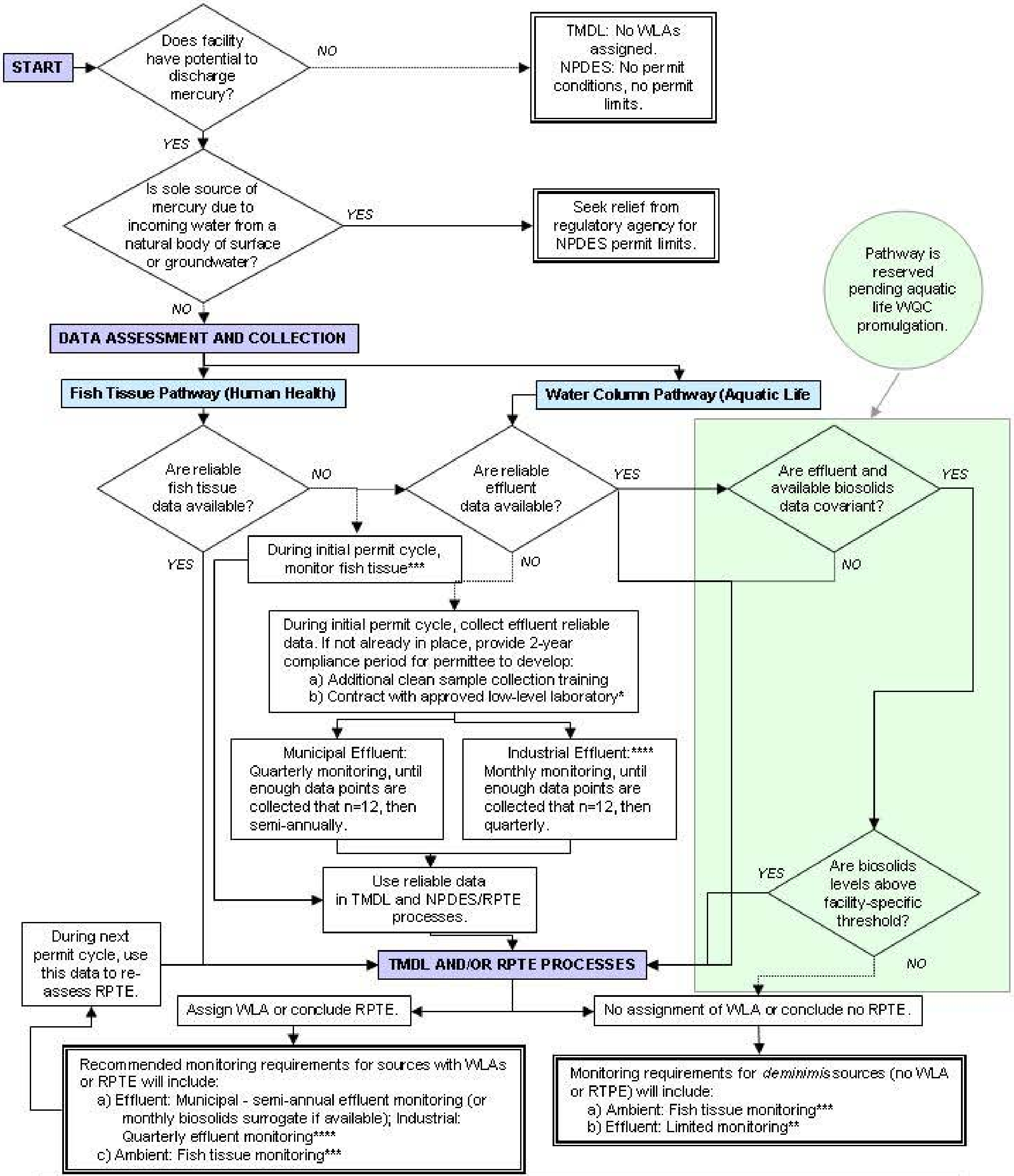
Although this variability may be a result of discharger characteristics (for example, major versus minor, or compliance history), Idaho would like to see effluent monitoring requirements applied consistently so that appropriate treatment of dischargers is achieved. In addition, a consistent approach will help ensure that data are valid and not biased by field or lab contamination.

Available data indicate that effluent monitoring for mercury is currently somewhat limited in Idaho. Relative to the total number of dischargers, few facilities have been required to collect the data necessary to support the TMDL source characterization or NPDES RPTE processes.

Proposed Conditions

The effluent monitoring framework has been designed to provide relevant and useful information without unduly burdening point sources (Figure 4-3). This approach is consistent: not only with the recognition that mercury issues nationwide are largely nonpoint issues (for example, air deposition), but also with how other states have developed their monitoring requirements.

Recommended monitoring frequencies shown in Figure 4-3 are dependent on whether a facility already has adequate monitoring data. If a discharger already monitors for mercury and reliable data (collected using low-level techniques) provide an adequate measure of variability, monitoring frequencies should be adjusted. Once the variability is established the permit writer can apply discretion in setting less frequent monitoring if variability of the discharge is low and no changes to the discharge characteristics (concentration or load) are anticipated.



NOTES:

* A list of recommended low-level laboratories is included in Appendix E.

** Mercury levels should still be tracked as part of otherwise-required periodic priority pollutant scans.

*** Can be accomplished either through individual facility monitoring, cooperative monitoring, or through the proposed state cooperative monitoring program.

**** If the variability of industrial discharges is relatively low, the recommended monitoring frequency should be consistent with low-variability municipal dischargers.

Figure 4-3. Recommended Mercury Effluent Monitoring Framework

If reliable effluent data are not available, then effluent data will need to be collected. During the initial permit cycle, Idaho is recommending the following schedule:

- Municipal: Quarterly effluent monitoring until the facility has 12 acceptable data points, and then the monitoring frequency will be reduced to semi-annually for the remainder of the permit cycle.
- Industrial: Monthly effluent monitoring until the facility has 12 acceptable data points, and then the monitoring frequency will be reduced to quarterly for the remainder of the permit cycle[15].

With respect to mercury, a different approach of municipal and industrial sourcemonitoring is warranted because municipalities do not generate mercury as part of the treatment process. Instead, municipal sources receive mercury wastes from upstream commercial, industrial, and residential customers. In contrast, some industrial permittees produce mercury wastes as part of their operations (e.g., selected mining or industrial activities, localized air deposition sources).

Reduced monitoring frequencies would seem to be particularly relevant for mercury in municipal or industrial waste streams that do not reflect slug or batch processing of mercury products. In the municipal case, mercury in influent has been found to be related primarily to diffuse sources, including dental offices and hospitals (Section 6.3.1; AMSA 2000). For example, data collected using reliable sampling and low-level analytical methods from the Caldwell WWTF between 1999-2000 indicate that effluent mercury levels averaged 8.2 ng/L (median 3.2 ng/L). These local data are similar to other reports where typical effluent levels from municipal facilities average 14 ng/L (median 7.0 ng/L; AMSA 2002).

Given the diffuse nature and relatively low levels of mercury in WWTF influent, municipal effluent variability would also be expected to be lower as compared to facilities where mercury is used or discharged in slug and batch processes (e.g., mercury-cell chlor-alkali facilities). Wisconsin has adopted a similar approach that applies less frequent monitoring requirements for significant municipal plants as compared to significant industrial facilities (NR 106.145[3]).

If not already available, a minimum value of 12 acceptable data points is stipulated to provide a statistically robust data set while balancing the costs of monitoring. For both municipal and industrial permittees, if multiple outfalls discharge essentially the same effluent (as documented by previous sampling or process descriptions), then only one outfall will be required to be monitored.

If a discharger does not already have a low-level program in place, the initial permit will include a 2-year compliance period in which to set up this program prior to the collection of any mercury monitoring data.

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[15] It is recommended that industrial monitoring be required more frequently when industrial mercury levels are more variable than municipal mercury levels. Mercury in municipal waste streams often include diffuse sources such as dental offices and residential waste, which do not tend to vary much over time in the absence of pollution prevention. If the variability of industrial discharges is relatively low, the recommended monitoring frequency should be consistent with low-variability municipal dischargers.

Biosolids Monitoring

Because effluent monitoring for mercury requires the use of low level clean techniques, an alternative available to those dischargers who produce biosolids is to use biosolids monitoring data as surrogate measures of mercury concentrations in the effluent. The vast majority of metals that enter WWTFs are bound to the biosolids materials as part of the treatment process because the organic matter and iron oxides in biosolids create many binding sites for trace elements like mercury (Ecology 2000, WDNR 1997). 40 CFR Section 503 requires that municipal wastewater facilities monitor biosolids for a list of metals, including mercury, on a monthly basis. The other advantage of this option is that biosolids monitoring does not require clean sampling techniques, so collection and analytical costs are not as high.

Following the initial permit cycle where RPTE is based on effluent monitoring, once adequate reliable effluent data have been collected and the permittee can show that effluent concentrations are covariant with biosolids levels (covariance measures the relationship between two ranges of data), then the biosolids data may be able to be used as a surrogate to determine whether the facility has RPTE[16]. (In addition, monitoring biosolids data during subsequent permit cycles can provide a long-term trend analysis of the effectiveness of voluntary or mandatory BMPs.)

If the biosolids concentrations of mercury are above a facility-specific threshold (based on the covariant relationship between effluent and biosolids concentrations), then the permit writer may conclude that there is no RPTE. In addition, no WLA should be assigned if the receiving water is being assessed as part of a mercury TMDL.

Exclusions

Some facilities that are permitted under the NPDES program have very little potential to discharge mercury; permit writers may exclude facilities from mercury effluent monitoring requirements in such situations. Examples include facilities that discharge non-contact cooling water without additives. This determination to exclude a facility may be based upon available data, surrogate facility monitoring (for example, if another facility for an industrial company uses the same processes and available mercury monitoring data indicate that no mercury is discharged), other literature information, or, absence of such information, best professional judgment.

The other situation where a facility may be excluded from mercury effluent monitoring requirements is when the sole source of background mercury is shown to be from intake water from surface or groundwater and that facility discharges to the source water body. Although this situation is not expected to be common, in the event that this situation occurs, no effective treatment technologies are available to treat this discharge and implementation of BMPs will not result in mercury reductions. Then the facility should consult with its permit writer to seek options for regulatory relief.

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[16] There are other examples of where surrogate measures are used to assess water quality criteria compliance. For example, bacteria are used as a surrogate for pathogens in recreational uses; turbidity is used as a surrogate for excess sedimentation.

4.2.2 Ambient Monitoring

This section describes recommended receiving water monitoring for permit holders. Traditionally, ambient monitoring is conducted by a discharger below a facility’s mixing zone, in close proximity to the point of discharge. With a fish tissue criterion the traditional approach does not make the most sense.

For example, some facilities will discharge to small streams that do not hold edible-sized fish. For these discharges fish tissue sampling would necessarily occur further downstream than would typically occur with water chemistry monitoring. This may also mean sampling in a much larger confluent stream where the discharge load is mixed with greater loads from other sources. Even if edible size fish do occur in the receiving stream, fish movement and the nature of mercury transport and methylation (see Chapter 2) may mean that more distant sampling is best for assessing environmental effect.

Furthermore, because mercury in most waters is likely not primarily related to point source discharges, and because high fish tissue levels of methylmercury may not manifest themselves local to a point source, fish tissue monitoring close to a discharge point could miss important environmental and human health problem areas.

Until a statewide cooperative program can be finalized (or for those facilities that may choose not to opt into the cooperative monitoring program), ambient monitoring of fish tissue will be required once every 5 years. More detailed information on facility ambient monitoring requirements is provided in Chapter 6.

DEQ believes the money spent on traditional discharge-related ambient monitoring would offer greater environmental and human health benefit if pooled into a statewide monitoring effort as described earlier. Such a cooperative effort would also offer benefits in more consistent, thus comparable, fish tissue mercury data across the state for assessment and reporting purposes. Thus, DEQ will work with dischargers and other state agencies to establish a monitoring cooperative that dischargers may opt in to, in lieu of traditional ambient monitoring.

4.3 Field Sampling Protocols

Whether data are collected on facility-specific basis or under the proposed statewide cooperative program, field sampling protocols will help ensure that mercury data are valid to be used in making management decisions. Mercury poses a specific challenge in that contamination from sampling or analytical techniques is quite common. In addition, the availability of low-level analytical methods means that contamination can easily provide data that are not valid.

4.3.1 Water and Effluent

Sampling and analytical methods used to determine compliance are to conform to the guidelines of 40 CFR 136 (IDAPA 58.01.02.090.01) unless otherwise specified in the NPDES permit. Procedures for conducting clean and ultra-clean metal analysis, and procedures for conducting biological tests should be based on EPA-approved procedures as described in IDAPA 58.01.02.090.02 -03.

If adequate reliable effluent data are currently available for the facility, these data will be used to determine WLAs during the TMDL process.

The quality of data used is a critical issue. In order to ensure that the data collected for regulatory decision-making are valid and not affected by contamination from sampling or analytical techniques, continuing attention to quality control must be incorporated in all sampling event planning, sample collection, sample preparation, and analysis activities.

Quality control requirements for trace metals sampling and analysis, including mercury, are rigorous because of the high risk for inadvertent sample contamination. Most of the water quality standards and ambient stream metal concentrations are at trace levels. Trace level metals data can be compromised by contamination during standard sampling, filtration, storage, and analysis.

Procedures referred to as “clean sampling” and “ultra-clean sampling” have been developed by EPA to provide guidance in planning and executing sample collection and analysis. The objective of the guidance is to both minimize the potential for contamination and, where contamination does still occur, to enable identification and quantitation of that contamination.

Additional information is provided in *Guidance on the Documentation and Evaluation of Trace Metals Data Collected for Clean Water Act* Compliance Monitoring (EPA 1996c) and Sampling Ambient Water for Trace Metals (EPA 1995b).

Effluent monitoring and ambient monitoring for mercury should be conducted using low-level clean techniques. For this reason the Idaho framework has defined reliable data as those data that have been collected using appropriate clean techniques (including documentation of field blanks) and that have been analyzed using the EPA methods specified below that have been performed by a laboratory listed in Appendix E. Alternatively, data may be considered reliable if all appropriate QA/QC procedures have been completed and show that the data are of good quality. If a discharger does not already have such a program in place, the initial permit will include a 2-year compliance period in which to set up this program prior to the collection of any mercury monitoring data[17].

With respect to mercury specifically, samples will be collected as grab samples because contamination has frequently been associated with 24-hour composite samplers (EPA 1996c). This is consistent with EPA Method 1669 requirements that provide the level of protection necessary to preclude contamination in nearly all situations. Method 1669 is also designed to provide the procedures necessary to produce reliable results at the lowest possible water quality criteria published by

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[17] DEQ encourages cooperative relationships between dischargers to coordinate effluent sampling so that volume discounts to such labs can be realized.

EPA. Appendix F contains field protocols developed by EPA and others to support clean sampling for mercury.

4.3.2 Fish Tissue

Monitoring protocols for fish tissue sampling generally follow the protocols developed by IFCAP. The only deviations from these protocols are related to needing to apply fish tissue data to the TMDL and NPDES programs.

Some of Idaho's water bodies are home to threatened and endangered species of fish, as identified under the ESA. In areas where these fish are present, surrogate species for analysis will be used to determine assessment of the biological community. Surrogate species may include fish resident to the water body (for example, Mountain whitefish).

Sample Target Species: Bass

Certain fish species, such as larger predatory species, are known to bioaccumulate higher concentrations of mercury and should be targeted for monitoring purposes. As a result, bass[18] have been selected as the target species for fish tissue monitoring within reservoirs/lakes.

The primary target size range ideally should include larger specimens harvested at each sampling site, as larger (older) fish within a population generally bioaccumulate the most methylmercury.

If these data indicate that fish tissue concentrations are nearing the fish tissue criterion, then additional confirmatory sampling may be required to assess the larger fish population. Consistent with fish advisory protocols, additional fish species that will be targeted, if available, include bottom feeders and game fish. Other popular game species targeted by IFCAP include trout, perch, crappie, and kokanee, with a particular focus on predators (Trophic Level 4 fish, including walleye and crappie) and bottom feeders (catfish, suckers, and carp).

For rivers and streams, although the target species will vary depending upon fishery use within each system, Trophic Level 4 fish will be priority species. Regional fishery biologists from each *Idaho Department of Fish and Game* (IDFG) region will be consulted in order to designate appropriate target species for monitoring. A preliminary list of major species noted by regional biologists include crappie, bass, trout, catfish, northern pike, perch, and kokanee. Appendix D provides a summary of regional fishery patterns and species.[19]

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[18] A mercury bioaccumulation study was performed by USGS in the South Yuba River, Deer Creek and Bear River Watersheds in the northwestern Sierra Nevada in California (May et al. 2000). The highest mercury concentrations were found in the upper-trophic-level predators (bass), with 88 percent of bass containing mercury concentrations greater than 0.3 mg/kg. Brown trout collected from streams were found to have generally much lower mercury concentrations (average total mercury of 0.16 mg/Kg wet weight) than bass and catfish collected from reservoirs (0.68 mg/Kg and 0.40 mg/Kg, respectively; May et al. 2000).

[19] Bull trout will specifically **not** be collected as part of this monitoring because of their protected status and because they are not consumed by humans. This is consistent with NOAA's support of sampling resident species as surrogates for listed

Regionally-stocked populations will not be targeted for monitoring; if these species are collected they would represent only a relatively short period of exposure to ambient conditions. IDFG provides a comprehensive list of where and when fish are stocked on a statewide basis (http://imnh.isu.edu/digitalatlas/geog/fishery/fishyfr.htm and http://fishandgame.idaho.gov/fish/stocking/); thus, these species will not be targeted for collection as determined in consultation with the Regional Fisheries Biologist.

Subsistence Issues

Tribal fish harvesting, or subsistence harvesting, primarily occurs within the Panhandle and Salmon Regions and the McCall Subregion and mainly includes steelhead, chinook, and kokanee. The statewide fish tissue monitoring program will target fish species that are predators and that demonstrate the highest levels of bioaccumulation of mercury. For example, mercury concentrations of kokanee samples collected from Coeur d'Alene in 2002 are well below mercury concentrations in other predator species such as largemouth bass (Figure 2-9). Although subsistence harvesting usually targets specific anadromous species and is associated with more frequent consumption, collection and testing of these species is generally prohibited under the ESA. However, Figure 2-9 (as well as Figure 2-10) shows that excluding these species provides a conservative view of mercury exposure for subsistence populations.

Sample Timing: July-September

EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1 (Section 6.1.1.5, EPA 2000a) and Idaho’s 1999 Beneficial Use Reconnaissance Project, Work Plan for Wadeable Streams (DEQ 1999) provides recommendations for when to sample fish tissue. In fresh waters, EPA guidance recommends that the most desirable sampling period is from late summer to early fall. Water levels are typically lower during this time, thus simplifying collection procedures. Fish lipid content is generally higher during this low flow season, allowing these samples to also provide information for other contaminant levels.

Although in Idaho the latter part of the growing season is from September through early November, USGS typically performs their monitoring between July and early September[20]. In order to take advantage of existing monitoring activities, this will be the targeted period for this monitoring program, as well.

Sample Number and Size: 10 Samples per Location

A certain level of statistical confidence is required for data to be useful in extrapolating advisories and determining level of stream impairment. In accordance

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salmonids (D. Mabe, pers. comm. 2004). In addition, Section 10 permitting allowing sampling threatened and endangered species would be difficult to apply for this purpose.

[20] EPA guidance recommends the late summer to early fall sampling period only if it does not coincide with the legal harvest season of the target species or if the target species spawns during this period. However, if the target species can be legally harvested during its spawning period, then sampling to determine contaminant concentrations should be conducted during this time. Exceptions may be made for various target species if the IDFG Regional Fishery Biologist recommends otherwise.

with generally accepted practice, at least 10 samples (per species if more than one species is collected) should be collected per sample location in order for the sample data to be statistically relevant. Therefore, at least 10 fish of adequate size should be collected for fish tissue samples at each sampling location. This preference will depend somewhat on the allowable amount per collection permits and the target water body.

Size requirements vary somewhat by region because, in some cases, there are very specific size requirements for harvesting a particular species. The IDFG Regional Fishery Biologists will be consulted to recommend fish size requirements for their regions, targeted species, and applicable fishing regulations should be considered in modifying this protocol for sample collection. Generally, specimens collected for analysis should at least meet IFCAP 10-inch minimum length and contain enough fillet tissue to meet the sample mass required by the lab (generally 2 grams at a minimum). In addition, to avoid large variances, IFCAP requires that the smaller fish should be no less than 50 percent of the largest individual (for example, the smallest fish should be no less than 10 inches if the largest fish is 20 inches).

If it is not possible to follow these protocols, this protocol may be modified in such a manner that is appropriate to the situation and does not degrade data quality.

Preparation Method: Skinless Fillets

All fish tissue will be collected as individual, skinless fillet samples. However, to preserve resources, Idaho will split available fillets so that one half is retained for individual analysis and the other half is used for compositing with other samples from the same species. (Only samples from the same species will be composited together.) The composite sample will be submitted for analysis, and if that analysis indicates that the concentration of mercury is within 20 percent of the target criterion (0.3 mg/kg default value), then analyses on individual species will be performed to verify this information and to provide meaningful data to the IFCAP program. For example, such analysis might be used to provide an estimate for the level of variance within the population.

Because mercury is differentially concentrated in muscle tissue, analyzing fillets provides a conservative approach for subsistence fishers, who generally eat more of the fish (gutted carcass), because the fillets provide higher mercury concentrations. Moreover, leaving the skin on the fish fillet results in a lower mercury concentration per gram (EPA 2001a), so using skinless fillets is a more conservative approach for addressing mercury exposures for members of the general population and most recreational fishers.

Sample Handling: IFCAP protocols

All fish samples will be handled according to the protocols outlined in the IFCAP program, which were adopted from IDFG and USGS sampling techniques (IFCAP 2004). The field biologist identifies the fish species, weighs and measures the species, tags the species, and ships each fish in foil to the analytical laboratory. The majority of samples will be analyzed by the state laboratory that supports the IFCAP program, unless analytical capacity is available via the USGS program.

Detailed procedures are discussed in Appendix B of the IFCAP protocol (IFCAP 2004).

4.4 Analytical Methods

Analytical methods for total (and dissolved) mercury and methylmercury have been developed for determinations in several mediums including water, sediments, and fish tissue. Organizations, including private laboratories, EPA, and USGS have been directly involved in development of these methods and each method meets the strict QA/QC requirements of EPA's Environmental Monitoring Management Council format. This is one of the primary reasons that a statewide monitoring program has been recommended—in order to ensure data validity and quality.

Because researchers have found that nearly all mercury in tissue is in the form of methylmercury (EPA 2000d), EPA suggests that analysis of tissue for total mercury, as a surrogate for methylmercury, is a useful means for implementing the methylmercury criterion. If total mercury results in tissue exceed the criterion, then further investigation of the methylmercury component may be desired[21] (see Chapter 3).

Available methods for analysis methods for total mercury include a modified Method EPA 1631 (see Appendix A of the method), and Method EPA 245.7/Method 7474. (Methylmercury analysis is completed by EPA 1630, although it has not yet been approved under 40 CFR 136 for regulatory reporting requirements under the CWA.)

These analysis methods are discussed in the following.

4.4.1 EPA Method 1631

In May 1998, EPA proposed *Method 1631* in 40 CFR Part 136 for use in determining mercury concentrations at ambient water quality criteria levels in EPA's Clean Water Act programs. EPA subsequently published a Notice of Data Availability (64 FR 10596) that included additional data supporting application of the method to effluent matrices. On June 8, 1999, EPA responded to numerous public comments on the proposed method and promulgated EPA Method 1631, Revision B: *Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry* in 40 CFR Part 136 for use in EPA's Clean Water Act monitoring programs.

Promulgation of the method was based on extensive validation of the procedures, including four single-laboratory studies and an inter-laboratory validation involving twelve participating laboratories and one referee laboratory. The highest Method Detection Limit (MDL) determined by all laboratories in reagent water was 0.0018

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[21] Methylmercury analysis is most appropriate when total mercury data indicate that fish tissue concentrations are within 20 percent of the criterion. If total mercury concentrations are higher than that, it is very likely that methylmercury concentrations are also above the criterion and it is not recommended that resources be spent confirming this relationship.

μg/L, indicating that this method is capable of producing reliable measurements of mercury in aqueous matrices at ambient water quality criteria levels. The typical MDL and method quantitation limit (MQL) for Method 1631 are 0.002 μg/L and 0.005 μg/L, respectively.

Since promulgation, EPA has revised Method 1631 to clarify method requirements, increase method flexibility, and address frequently asked questions. The current method (Method 1631, Revision E) includes recommendations for use of clean techniques contained in EPA's *Method1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*, EPA 821-R-96-011, July 1996). However, Method 1631 only measures mercury (total and dissolved) in aqueous samples and is not capable of measuring the methylmercury species.

Method 1631, *Appendix A* was developed for processing fish tissue samples to be analyzed for total mercury using the previously validated and approved Method 1631 analytical procedures. The procedures in the appendix are not approved, but are currently being implemented in EPA's National Study of Chemical Residues in Fish Tissue (EPA 2002d). Although the method appendix has not been fully validated (i.e., via an inter-laboratory validation study), it was validated by EPA in a single laboratory study, and the techniques have been widely reported in the literature. Moreover, as discussed above, the analytical component of the method (Method 1631) has been fully validated and approved for measurement of total or dissolved mercury in aqueous matrices. The expected method detection limit for total mercury in fish tissue is 0.002 mg/kg, which is well below Idaho's water quality criterion for methylmercury of 0.3 mg/kg.

Since promulgation, EPA has revised Method 1631 to clarify method requirements, increase method flexibility, and address frequently asked questions. The current method (Method 1631, Revision E) includes recommendations for use of clean techniques contained in EPA's *Method1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*, EPA 821-R-96-011, July 1996b). However, Method 1631 only measures mercury (total and dissolved) in aqueous samples and is not capable of measuring the methylmercury species. This method's MDL and MQL limits are usually 0.002 μg/L and 0.005 μng/L.

4.4.2 EPA Method 245.7

In April 2004, EPA proposed to approve EPA Method 245.7 for mercury in water. This new method is less expensive than Method 1631. Its MDL and MQL limits are similar (0.0018 μg/L and 0.005 μg/L, respectively) to those of EPA Method 1631. However, the new method should be usable for effluent monitoring because these values are below the aquatic life criteria.

Appendix F contains laboratory protocols (based on those developed by Wisconsin) to support clean sampling for mercury. Once adequate reliable effluent data are available, these data will be used to determine WLAs during the TMDL process (if the receiving water has been listed under the 303(d) program, see Chapter 5) and/or the NPDES RPTE process (see Chapter 6).

4.5 Data Evaluation

4.5.1 Assessing Older Data

For purposes of determining water body impairment and inclusion on section 303(d) lists, Idaho must consider all existing and readily available water-quality related data and information (40 CFR 130.7). As a result, Idaho will need to consider mercury from samples collected and analyzed several years in the past. The reliability of this information and its accordance with applicable data collection and/or QA/QC program requirements will be determined before using these data for listing assessments.

As stated in the WBAG, Idaho generally bases assessments of water quality on data that is no more than five years old (Grafe et al. 2002). Older data may be used, if newer data is not available, but such data is considered Tier 2 data—of lesser relevance to current water quality conditions. Tier 2 data, by itself, is not used to make listing decisions.

The decision to use older data will be determined by evaluating the analytical method used to analyze the samples. Previous analytical methods could not quantify mercury results as well as current methods, and thus older data sets may have many non-detections in the range of the criterion. In addition, samples collected or analyzed from before the mid-1990s may reflect either field or laboratory contamination; it was not until the mid-1990s that the clean techniques were as readily used. For these reasons, caution will be used when using older data.

4.5.2 Using Non-detect Data

In computing the mean concentration of mercury in fish tissue, it is possible that the datasets will include analyzed values below the MDL. This may not happen very frequently—newer analytical Methods 1630 and 1631 are able to quantify mercury at 0.002 mg/kg, which should be lower than the observed mercury in almost all fish tissue samples being analyzed.

However, if non-detect data are observed, Idaho will follow the convention recommended in EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1, (Section 9.1.2, EPA 2000a). This convention recommends using one-half of the MDL for non-detects in calculating mean values. This guidance also recommends that measurements that fall between the MDL and the *Method Quantitation Limit* (MQL) be assigned a value of the MDL plus one-half the difference between the MDL and MQL[22].

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[22] EPA notes, however, that these conventions provide a biased estimate of the average concentration (Gilbert 1987), and where the computed average is close to the criterion, may suggest an impairment when one does not exist or, conversely, suggest no impairment when one does exist. These biases depend on the frequency of non-detects in the data set.

4.5.3 Treatment of Outliers

It is fairly common for environmental data sets to contain values that are so different than the rest of the values that they are not representative and should be considered “outliers.” If at least 11 different results exist for a given parameter, an outlier analysis should be done to determine if any of the values should be excluded from the data set for the RPTE analysis. The default outlier analysis recommended in this guidance is the Grubbs' test (also known as the extreme studentized deviate [ESD] method) (Iglewiz and Hoaglin 1993; Barnett et al. 1994).

4.6 Application of Data

4.6.1 Ambient Monitoring

Statewide fish tissue monitoring data will be applied within the TMDL and NPDES programs as explained in more detail in Chapter 5 (TMDL) and Chapter 6 (NPDES). This application requires the calculation of the average fish tissue concentration.

DEQ’s preference and hierarchy to follow when deriving average mercury fish tissue concentrations includes the following:

- Use local consumption data (creel surveys) when available or from studies reflecting similar geography/population groups
- Or use the national average default Trophic Level 4 average

In absence of data to apportion fish consumption among trophic levels, Idaho will assume all consumption occurs at the highest trophic level in known areas with endangered species, so as to err on the side of protection of wildlife protection. This decision is discussed in further detail in Chapter 7 in terms of its potential impact on wildlife.

If appropriate creel survey data are available, mercury fish tissue concentrations should be determined using this information by factoring the consumption by trophic level in computing the average mercury in fish tissue. Fish creel data from IDFG are one justifiable basis for estimating types and amounts of fish consumed from a given water body.[23]

If these data are not available, but concentration data from Trophic Level 2, Trophic Level 3, and Trophic Level 4 fish are available, this information can be used to calculate the average mercury concentration in fish tissue using Equation 4-1:

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[23] Ideally, local consumption data would be based on a statistically-designed fish consumption study on that water body or a water body that has a population that can be assumed to have similar consumption patterns. If such well designed studies have not been completed on the water body or cannot be applied to the water body, the highest trophic level (e.g., a default Trophic Level 4 average) should be applied.

$$\text{Cavg} = \left(\frac{(\text{IR2} * \text{C2}) + (\text{IR3} * \text{C3}) + (\text{IR4} * \text{C4})}{IR2 + IR3 + IR4} \right)$$

Equation 4-1. Calculation of the average fish tissue mercury concentration

Where:

C_{avg} = Average fish tissue (mg/kg)

IR_i = Consumption factor of fish in *i*th trophic level (kg/day)

C_i = Average fish tissue concentration for *i*th trophic level (mg/kg)

The consumption factor of fish in the each tropic level are applied using EPA default values (for a total daily intake of 17.5 g/day):

- 5.7 g/day of Trophic Level 4 fish
- 8.0 g/day of Trophic Level 3 fish
- 3.8 g/day of Trophic Level 2 fish

An example of how to use consumption information to calculate a weighted average fish tissue value is presented in Table 4-2.

Table 4-2. Example Weighted Average Fish Tissue Calculation.

Species	Trophic Level	Number of Samples	Mean Hg Concentration (mg/kg ww)
Cutthroat trout	3	30	0.07
Kokanee	3	30	0.12
Yellow perch	3	30	0.19
Smallmouth bass	4	95	0.45
Pumpkinseed	3	30	0.13
Brown Bullhead	3	13	0.39
AVERAGE Trophic Level 3	--	--	0.15
AVERAGE Trophic Level 4	--	--	0.45

NOTE: The trophic level average should be calculated as the weighted arithmetic mean value, which is dependent on the number of samples obtained and reflects averaging on the basis of each individual fish.

These concentrations are used to compute a weighted average of tissue values for comparison to the 0.3 mg/kg criterion. All fish measured are classified as Trophic Level 3 fish, except smallmouth bass, which is Trophic Level 4. The mean value for Trophic Level 3 fish is 0.18 mg/kg. Applying Equation 4-1 using the data from this table yields the following:

$$\text{Cavg} = \left(\frac{(8.0 * 0.18) + (5.7 * 0.45)}{8.0 + 5.7} \right) = 0.29\ mg / Kg$$

As shown in this example, if data from Trophic Level 2 are missing, the consumption factor for that trophic level should be dropped from both the numerator and denominator. This calculation preserves the relative contribution of each trophic level to consumption patterns.

Although EPA recommends that an alternative approach should be used if there are no data for Trophic Level 4 fish, in Idaho there are likely to be a number of headwater streams that contain only Trophic Level 3 fish and lower (for example, the South Fork Boise River and the upper mainstem Salmon River). Thus, this approach should be applied to all trophic levels in Idaho.[24]

4.6.2 Facility Monitoring

Effluent monitoring data will be applied within the TMDL and NPDES programs as explained in more detail in Chapter 5 (TMDL) and Chapter 6 (NPDES).

Once reliable data have been obtained for the facility (effluent) and for the receiving water (fish tissue), these data will be used to determine potential listing under the 303(d) list, as described in Chapter 5 and/or the RPTE process as described in Chapter 6.

Depending on the outcome of the TMDL or NPDES/RPTE processes, different monitoring requirements should be applied in subsequent permit cycles. These requirements are discussed in Chapter 6.

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[24] Again, in absence of data to apportion fish consumption among trophic levels, Idaho will assume all consumption occurs at the highest trophic level in known areas where endangered species are located, so as to err on the side of protection of human health. This decision is discussed in further detail in Chapter 7 in terms of its potential impact on wildlife.

5. TMDL Program

This chapter discusses the relationship between the mercury water quality criterion and the Total Maximum Daily Loads (TMDL) program.

5.1 Introduction

The TMDL process for mercury will follow and be as consistent as possible with existing federal and Idaho *Guidance of the Development of Total Maximum Daily Loads* (1999) and its successors. Because federal guidance on developing and implementing TMDLs for mercury based on the new fish tissue methylmercury criterion are in the process of being developed, Idaho's approach is based on case studies elsewhere in the region and nationwide.

Fundamentally, mercury TMDLs will continue to be a pollutant budget, taking into account loads from point and nonpoint sources, as well as human-caused and natural background loads. However, developing TMDLs for waters impaired by mercury raises a number of technical and policy issues. Idaho will structure its TMDLs for mercury using a phased approach and adaptive management; as additional monitoring data become available, the process will be updated as necessary.

5.1.1 Phased Approach

Because mercury in Idaho is likely to be largely a result of air deposition and scattered natural geologic background[25] or legacy mining, regional approaches to 303(d) listings and TMDL development process are strongly encouraged.

The phased approach recognizes that the predominant source of mercury to water bodies may differ throughout the state.

Consistent with other mercury TMDLs, which have concluded that over 90 percent of mercury loading is due to atmospheric sources (EPA Region 6 and Louisiana DEQ 2001, FTN 2002, Parson 2003), air deposition may be the predominant source of mercury to many water bodies in Idaho. Air deposition of mercury in Idaho primarily comes from regional and global sources, and identifying the relative contribution of each of these sources is difficult. Idaho's Clean Water Act program does not have the authority to address all of these sources and will depend on a variety of programs, such as regulations under the Clean Air Act, pollution prevention programs, and international efforts.

In areas where large numbers of water bodies are expected to be impaired by mercury from air deposition, Idaho believes it may more efficient to take a broad-scale approach (potentially integrating a number of 4th field hydrologic Assessment Units

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[25] Natural background only includes that amount of mercury that would occur under undisturbed conditions.

that form the basis of TMDL subbasin delineations) in developing TMDLs, rather than performing a water body-by-water body analysis. To the extent practicable, DEQ will coordinate its Clean Water Act program with other programs in order to address these mercury sources.

In other water bodies, significant loadings may come from other sources, such as mining or even background geologic sources or legacy mining. Where a mix of sources other than air deposition exists, Idaho believes it will be appropriate to conduct a more tailored, water body-specific analysis.

It should also be noted that air mercury deposition on the land can be transported to the water body via storm water runoff and erosion associated with land uses, such as forestry or agriculture. The Willamette mercury TMDL concludes that runoff of air deposition accounts for 46 percent of non-point source inputs, while surface soil erosion accounts for the other 54 percent of non-point source inputs (ODEQ 2004). As a result, management practices that control these transport mechanisms can reduce mercury loads to water bodies and should be considered in the TMDL process.

5.1.2 Adaptive Management

In terms of adaptive management, the federal Clean Water Act and the *Idaho Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02) indicate that all feasible steps should be taken to achieve the highest quality water attainable. However, in watersheds where non-point sources are a major pollutant contributor, feasible steps may be difficult to identify and implement.

The concept of adaptive management, as it applies to TMDL development and implementation plans, allows on-the-ground implementation to proceed where uncertainty exists about how and when reduction targets will be met. The adaptive management approach acknowledges that while beneficial uses may not be restored for a long period, the actions taken provide a short-term pathway by which to gauge progress toward that goal. Adaptive management will be an important tool for mercury in Idaho as additional ambient data are collected and evaluated.

5.2 303(d) Listing Process

The most recently approved Idaho 303(d) list (in 1998, with additions from EPA) for Idaho indicates only Jordan Creek (Headwaters to Williams Creek) and Brownlee Reservoir as impaired by mercury.

5.2.1 Integrated 305(b)/303(d) List

In 2002, an integrated 305(b) and 303(d) list was developed, and this process has added Salmon Falls Creek Reservoir, Lake Coeur d’Alene, and Lake Lowell. In addition to this change, revised 2002 and 2004 integrated list guidance (EPA 2002, 2003) includes different listing categories that have relevance for mercury-affected water bodies. The guidance notes that the water quality attainment status for each water body or assessment unit should be placed in only one of five distinct categories:[26]

Category 1. Attaining the water quality standard and no use is threatened

Category 2. Attaining some of the designated uses; no use is threatened

Category 3. Insufficient or no data and information to determine if any designated use is attained

Category 4. Impaired or threatened for one or more designated uses but does not require the development of a TMDL for one of three reasons:

a. TMDL has been completed
b. Other pollution control requirements are reasonably expected to result in the attainment of the standard in the near future (for example, reductions in atmospheric deposition under the Clean Air Act)
c. Impairment is not caused by mercury as a pollutant. These waters are deemed to be impaired based on physical conditions, such as poor habitat or hydrologic modifications. If the available data are insufficient to determine whether impairment is caused by regional or local mercury sources, the water should be included in Category 5 as requiring a TMDL.

Category 5. The water quality standard is not attained. Placing waters into Category 5 is appropriate when a TMDL is required to address an impairment caused by mercury. This category constitutes the Section 303(d) list of waters impaired or threatened by a pollutant(s) for which one or more TMDL(s) are needed.

Under Category 4B, “near future” is typically defined as within one listing cycle (or 2-5 years). In the case of mercury, the control of which has been associated largely with large-scale and regional-scale control of air deposition in every mercury TMDL completed to date, one listing cycle may be too short to realize standards attainment. Other recent mercury TMDL implementation time frames have been estimated to take several decades (FTN 2002, EPA Region 6 and Louisiana DEQ 2001).

The basis for EPA’s tight deadline of the 2-year/next listing cycle window is the desire to avoid the indefinite postponement of a TMDL pending the outcome of “other pollution controls” that have uncertain effectiveness. In fact, mercury-impaired waters appear to be the ideal case for expanding the time period of a reasonable time beyond the 2-year/next listing cycle window for two important reasons:

- Given that mercury will continue to be deposited into the waters from regional, national, and international sources, there is very little chance that a water body will attain water quality standards for mercury within a 2-year period based solely upon TMDL implementation.

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[26] Currently, EPA recommends that every water body be placed into only *one* of the above categories. In Idaho, this could mean that a water body is placed in Category 5 if other constituents (for example, sediment) are causing impairment, even if mercury data are limited.

- The accumulation of mercury within fish tissues means that attainment of the water quality standards for mercury is likely to take a lengthy period of time. Until the mercury is removed from the smaller fish in the food chain, and the larger, more contaminated fish are removed from the waters through capture or death, mercury fish advisories will remain in effect, at least for fish over a certain size.

When sufficient data are available, these data would be assessed within the appropriate framework to determine if a listing is justified (EPA 2002, 2003). As discussed in Chapter 4, a credible, robust set of water quality data is needed to determine whether a water body is impaired. The fact that very limited mercury monitoring data, particularly in fish tissue, are available in Idaho means that additional water bodies will likely be listed as impaired for mercury as additional data are collected. Given the processes of methylation, these water bodies will likely be reservoirs/lakes where mercury tends to methylate and piscivorous food chains are located to be able to biomagnify the methylated mercury (for example, warm-water fish replace cool/cold- water species), as well as larger streams where higher trophic level fish are present.

For waters that are listed due to a fish consumption advisory, it should be confirmed that the listing was based on a valid data set and analysis of mercury levels using the methods specified in Chapter 4. This confirmation is necessary because a critical component of the TMDL program is to delineate the sources of mercury to determine whether a TMDL is the appropriate control mechanism. For example, even in those water bodies that have been listed (e.g., Brownlee Reservoir), the development of a mercury TMDL may be postponed until additional monitoring data are collected to better determine if impairment actually is occurring and, if so, the appropriate source identification and load allocations.

5.2.2 303(d) Listing for TMDLs

Possible TMDL pathways are described below:

- If average mercury levels in resident fish tissue (as determined by the monitoring approach in Chapter 4) are below 0.3 mg/kg (defined as ≤0.24 mg/kg as a 20 percent implicit margin of safety), no 303(d) listing is required. However, a 5- to 8-year fish tissue monitoring cycle will be used to confirm non-impairment. The 20 percent margin of safety is based on the documented method controls of EPA Method 1631 and other recent mercury TMDLs (EPA Region 6 and Louisiana DEQ 2001, FTN 2002).[27] These water bodies should be placed in Category 1 or 2, depending on other pollutants that have been assessed.

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[27] Typically, the recommended control limit for analytical duplicates is <20 percent relative percent difference if sample concentrations are greater than or equal to the quantification limit (EPA 1997). In addition, EPA Method 1631 specifies that when field duplicates are analyzed, the relative percent difference between field duplicates should be <20 percent (EPA 2002a).

- If average mercury levels in resident fish tissue (as determined by the monitoring approach in Chapter 4) are between 0.24 mg/kg and 0.3 mg/kg, affected stakeholders may elect to further assess impairment over a 2-3 year timeframe. This could be accomplished through individual facility monitoring efforts, collective monitoring efforts, or through the proposed statewide monitoring cooperative program (see Chapter 4). In the interim, voluntary mercury-control BMPs will be encouraged. These water bodies should be placed in Category 3 until a more complete data set is developed.
- If average mercury levels in resident fish tissue (as determined by the monitoring approach in Chapter 4) are ≥0.3 mg/kg, a 303(d) listing is required for that Assessment Unit. Although upstream segments from the listed Assessment Unit may not be listed themselves, they will be addressed under source characterization during the TMDL process. These water bodies should be placed either in Category 4B or 5, depending on monitoring results and other available information. It is most likely that these would be placed into Category 5 because information necessary to determine the applicability of Category 4B will not be available at the time of listing.
- If average mercury levels in all fish consumed are ≥0.3 mg/kg (as determined by the monitoring approach in Chapter 4), coordination with the fish consumption advisory program will also be facilitated by DEQ. This is discussed in more detail in Chapter 8.

5.3 TMDL Process

Consistent with EPA recommendations, Idaho will approach our mercury-impaired water bodies with a simple, screening-level analysis of mercury loadings and sources. Idaho can then conduct more complex analyses associated with traditional TMDLs as needed. As a practical matter, it is expected that the TMDL process will be prioritized by focusing first on those water bodies with multiple NPDES dischargers that may require WLA clarification for NPDES permitting.

5.3.1 Screening-Level Analysis

A simple screening-level analysis of the mercury sources impacting a water body or water bodies can assist in determining where TMDLs are needed and what type of approach to TMDLs is most appropriate.

One tool available to assist Idaho with such an analysis is EPA's Mercury Maps system. Mercury Maps is a geographic information system (GIS) that displays available mercury fish tissue and other data on a watershed–by-watershed basis nationwide (http://www.epa.gov/waterscience/maps/). Mercury Maps shows the watersheds across the nation where current fish tissue concentrations are expected to exceed the new methylmercury fish tissue criterion, and, thus, where mercury load reductions may need to occur.

The Mercury Maps model is designed to work only with watersheds where air deposition is the sole significant source of mercury. As such, it eliminates watersheds if they contain potentially significant, but unquantified, runoff and effluent loads from: mercury mines, large-producer gold mines, and mercury-cell chlor-alkali facilities. Within Idaho, there are a number of significant-producer gold mines and municipal wastewater treatment plants, but no mercury-cell chlor-alkali facilities and only one pulp and paper mill.

Because the majority of fish tissue data from Idaho have not been geo-referenced (and were therefore not incorporated into Mercury Maps), Idaho will rely on existing statewide fish tissue data on point source effluent loads, as well available information on other significant sources of mercury in the state (e.g., erosion of mine tailings or natural geological formations). Other air deposition models that may be made available from EPA or others and that are appropriate for Idaho can also be used for screening analyses.

This information will be used to group mercury-affected water bodies into two types or categories:

- When existing air regulations are expected to achieve water quality standards (air deposition may or may not be the dominant mercury source), the water body should be moved into Category 4B. This action can only occur if the dominant source of mercury is known at the time a listing decision is made, which will have limited application in the initial phases of the mercury TMDL program. If a water body is moved into Category 4B, a TMDL is not required because other pollution control requirements are expected to result in attainment of the mercury standard. In this case, DEQ expects that stakeholders will implement voluntary mercury-control BMPs. In turn, DEQ will participate in regional air pollution control activities to the extent feasible.
- When existing air regulations are not expected to achieve water quality standards (air deposition may or may not be the dominant mercury source), the water body should remain in Category 5 and a traditional TMDL analysis should be conducted.

Mercury TMDL analyses are discussed in the following.

5.3.2 Traditional TMDL Analysis

Similar to the overall TMDL framework in Idaho (DEQ 1999b), TMDLs for mercury will be prepared using the standard three-step process: subbasin assessment, loading analysis, and implementation plan.

Subbasin Assessment

The subbasin assessment is the initial section of the TMDL that describes the elements necessary to characterize the watershed. While typical TMDLs focus on the aspects of the watershed that answer the questions of source identification and pollutant control efforts, mercury TMDLs in Idaho are expected to focus primarily, though not exclusively, on legacy mining and/or air deposition issues that will require a slightly different format.

Specific issues that should be addressed in mercury subbasin assessments include the following items.

Characterization of the Watershed

Present physical and biological characteristics, such as native mercury deposits and formations are to be included in this section. In addition, identification of fisheries (including anadromous use and other native/non-native species that are caught for recreational uses) is required. This information is summarized by region in Chapter 4, and regional IDFG offices should be consulted for fish species information for specific water bodies.

Cultural characteristics should also be summarized. These include the location of point and nonpoint sources from within the watershed. Potential internal sources of mercury to water bodies in Idaho include the following:

- Direct discharges of mercury from water point sources, including industrial dischargers and municipal wastewater treatment plants
- Atmospheric deposition from facilities within the watershed including a) direct deposition to the water body surface, and b) indirect deposition to the watershed, which then transfers to the water body via runoff
- Runoff from current or legacy mining sites or mining wastes, as well as other waste disposal sites, such as landfills
- Sediments, which may have mercury contamination or hot spots as result of past discharges or historical placer mining activities
- Geologic or “naturally occurring” mercury in soils

External sources of mercury may include upstream water bodies and regional and global air deposition from various industrial sources (e.g. portland-process cement plants; ore roasting operations; coal, oil, or gas fired boilers; and coal-fired power facilities).

Within Idaho, the only TMDL for mercury that has been attempted to date is within the Snake River-Hells Canyon reach (DEQ 2004). This TMDL concluded that both internal (natural and anthropogenic) and external sources (natural and background loads from the watershed and airshed) of mercury occur. Natural geologic sources include volcanic rocks and mineral deposits (particularly cinnabar) in several areas of the Snake River-Hells Canyon drainage (see Figure 2-7). Anthropogenic sources within the watershed include legacy seed treatments, sewage sludge (biosolids) and municipal/industrial wastewater treatment plants, landfills, legacy mining activities, and air deposition. The TMDL should also note where storm water and erosion control practices may be able to mitigate transport of air-deposited mercury to a water body.

Water Quality Concerns and Status

This section of the subbasin assessment should summarize applicable water quality standards and associated beneficial uses. The Idaho fish tissue criterion of 0.3 mg/kg and the existing EPA 2002 recommended water column numbers (acute criterion of 1.4 µg/L and chronic criterion of 0.77 µg/L, even though Idaho is electing to reserve [that is, remove] these criteria pending resolution of NOAA Fisheries and U.S. Fish and Wildlife Services Section 7 consultation) can be restated in this section as benchmarks. Beneficial uses will vary throughout the state and can be found in *Idaho Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02). In the context of mercury, specific aquatic life designated uses don't result in a different fish tissue criterion because it is a human-health based number. In other words, as long as the concentration of mercury is the same in both cold-water species or warm-water species, the risk from mercury ingestion is also the same.

In addition to aquatic life criteria, recreational designated uses must also be protected. As long as the fish consumption advisory program follows the same protocols outlined in this guidance, if a water body is listed for a fish consumption advisory by BEHI (http://www2.state.id.us/dhw/behs/fish_advisory_program), then fishing beneficial uses are not fully supported.

Available mercury monitoring data should be presented in this section (following the methodologies presented in Chapter 4), particularly as they relate to either the 303(d) listing or fish consumption advisory. If historical data are available, a discussion of trends would be helpful, even though this guidance recommends only using data collected from the past 5 years for determining impairment. In addition to any chemical data on mercury that are available from the water column, fish tissue, or sediments, any additional biological data that may be available should also be presented.

From these data, conclusions should be drawn about which priority areas within the water body are truly water quality limited for mercury and would need a loading analysis. If data gaps are discovered, these should be identified and monitoring strategies to address these data gaps should be developed. This may be particularly helpful if there are suspected source "hot spots" for which data are unavailable. Another situation where this approach may be helpful would be when nonpoint sources of mercury are expected to be so minimal that filling these data gaps is not a wise use of monitoring resources.

Pollutant Sources Inventory

This section of the TMDL should reference the summary of point sources and nonpoint sources provided earlier in the *Characterization of the Watershed*. To the extent possible, the transportation of mercury from these sources should also be estimated (for example, by using relative yields from discharge monitoring reports, literature values, or EPA guidance if site-specific data are not available).

In the case of mercury, it is also important to discuss the delivery potential of mercury to reach areas most sensitive to impairment (for example, reservoirs and lakes where methylation processes occur and where recreational/wildlife uses are concentrated). Below is further discussion on estimating the loadings from each of the typical types of sources found in Idaho.

Point Sources

Determining loadings from point source dischargers may require a combination of approaches. Although some point source dischargers may have permit limits for mercury, most dischargers, especially smaller dischargers, likely do not have such limits. In addition, those facilities with permit limits may currently discharge at detection limits for mercury or may have used older, less sensitive analytical methods. In the absence of accurate discharge data, a sampling of a representative portion of dischargers using newer analytical techniques may be needed to estimate the total mercury discharges from point sources. The issue of NPDES permit monitoring is addressed in the following chapter.

Although landfills are a potential source of mercury (typically associated with the disposal of batteries, broken fluorescent light bulbs, and other mercury-containing products), these facilities tend to be located far away from surface water sources. Statewide, landfills are likely a minimal source of mercury loading given their relative sparseness. However, in a given watershed or region, if landfills are suspected of being a relatively large source (for example, based on localized fish tissue or ambient monitoring data), then such loads from these facilities should be estimated.

Atmospheric Deposition

Deposition of mercury from the air has emerged as a significant source of mercury in many water bodies nationwide, with some water bodies identified as having as much as 99 percent of the total loadings from atmospheric deposition (Parsons 2003). In other parts of the country, the primary anthropogenic sources of mercury emissions are from combustion of material containing mercury, such as coal-burning utilities and boilers and waste incinerators. There are also emissions from industrial processes, such as chlor-alkali plants and gold mining operations.

Aside from legacy gold mining operations, no such sources are present within Idaho. Thus, atmospheric deposition in Idaho water bodies comes from outside the state on a regional and, possibly, international scale. Recent studies in Oregon, showing narrow ranges of fish tissue mercury levels throughout the state, indicate that atmospheric transport is an important vehicle for mercury distribution in the region (Peterson et. al. 2002).

Where possible, a TMDL should identify the types or categories of air sources likely to contribute to mercury deposition in a water body. An example of this type of air emission source analysis is included in the Savannah River mercury TMDL issued February 28, 2001, and a series of mercury TMDLs issued February 28, 2002, for a number of watersheds in middle and south Georgia (see http://www.epa.gov/region4/water/tmdl/georgia/index.htm; EPA 2001c).

Although other tools available to characterize mercury deposition include the Mercury Deposition Network (http://nadp.sws.uiuc.edu/mdn/), this monitoring network focuses on the mid-west and east coast (as shown in Figure 5-1), where regional sources of mercury emissions are much more common. The current national monitoring network is presented below.

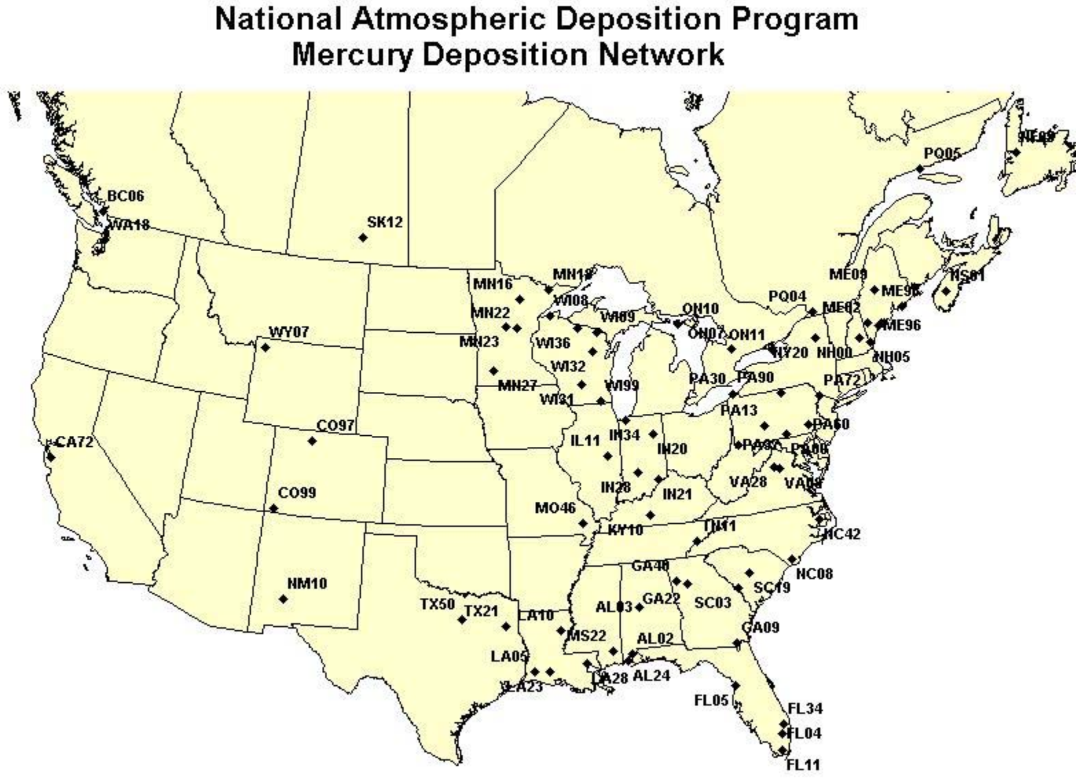
National Atmospheric Deposition Program
Mercury Deposition Network

Figure 5-1. National Atmospheric Mercury Deposition Network

Further information on tools and approaches for characterizing atmospheric deposition to water bodies can be found in Frequently Asked Question About Atmospheric Deposition at http://www.epa.gov/owow/oceans/airdep/air7.html.

Mining Activity

Determining loadings from mining involves estimating both historical and recent mining activity within the watershed. Because quicksilver mines are not as common as gold mines in Idaho, mining areas of particular interest are those involving “placer” deposits, in which mercury itself is present in the ore, or those deposits for which mercury is used as an amalgam to extract other metals, such as gold. Conducting a geologic assessment of types of deposits may help to screen for potential mercury loadings, (for example, sulfide replacement deposits and epithermal formations are often associated with mercury).

Sources of data on potential mercury deposits associated with mining activity include USGS, the US Bureau of Mines (for a list of major deposits of gold and silver), the *State Inactive Mine Inventory*, and the EPA Superfund program (see Figure 2-7).

Monitoring to determine loadings from mining areas may include sampling at direct seeps, as well as leachate from tailings or spoil piles. Where monitoring data is not available, an alternative is to examine existing data on sediment as well as runoff from within or up-gradient to the impaired water body.

Sediments

If possible, a TMDL analysis should attempt to account for any mercury present in instream sediments because of past mercury loadings. Data on levels of mercury in sediments are important in determining the extent to which controls on other sources will be effective and how long it will take to achieve water quality standards. An examination of past industrial practices in the watershed may also be useful as a first step in determining whether sediments may serve as a reservoir for mercury.

Various national databases, such as the *National Sediments Database* (EPA 2002g) and data collected by USGS, may also identify isolated locations of elevated mercury in sediments. In the absence of sediment data for a particular water body, site-specific monitoring may be needed to confirm the levels of mercury in sediments and to use as input to water quality models.

Alternatively, the level of mercury in sediments may be calculable as a function of a water quality model. These models are more complex, but offer the advantage of being able to estimate the change in release of mercury from sediments to the water column as the loadings to the water body decrease over time. Because this guidance focuses on the use of simpler approaches (that is, percent reductions based on fish tissue levels), Idaho does not anticipate extensive use of complex mercury models in the TMDL process.

Geologic or “Background” Levels in Soils

Mercury is a naturally-occurring ore within Idaho (see Chapter 2); separating the anthropogenic from “natural” mercury levels in soils can be challenging.[28]

Levels of mercury in soils may include mercury of geologic origin or mercury produced by the weathering of geological materials, together with mercury of anthropogenic origin (that is, mercury emitted over time from human sources and then deposited on soils).

If available, local or regional studies of geologic levels of mercury in soils may help address this question. For example, studies of mercury levels in the rocks can be used to estimate geologic levels of mercury. These “geologic” levels are then subtracted from the total levels of mercury measured in soils to estimate the “non-geologic” anthropogenic levels of mercury in soils.

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[28] Natural background only includes that amount of mercury that would occur under undisturbed conditions.

Summary of Past and Present Pollutant Control Sources

This section of the TMDL should summarize current sources that are not being controlled, or could be better controlled.

Loading Analyses

TMDLs are required to establish the load necessary to achieve standards, accounting for a margin of safety and seasonal variations. Allocations are generally made to each point source individually and to nonpoint sources, collectively, as a category or several categories.

General TMDL Formula

TMDLs generally can be represented using the formula of :

$$\text{TMDL} = \sum \text{WLAs} + \text{LA} + \text{MOS}$$

Equation 5-1. General TMDL Formula.

Where: WLA = Wasteload allocation (to point sources)

LA = Load allocation (to anthropogenic non-point sources and natural background)

MOS = Margin of safety

Seasonal variations are also typically included in TMDL determinations: for example, one TMDL applies during the summer and another TMDL applies during the winter.[29]

TMDLs for mercury typically link together models of atmospheric deposition, watershed loading, and mercury cycling with bioaccumulation. This enables a translation between the end-point for the TMDL (expressed as a fish tissue concentration of mercury) and the mercury loads to the water (expressed in water column loads).

Thus, Idaho will rely on a simple approach where mercury TMDLs will be expressed as a percent reduction required to achieve 0.3 mg/kg methylmercury fish tissue values (or to whatever localized criterion has been developed). Water column concentrations of methylmercury in the impaired water body would need to be reduced by the same percentage.

Note: The relationship between fish tissue methylmercury levels mercury loads to the water body has been assumed to be linear, consistent with numerous other cases (EPA Region 6 and Louisiana DEQ 2001, FTN 2002, Parsons 2003). In addition, EPA models in the Florida Everglades have shown that the relationship between current

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[29] For mercury, this seasonal approach is not necessary because fish tissue values integrate conditions over seasonal and annual periods. In fact, because data will be collected during fall, when the lipid content is the highest, the data already provide a conservative estimate of mercury concentrations during low-lipid-content seasons such as spring.

atmospheric deposition rates and current fish tissue concentrations is approximately linear (Florida DEP 2003).

For example, if average watershed fish tissue mercury concentrations are determined to be 0.40 mg/kg, this would mean that water concentrations of methylmercury would need to be reduced by 25 percent to improve concentrations from 0.40 to 0.30 mg/kg. The final percent reduction target would be 30 percent, including an additional 5 percent reduction as an explicit *Margin of Safety* (MOS).

This approach is consistent with TMDL rules that clearly indicate TMDLs can be expressed in terms of either mass per unit time, toxicity, *or other appropriate measures* (40 CFR 130.2(I) [emphasis added]).

An additional 5 percent reduction in water concentrations will be required as an explicit MOS. The MOS accounts for the uncertainty in the relationship between the pollutant loads and the quality of the receiving water body. This explicit MOS is added to the implicit MOS used by EPA to develop the fish tissue criterion, including conservative intake rates and reference dose concentrations (as discussed in more detail in Chapter 3) and the explicit MOS (20 percent) used to make 303(d) TMDL listing decisions.

There are no guidelines as to how to set an explicit MOS in a meaningful way except to use best professional judgment (other mercury TMDLs have derived explicit MOS ranging from 0 to 50 percent). Background loads should not be assigned a percent reduction, because these loads represent outside sources that cannot be reduced by in-watershed activities.

Although allocation schemes are expected to vary somewhat within each TMDL, required percent reductions should be applied to sources that produce mercury (that is, any facility with an industrial or treatment process that adds to or concentrates mercury in its discharge). Examples of these sources most commonly include certain mining or industrial activities. Setting numeric wasteload allocations (WLAs) requires numeric permit limits based on Water Quality Based Effluent Limits (WQBELs).

While this may be appropriate for those sources that produce mercury-containing waste (that is, have an industrial or treatment process that adds or concentrates mercury to its discharge), it is inappropriate to specify numeric limits for *de minimis* sources or sources that have no feasible treatment alternatives except for mercury-control BMP-based programs.[30] Setting numeric limits when there are no feasible means to meet these limits creates major compliance issues that must then be addressed using lengthy and expensive site-specific options such as variances.

TMDL writers should reasonably consider the relative contribution of each source as one factor in developing allocations. In other recent TMDLs where the majority of the mercury loadings come from air deposition, with a small proportion of the total

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[30] When the only source of mercury in the effluent comes from intake water, permit conditions may include a no-net-increase provision with limited monitoring to confirm that influent and effluent levels do not increase.

loadings from point sources, wasteloads either were not identified (FTN 2002) or were set at existing loads (EPA Region 6 and Louisiana DEQ 2001, Parsons 2003).

One factor that may have a bearing on allocation decisions for mercury TMDLs is the ability to provide reasonable assurance, particularly for those water bodies dominated by air loadings of mercury. Under current guidance, when a TMDL is developed for waters impaired by both point and nonpoint sources and the WLA is based on the assumption of reductions in the nonpoint sources, the TMDL should provide reasonable assurance that nonpoint source control measures will achieve expected reductions (EPA 1997b). This concept is also reflected in the definition of a TMDL, which allows for less stringent WLAs when BMPs or other nonpoint source controls make more stringent load allocations practical (40 CFR 130.2(i)).

NPDES permit conditions will include monitoring, mercury-control BMP-based approaches, and other feasible treatment improvements. As discussed in more detail in Chapter 6, the application of TMDLs to NPDES permits will occur within a tiered framework.

5.3.3 Accounting for New or Increased Discharges

In general, any entity proposing a new or increased discharge of mercury will be subject to the same TMDL and NPDES permitting processes described elsewhere in this guidance, including the RPTE process. These basic requirements prevent new or increased discharges from causing a violation of the water quality standards. Additional considerations for antidegradation purposes are discussed in Chapter 6.

Pre-TMDLs

According to Idaho water quality standards (IDAPA 16.01.02.054), new or increased discharges of a pollutant to a water body listed in Category 5 (requiring a TMDL) are potentially restricted—these are often referred to as no-net-increase requirements. As described below, restrictions are dependent on listing priority status:

- *High priority* – Until a TMDL or equivalent process is completed, the new or increased discharge may be allowed if interim changes, such as pollutant trading or some other approach are implemented and the total load remains the same or is decreased within the watershed. Interim changes are to maximize use of cost-effective measures to cap or decrease controllable human-caused discharges from point and non-point sources.
- *Medium and low priority* - Until a TMDL or equivalent process is completed, DEQ will require interim changes in permitted discharges from point sources and BMPs for non-point sources deemed necessary to prohibit further impairment of designated or existing beneficial uses. In determining the need for interim changes, DEQ will consult with the Basin Advisory Group (BAG) and Watershed Advisory Group (WAG) and evaluate impacts caused by past regulated and unregulated activities. Such changes also are to maximize use of cost-effective, timely measures to ensure no further impairment.

Thus, prior to a TMDL, any new or increased point source of mercury to a listed water body will have to demonstrate that the above no-net-increase requirements will be met. The NPDES process, including reasonable potential to exceed determinations, can be used to address no-net-increase requirements in this case.

DEQ is currently developing guidance on water quality trading (DEQ 2003), but it is not expected to include the no-net-increase requirements of the pre-TMDL situation. In the interim, strictly for the purposes of this initial issuance of the Idaho mercury criterion implementation guidance, the following no-net-increase evaluation will be applied to new or increased discharges of mercury:

- The total allowable mercury discharge in the watershed will be established as the baseline (existing) condition rather than the water quality criteria, with the baseline to be agreed upon by the WAG in consultation with DEQ.
- A new or increased discharge would be permitted if the baseline condition will not be exceeded by a greater than *de minimis* amount.

DEQ will make this determination on a case-by-case basis consistent with existing state policy.

Post-TMDLs

For high priory watersheds, after a TMDL or equivalent process is completed, any new or increased discharge will only be allowed if consistent with the TMDL. State regulations (IDAPA 16.01.02.054) specifically authorize that pollutant trading can be included in the TMDL or equivalent process or interim changes, with the goal of restoring the water body to comply with water quality standards.

5.3.4 Implementation Plan

Consistent with other TMDL implementation guidelines, Idaho mercury TMDL implementation plans should should contain the following:

- The expected timeframe for meeting water quality standards
- The approaches to be used to meet load and wasteload allocations
- An identification of the federal, state and local governments, individuals or entities that will be involved in or be responsible for implementing the TMDL
- A monitoring strategy to measure implementation activities and achievement of water quality standards
- Support of regional air pollution control activities
- Relying on BMPs that are focused on mercury-control activities
- Implementation of pollution prevention and public education programs

In addition, milestones for TMDL achievement should be included to the extent that they are feasible.

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6. NPDES Program

Treatment of the new methylmercury criterion within the NPDES framework is complex. The strategy adopted by Idaho rests on a tiered approach based on available monitoring data[31] (see Chapter 4).

Elements of this strategy are discussed in the following.

6.1 Overview

Because mercury monitoring data (both effluent and ambient) in Idaho is currently relatively scarce relative to other states, NPDES permitting strategies are expected to evolve as additional monitoring data become available.

6.1.1 Effluent Point Sources

Recommended permit conditions for effluent point sources depend entirely on whether the sources are considered to be significant or *de minimis* (Table 6-1). As these terms are applied to the mercury criterion, significant permittees are defined as having either been assigned a wasteload allocation (WLA) as part of the TMDL process or having been determined to have reasonable potential to exceed (RPTE) the mercury criteria. *De minimis* permittees are those facilities that, although they may discharge mercury, do not discharge enough mercury to be assigned a WLA within the TMDL process nor do they have RPTE to exceed the mercury criteria.

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[31] The recommended NPDES permitting program described in this chapter specifically applies only to mercury. Within the NPDES framework, mercury needs to be addressed somewhat differently than traditional NPDES approaches because of its expression for human health criteria as fish tissue and aquatic life criteria as water column values. To the extent that elements of the traditional NPDES approach outlined in EPA's Technical Support Document ([TSD] EPA 1991) should be applied, redundant discussions of these elements are not provided in this guidance.

Table 6-1. Summary of Recommended NPDES Permit Conditions.

	Permit Limits*	Effluent Monitoring	Ambient Fish Tissue Monitoring**
Significant Sources***			
Municipal Permittees	Mandatory BMPs, No-net-increase	Effluent– Quarterly until n=12 then Semi-annually	Once during initial 5-year permit cycle, then at least once every 5 years
Industrial Permittees	Mandatory BMPs, Numeric Limits (only if feasible treatment options exist), No-net-increase	Effluent – Monthly until n=12 then Quarterly	Once during initial 5-year permit cycle, then at least once every 5 years
De minimis Sources***			
Municipal or Industrial Permittees	Voluntary BMPs, No-net-increase	Limited in first permit cycle to establish *de minimis* status, then in subsequent permit cycles only via otherwise-required priority pollutant monitoring	Once during initial 5-year permit cycle, then at least once every 5 years (or at least once every 5-8 years if statewide cooperative monitoring data indicate receiving water is a low-priority watershed)

NOTES:

* Permit limits should include a no-net-increase provision if the facility is located on an impaired water body and a TMDL has not yet been completed. No-net-increase provisions are generally numeric if the receiving water is considered a high priority and necessary data are available; otherwise, no-net-increase provisions should be non-numeric.

** Ambient fish tissue monitoring will be conducted either on a facility-specific basis or within the proposed statewide cooperative fish tissue monitoring program in lieu of facility-specific monitoring. This monitoring approach is discussed in more detail in Chapter 4. NPDES facility monitoring requirements are a factor in the prioritization of which water bodies are sampled earlier in the 5-year rotational cycle. In addition, the frequency of fish tissue monitoring may be conducted on an annual basis if the facility is located on a "core" water body targeted for annual statewide monitoring.

*** If a TMDL is being developed, additional monitoring of effluent and receiving water will probably need to be conducted to support the TMDL. If NPDES permit conditions are necessary in the interim, permit conditions for major and minor NPDES dischargers can parallel "significant" or "*de minimis*" requirements, respectively. Major municipal dischargers include "all facilities with design flows of greater than 1 MGD and facilities with EPA/State approved industrial pretreatment programs" and major industrial facilities are "determined based on specific ratings criteria" (*EPA HQ NPDES Permit Writing Training Manual, EPA-833-B-93-003, March 1993*). These criteria include toxic pollutant and human health potentials, the relative contribution of the discharge to instream flows, and water quality factors (including 303(d) listings). Thus, minor NPDES dischargers that fall outside of these definitions should be treated, generally, as *de minimis* discharges (with associated recommended permit conditions as detailed above). Exceptions would be in special cases when the above major criteria may be applicable, and, in these situations, EPA HQ guidance stipulates that the EPA Regional Administrator has the discretion to classify minor discharges as major (*EPA HQ NPDES Permit Writing Training Manual, EPA-833-B-93-003, March 1993*).

Similar to other parameters, it is important to note that certain facilities that have very little potential to discharge mercury would be excluded from requiring any NPDES mercury permit conditions. Examples include facilities that discharge non-contact cooling water without additives.

Permit writers may exclude facilities from mercury requirements in these situations. This determination may be based on available data, surrogate facility monitoring (for example, if another facility for an industrial company uses the same processes and available mercury monitoring data indicate that no mercury is discharged), other literature information, or best professional judgment in the absence of such information.

The other situation where a facility may be excluded from mercury effluent monitoring requirements is when the sole source of background mercury is shown to be from intake water from surface or groundwater and that facility discharges to the source water body. Although this situation is not expected to be common, in the event that this situation occurs, no effective treatment technologies are available to treat this discharge and implementation of BMPs will not result in mercury reductions. Then the facility should consult with its permit writer to seek options for regulatory relief.

6.1.2 Storm Water Point Sources

Storm water point sources are addressed under both municipal permits and industrial permits.

Municipal Permits

Federal guidance on how storm water is addressed in TMDLs and NPDES permits has evolved. In November 2002, EPA (2002e) issued guidance indicating that NPDES permits for storm water discharges to water quality-impaired reaches should include the following:

- WLAs with BMP controls for storm water discharges
- No additional controls where BMPs meet WLA and numeric limits only in rare cases
- Multiple sources as single allocation where data and information are insufficient to assign each source/outfall an individual WLA
- Monitoring as necessary to determine compliance with limits, and mechanisms to make adjustments as required in the permits (adjustments can be in the form of re-opener clauses that can be initiated by EPA, DEQ, or the permittee)

Pollutants in storm water, including mercury, are regulated under the Phase I and II NPDES programs. Storm water discharges that fall under the NPDES Phase I or II programs must follow the guidelines of these programs in order to meet the goals of any associated TMDL for mercury that may apply.

This mercury implementation guidance does not envision that additional Idaho requirements are needed specific to mercury for municipal storm water permits.

Industrial Permits

Similar to municipal permits, industrial NPDES storm water permits have focused on implementation of BMPs. These permits are implemented via *Storm Water Pollution Prevention Plans* (SWP3s). EPA currently has in place a *Multi-Sector General Permit* (MSGP) applicable to industrial activities that requires SWP3s and other conditions (EPA 2000e). Industrial facilities receive coverage by this permit via a *Notice of Intent* (NOI) process.

The MSGP includes sector-specific monitoring requirements associated with benchmarks. Mercury is identified as a benchmark parameter for several industrial categories. Benchmarks are not numeric effluent limitations, and an exceedance is not considered a permit violation. However, if monitoring indicates benchmark concentrations are being exceeded at a particular facility, then the SWP3 should be modified to further control that pollutant. Exceedance of benchmarks may also indicate the need for issuance of an individual permit for that facility.

The MSGP also has provisions to ensure that storm water discharges are consistent with any TMDL for the receiving water.

Although general permits authorize the majority of storm water discharges, coverage may also be necessary under individual permits. If a WLA is established through a TMDL process for a storm water source, then this is typically implemented in an individual permit rather than the general permit.

This mercury implementation guidance does not envision that additional Idaho requirements are needed specific to mercury for industrial storm water permits.

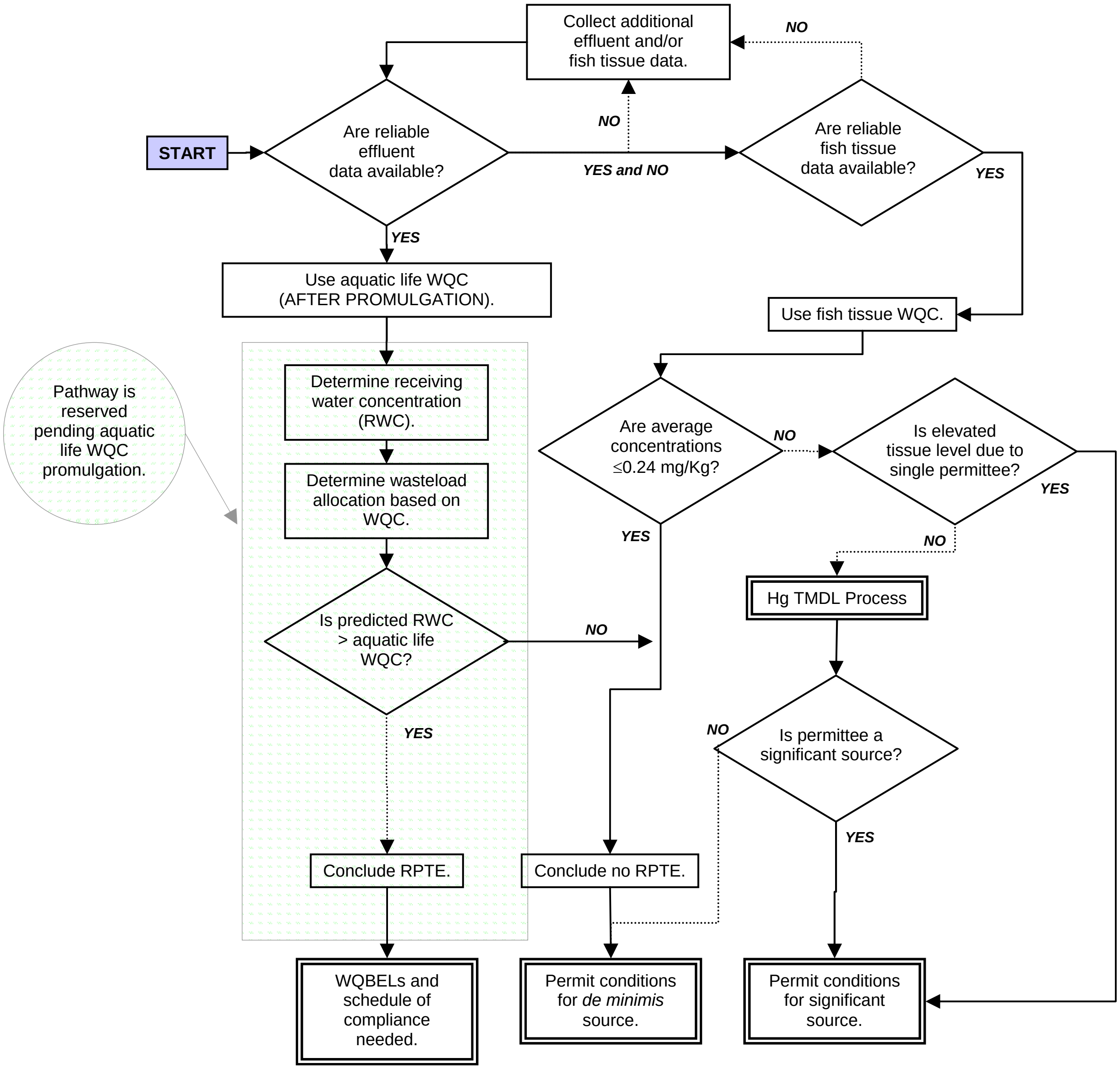
6.2 RPTE Process

The RPTE process is used to determine necessity of effluent limitations for mercury, depending somewhat on the earlier scenarios presented in Section 6.1. For facilities that have the potential to discharge mercury, the permit writer has discretion as to the level of RPTE analysis that is required.[32]

To determine RPTE, federal regulations require accounting for existing controls on point and nonpoint sources of mercury, the variability of mercury in the effluent, and, where appropriate, the dilution of the effluent in the receiving water. Permit writers should use best professional judgment as a screening tool to determine whether it is necessary to go through the full RPTE statistical analysis.

6.2.1 General RPTE Framework

The general RPTE process for mercury addresses both the fish tissue criterion and the aquatic life criterion, with the recognition that the more stringent of the two endpoints will determine whether a facility has RPTE. This parallel process is shown in Figure 6-1 and can be summarized in the following steps:`



NOTE: As detailed in Chapter 5, If a TMDL is not yet in place for an impaired water, permit conditions would be required until a TMDL can be completed. These conditions may be revised, if needed, following the TMDL process.

Figure 6-1. Recommended Mercury RPTE Process.

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[32] In Region 10, it is typical that if mercury is present in the effluent at quantifiable levels (in the 0.005 µg/L range as per EPA Method 1631), permit writers conduct an RPTE analysis.

Step 1: Assess the reliability of available water quality data, both water column and fish tissue concentrations, as available. (Data reliability is discussed in detail in Chapter 4.) If mercury data are not available, then the facility should be required to monitor mercury during the next permit cycle as specified in Chapter 4.[33] If mercury data are available, these data should be used to calculate RPTE[34].

Step 2: Determine RPTE using available fish tissue monitoring data. (Available water column data can only be used once aquatic life criteria are promulgated).

If fish tissue data are available, average fish tissue data are compared against the 0.24 mg/kg (providing a 20 percent MOS below the default fish tissue criterion). If fish tissue concentrations exceed the 0.24 mg/kg threshold, then RPTE is present for all significant dischargers. If the fish tissue concentrations are below the 0.24 mg/kg threshold, then no RPTE is present.[35]

Step 3: Determine need for TMDL (if water body is not already listed). If fish tissue data from the watershed indicate that a single permittee is responsible for elevated concentrations, then permit conditions will be required for that significant source. If multiple sources are present, then the TMDL process should be initiated as described in Chapter 5.

6.2.2 Human Health (Fish Tissue) RPTE Analysis

The RPTE analysis for human health criteria (expressed as the fish tissue methylmercury criterion) is relatively simple. Given that reliable fish tissue data are available, these data should be compared against 0.24 mg/kg. All data should be from the same water body or downstream waters from the point of discharge. This value applies a protective factor of 20 percent (as a protective threshold to represent analytical error) to the 0.3 mg/kg fish tissue criterion.

If fish tissue concentrations are >0.24 mg/kg then a RPTE exists, and more stringent permit conditions may be required. As outlined in Chapter 5, additional

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[33] In the absence of sufficient effluent data, DEQ recommends collecting additional data to determine RPT in lieu of other factors that could be used to determine RPTE (e.g., type of industry or municipal discharge, discharge monitoring report, or application information). Many of these factors would be used to determine fish tissue monitoring priorities within the proposed statewide monitoring program.

[34] Surface water data collected in Idaho since 1995 indicate that typical mercury concentrations in receiving waters are less than 0.025 μg/L (USGS 2004). (Unpublished data from the Lower Boise River show concentrations in the 0.002-0.008 μg/L range.) These levels are much lower than EPA's 2002 aquatic life criterion (0.77 μg/L for chronic). EPA guidance (1991) recommends that background concentrations be set to zero in the RPTE calculations if no data are available for the specific receiving water body of interest.

[35] This approach was taken because fish tissue concentrations are an integrative measure of impairment and the relationship between methylmercury in fish tissue and mercury in the water column is not well understood. DEQ recognizes that even if a water body meets a water quality criterion, RPTE may still exist because effects from current discharges may not yet be reflected in potentially elevated fish tissue concentrations. Permit conditions, including periodic effluent monitoring within the typical priority pollutant scans as might otherwise be required and continued ambient fish tissue monitoring, will be specified for those permittees with no RPTE. These conditions should dovetail to confirm this assumption and to ensure that concentrations do not exceed the criterion in the future (see Section 6.3). In addition, permit conditions for *de minimis* sources may include a no-net-increase provision and voluntary mercury-source control programs to help ensure no future RPTE.

methylmercury monitoring may be conducted to confirm that fish tissue levels are above 0.3 mg/kg. This monitoring can be accomplished through individual facility monitoring efforts, collective monitoring efforts, or through the proposed statewide monitoring cooperative program (see Chapter 4). If fish tissue concentrations are ≤0.24 mg/kg then no RPTE exists, the discharger is considered *de minimis,* and less stringent permit conditions should be specified (see Table 6-1).

The phrase "*de minimis*" literally means "of minimum impact." A uniform quantification of *de minimis* dischargers is not expected to be necessary given the implementation framework laid out in this guidance. Two cases (and associated *de minimis* definitions) are summarized below.

Case 1: Receiving water is not impaired (as determined by fish tissue monitoring). The ambient concentration of mercury can be considered the *de minimis* level of effluent that is discharged to that water body. This is consistent with a no RPTE determination.

Case 2: Receiving water is impaired (as determined by fish tissue monitoring), but no TMDL is in place yet (or is in process of being developed). Monitoring: Additional monitoring of effluent and receiving water will probably need to be conducted to support the TMDL. Thus, if NPDES permit conditions are necessary in the interim, permit conditions for major and minor NPDES dischargers can parallel “significant” or “*de minimis*” requirements, respectively, as specified in Table 6-1 of the Guidance.[36] For example, if a mercury TMDL is to be developed that affects major NPDES dischargers, then those major dischargers may be required to monitor their effluent as specified for significant dischargers in Table 6-1, and they should receive a no-net-increase provision until the TMDL is completed. Minor NPDES dischargers may also be required to monitor their effluent (or certify that they have no potential to release or concentrate mercury) as specified for *de minimis* dischargers in Table 6-1, and they should also receive a no-net-increase provision until the TMDL is completed. Receiving water fish tissue concentrations will also continue to be monitored under a higher priority in the statewide program.

Thus, *de minimis* discharger permits will still have periodic effluent monitoring as may otherwise be required as part of priority pollutant scans (typically once every permit cycle) and periodic (on the order of once every 5 years) ambient fish tissue monitoring requirements to confirm the RPTE conclusion (more information on permit conditions is provided in Section 6.3).

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[36] Major municipal dischargers include “all facilities with design flows of greater than 1 MGD and facilities with EPA/State approved industrial pretreatment programs” and major industrial facilities are “determined based on specific ratings criteria” (*EPA HQ NPDES Permit Writing Training Manual, EPA-833-B-93-003, March 1993*). These criteria include toxic pollutant and human health potentials, the relative contribution of the discharge to instream flows, and water quality factors (including 303(d) listings). Thus, minor NPDES dischargers that fall outside of these definitions should be treated generally as *de minimis* discharges (with associated recommended permit conditions as detailed in Table 6-1). Exceptions would be in special cases when the above major criteria may be applicable, and in these situations EPA HQ guidance stipulates that the EPA Regional Administrator has the discretion to classify minor discharges as major (*EPA HQ NPDES Permit Writing Training Manual, EPA-833-B-93-003, March 1993*).

While it is true that even if fish tissue concentrations are <0.24 mg/kg, RPTE could still be present because fish tissue concentrations do not respond immediately to changes in water column concentrations, in practical terms this possibility is unworkable because then there could never be enough fish tissue data collected to determine whether RPTE is present or not, or whether a discharger is in compliance. The 20 percent margin of safety addresses the inherent uncertainty in applying the proposed RPTE approach.

Permit Limits: While a TMDL is being developed, all dischargers—including *de minimis* dischargers—will be required to comply with conditions designed to ensure that discharge concentrations do not increase. These requirements include a no-net-increase provision to prevent added contributions to any mercury impairment. Where mercury control is feasible for major dischargers, it may be pursued if needed to maintain a no-net-increase. However, DEQ also believes that it is appropriate to balance the cost of such controls with the benefits to water quality. While d*e minimis* sources will not be assigned numeric WLAs in Idaho TMDLs developed to address mercury impaired waters, non-numeric requirements will be considered WLAs for purposes of satisfying federal TMDL regulations. That this complies with federal regulations is evidenced by TMDLs issued in Regions 4 and 6 discussed in Chapter 5.

6.2.3 Aquatic Life (Water Column) RPTE Analysis

Similar to other parameters, the RPTE analysis for mercury aquatic life criteria follow the guidelines set forth in the *Technical Support Document* (TSD) *for Water Quality-based Toxics Control* (EPA 1991), as appropriate. Because mercury behaves somewhat differently from other metals, mercury-specific RPTE analyses that Idaho believes are appropriate are discussed below. These procedures apply only to the mercury aquatic life criteria. As of the writing of this guidance, DEQ is proposing to reserve (that is, remove) both the acute and chronic numeric aquatic life criteria pending resolution of NOAA Fisheries and U.S. Fish and Wildlife Services Section 7 consultation on EPA’s 2002 values (1.4 µg/L and 0.77 µg/L, respectively).

From a practical perspective, this means that a detailed aquatic life analysis will not be able to be completed for facilities until acute and chronic numeric values are promulgated. Although narrative criteria can still be applied, the application of narrative standards may require the development of a site-specific numeric value. Thus, situations where aquatic life RPTE analysis is warranted are limited in the short-term (not only because development of a site-specific criteria is expensive and time-consuming but also because it is very rare that aquatic life criteria are expected to cause RPTE). In the interim, procedures for aquatic life RPTE in anticipation of future numeric criteria promulgation are set forth in Appendix G.

If is it determined that a permittee has RPTE, WQBEL-based permit limits will be established as outlined in Section 6.3.

6.3 Establishing Permit Conditions

While establishment of numeric and non-numeric permit conditions will vary, depending on the type of permittee as described earlier, there are three basic conditions specific to mercury that may be incorporated into NPDES permits:

- *Permit Limits*. The inclusion of permit limits does not necessarily mean that a numeric mercury limit will be required. An “effluent limitation” is defined as any restriction imposed on quantities, discharge rates, and concentrations of pollutant discharge from point sources (40 CFR 122.2). This definition encompasses non-numeric restrictions on the discharge of mercury (most commonly BMPs related to source control). This approach is identical to those permitting policies used elsewhere (for example, Ohio, Michigan, and Wisconsin) that rely on BMP-based source control permit conditions to provide relief to NPDES dischargers who have no feasible treatment options (see Section 2.2.6). Consistent with a BMP-based approach, including a narrative no-net-increase provision is also appropriate (and can be tracked via periodic pollutant priority scans as otherwise required in the permit).

  If necessary, numeric permit limits will also be determined based on the feasibility of treatment technologies. That is, if a permittee is discharging mercury that can be controlled by changing industrial processes or implementing appropriate and feasible effluent treatment technologies, numeric limits may be appropriate.

- *Effluent Monitoring.* Monitoring of effluent will only be required of those permittees who have been determined to be significant sources of mercury (either through the RPTE or TMDL processes). Periodic evaluation of lack of RPTE will be assessed using ambient fish tissue monitoring.

- *Ambient Fish Tissue Monitoring.* For other pollutants associated with water column criteria only, monitoring of the receiving water is appropriate for a number of technical reasons. In this case, the methylmercury fish tissue criterion is already an integrative metric (that is, fish travel throughout the subject watershed. Sampling fish to determine in-stream concentrations of mercury downstream of point discharges doesn’t necessarily yield useful information about the discharge-specific impacts, unless the fish being monitored are relatively non-migratory (such as sculpin). For this reason, Idaho is encouraging all permittees to enter into the proposed statewide fish tissue cooperative monitoring program in lieu of facility-specific monitoring. Until this program is developed and funded, or for those facilities that opt to not participate in the cooperative program, facility-specific ambient fish tissue monitoring will be required.

Each of these components is discussed in more detail.

6.3.1 Significant Sources

Significant sources will consist of municipal and industrial permittees, both of which are discussed in the following.

Municipal Permittees

Municipal mercury sources typically include sources not regulated by industrial pretreatment programs. The majority of mercury in municipal waste typically comes from dental, medical, and laboratory sources. The other contributor of mercury is from commercial sources/residences, including human waste and consumer products (thermometers, switches, and fluorescent bulbs; AMSA 2000).

If the RPTE process indicates effluent limits are necessary, or if WLAs are assigned in the TMDL, the permit must contain permit conditions for mercury. However, permit conditions do not necessarily mean that a numeric mercury limit will be required. An “effluent limitation” is defined as any restriction imposed on quantities, discharge rates, and concentrations of pollutant discharge from point sources (40 CFR 122.2). This definition encompasses non-numeric restrictions on the discharge of mercury.

For municipal sources, numeric effluent limits are typically not appropriate because achievement of numeric limits may not be feasible due to detection difficulty, the tremendous expense required to install treatment technology, or the uncertain performance of available control technologies once installed. For example, Ohio EPA has estimated that the average cost to municipalities to reduce mercury below 0.012 μg/L through end-of-pipe treatment is in excess of $10 million per pound of mercury removed (Ohio EPA 2000). Non-numeric permit conditions, including mandatory BMPs, are more appropriate for municipal permits.

BMPs are one type of non-numeric restriction that can be used to control or reduce the quantities, discharge rates, and concentrations of mercury. Federal regulations clearly support the use of BMPs when they are reasonably necessary to achieve water quality standards, or when numeric limitations are not feasible for some reason (40 CFR 122.44(k)). BMPs can provide a mechanism for point source dischargers to effectively minimize mercury discharges and attain water quality standards without installing costly end-of-pipe treatment. In other regions, *Pollution Prevention* (P2) and *Pollution Management Plans* (PMPs) are the most common form of mercury control (see Section 2.2.6).

In addition, source control measures can result in effective mercury reductions without the application of control technologies. Effective source control programs can be implemented immediately and without significant capital expenditures. Consistent with a BMP-based approach, including a narrative no-net-increase provision is also appropriate (and can be tracked via periodic pollutant priority scans as otherwise required in the permit).

If it is determined that numeric limits are required for municipalities and can be feasibly met, procedures for developing these limits are provided in Appendix G. A schedule of compliance will be incorporated into permit conditions for these situations. In addition, if a TMDL is being developed on the receiving water, permits should contain a re-opener clause that will allow revised limits after final WLAs are assigned. Consistent with other constituents, re-opener activities can be initiated by

EPA, DEQ, or the permittee This type of provision is necessary to ensure that numeric permit limits can be revised consistent with antidegradation policies and antibacksliding regulations (see Section 6.4).

Assuming that adequate data exist to be able to define variability (if not, then RPTE would not have been able to be assessed), recommended permit conditions will also require periodic monitoring mercury levels in effluent and biosolids, if applicable. This monitoring will be conducted to track trends in mercury loads. Consistent with a BMP-based approach, including a narrative no-net-increase provision is also appropriate (and can be tracked via periodic pollutant priority scans as otherwise required in the permit). Permit conditions may also specify that biosolids be monitored as a tracking mechanism—if the permittee can demonstrate that concentrations of mercury in biosolids are covariant with concentrations of mercury in effluent.

Finally, permit conditions for significant municipal permittees will require monitoring ambient fish tissue mercury levels, either on a facility-specific basis or within the proposed statewide fish tissue monitoring program. Other details of this program is discussed further in Chapter 4.

One of the important components within the context of the statewide cooperative monitoring program is that higher-priority watersheds (which depend, in part, on NPDES monitoring requirements) will be sampled within the first part of a 5-year cycle, with lower-priority watersheds targeted for the latter part of a 5-year cycle.

As data become available over a longer time period, this monitoring framework will be adapted so that resources are shifted from lower-priority watersheds to higher-priority watersheds that contain impaired waters and/or receive larger discharges of mercury. This means that following the initial 5-year monitoring cycle some watersheds will be monitored more frequently than 5 years and others will be monitored less frequently than 5 years. It is anticipated that those receiving waters that are associated with significant mercury discharges will be assigned relatively higher priorities and be monitored more frequently than once every 5 years.

Industrial Permittees

If the RPTE process indicates effluent limits are necessary, or if WLAs are assigned in the TMDL, the industrial permit must contain permit conditions for mercury. Similar to municipal permittees, the inclusion of permit limits does not necessarily mean that a numeric mercury limit will be required. An “effluent limitation” is defined as any restriction imposed on quantities, discharge rates, and concentrations of pollutant discharge from point sources (40 CFR 122.2). This definition encompasses non-numeric restrictions on the discharge of mercury.

BMPs are one type of non-numeric restriction that can be used to control or reduce the quantities, discharge rates, and concentrations of mercury. Federal regulations clearly support the use of BMPs when they are reasonably necessary to achieve water quality standards, or when numeric limitations are not feasible for some reason (40 CFR 122.44(k)). BMPs can provide a mechanism for point source dischargers to effectively minimize mercury discharges and attain water quality standards without installing costly end-of-pipe treatment.

If a significant industrial facility produces or concentrates mercury waste as part of its operations, numeric permit limits will be required. These limits may be set at current discharge loads (which reflect a no-net-increase concept) or smaller loads that reflect improvements necessary to meet criteria or TMDL requirements. Procedures for these situations are provided in Appendix G. In addition to numeric limits, industrial permits should also include a compliance timeline for achieving feasible treatment improvements (e.g., process recovery).

Assuming that adequate data exist to be able to define variability (if not, then RPTE would not have been able to be assessed), recommended permit conditions will also require monitoring mercury levels in effluent on a periodic basis.This monitoring will be conducted to determine compliance with numeric permit limits (if appropriate) and to track trends in mercury loads (for those industrial dischargers that are not assigned numeric permit limits).

Finally, permit conditions for significant industrial permittees will require monitoring ambient fish tissue mercury levels, either on a facility-specific basis or within the proposed statewide fish tissue monitoring program. This program is discussed further in Chapter 4.

One of the important components within the context of the statewide cooperative monitoring program is that as data become available over a longer time period, this monitoring framework will be adapted so that resources are shifted from lower-priority watersheds to higher-priority watersheds that contain impaired waters and/or receive larger discharges of mercury. This means that following the initial 5-year monitoring cycle some watersheds will be monitored more frequently than 5 years and others will be monitored less frequently than 5 years. It is anticipated that those receiving waters that are associated with significant mercury discharges will be assigned relatively higher priorities and be monitored more frequently than once every 5 years.

6.3.2 *De minimis* Sources

If a source is a *de minimis* contributor to the water’s impairment (defined as receiving no WLA and/or having no RPTE), reductions on these discharges will not have a significant improvement on mercury levels in the water body. Permit conditions for both municipal and industrial *de minimis* sources will rely on voluntary BMPs used to control or reduce the discharge of mercury, where feasible. Such permits may require a voluntary plan to reduce mercury discharges or to simply certify that there are no known or suspected operations that could reasonably be expected to discharge mercury.

In addition, permit conditions should include a no-net-increase provision to help ensure no future RPTE. This provision can be enforced via limited effluent monitoring as may otherwise be required as part of priority pollutant scans (typically once every permit cycle) and periodic (on the order of every 5 years) monitoring of ambient fish tissue mercury levels, either on a facility-specific basis or within the proposed statewide fish tissue monitoring program. This concept is similar to other metals that have water column criteria, where limited and periodic monitoring of the receiving stream is required, even if the facility has demonstrated no RPTE. Because the cost savings associated with a statewide program are substantial for smaller dischargers, participation in the proposed statewide cooperative program is encouraged.

Initially, watersheds in the cooperative monitoring program will be sampled every 5 years on a rotating schedule. As data become available over a longer time period, this monitoring framework will be adapted so that resources are shifted from lower-priority watersheds to higher-priority watersheds that contain impaired waters and/or receive larger discharges of mercury. It is anticipated that receiving waters associated with *de minimis* discharges may be monitored on a less frequent basis (on the order of once every 5-8 years) if data collected as part of the statewide cooperative program indicate the receiving water is a low-priority water.

6.4 New Discharges or Increased Existing Discharges

The issue of new or increased discharges is complex for this criterion because fish tissue concentrations are not predictive of what potential impacts new/increased discharges will have on a water body. Because Idaho is electing to not incorporate bioaccumulation factors into this framework, an alternative approach has been developed that is consistent with current antidegradation and antibacksliding regulations.

In general, any entity proposing a new or increased discharge of mercury will be subject to the same NPDES permitting processes described elsewhere in this chapter, including the RPTE process. These basic requirements prevent new or increased discharges from causing a violation of the water quality standards. As described in Chapter 5, RPTE determinations can be used to address no-net-increase requirements for new or increased discharges that are proposed for water bodies listed in Category 5 but which have no TMDL yet. For high priory watersheds, after a TMDL or equivalent process is completed, any new or increased discharge will only be allowed if consistent with the TMDL.[37]

The RPTE process for new or increased discharges follows the same general process as shown in Figure 6-1, with the following additional considerations.

6.4.1 Increased Discharges

Because the fish tissue criterion is based on the theory that the tissue concentration is proportional to the water column concentration, the fish tissue RPTE will be determined by assuming the tissue concentration will increase by the same percentage

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[37] State regulations (IDAPA 16.01.02.054) specifically authorize that pollutant trading can be included in the TMDL or equivalent process or interim changes, with the goal of restoring the water body to comply with water quality standards.

as the increase in water column concentration. This determination will be made using simple mass balance that calculates the expected receiving water concentration after complete mixing.

For rivers, streams or unidirectional reservoirs, Equation 6-1 applies:

$$RWC = \frac{(Qe * Ce) + (Qr * Cr)}{(Qe + Qr)}$$

Equation 6-1. Receiving water concentration calculation for rivers and streams.

Where:

RWC = Predicted receiving water concentration

C_e = Predicted effluent concentration

Q_e = Predicted increased effluent discharge

Q_r = Receiving water design flow (harmonic mean for human health criteria)

For lakes or multi-directional reservoirs:

$$RWC = \frac{C_e + \left[(D - 1) * C_r\right]}{D}$$

Equation 6-4. Receiving water concentration calculation for lakes and reservoirs

Where:

RWC = Predicted receiving water concentration

Ce = Predicted effluent concentration

D = Dilution factor at mixing zone boundary, defined as a unitless ratio of the sum of the effluent and receiving water volumes to the effluent volume

Cr = Background concentration in the receiving water

Thus, if the mercury concentration in fish affected by the discharge is currently 0.10 mg/kg, and the in-stream RWC is expected to increase by 10 percent, then the predicted tissue concentration after the increased discharge would be 0.11 mg/kg. Because this concentration is less than 0.24 mg/kg, there would be no RPTE. (This linear relationship is discussed in more detail in Section 5.3.2.)

Existing data for the background concentration in the receiving water should be used if measured within the last 5 years. (Older data may be used if there have been no changes in the watershed that would be expected to increase mercury levels.) If such data are not available, statewide or regional average values can be used as a default. On a statewide basis, surface water data collected by USGS since 1995 indicate that typical total mercury concentrations in receiving waters are less than 0.025 µg/L. If other regional studies provide more region-specific values, these concentrations could be used to estimate background concentrations as appropriate. Alternatively, additional ambient receiving data can be collected using acceptable procedures as described in Chapter 4.

Municipal Permittees

For municipal permittees, the following considerations regarding increased discharges apply:

- *Increase as a result of growth*. If population growth is controlling the proposed increase, with the pretreatment and wastewater treatment processes remaining the same or better (thus no increase in mercury concentration is anticipated), then the normal RPTE process for mercury aquatic life criteria is followed without modification. For the aquatic life RPTE assessment, the increase in flow is accounted for in the WLA calculation as described earlier.
- *Increase as a result of process change or new source.* In some cases the increase will be due to a new *Significant Industrial User* (SIU) that would cause a substantial increase in effluent mercury loadings (this can be assessed using pretreatment program local limits evaluation methods), a major change in process or mercury loading by an existing SIU, new wastewater treatment processes, or other major new mercury sources within the collection system. In these cases, because of the uncertainty in effluent quality, the permittee will be required to complete another round of monitoring, as specified in the initial mercury permit cycle. That is, a municipality that was previously determined to be a *de minimis* source would need to develop at least 12 post-increase effluent data values to assess *de minimis* status.

Industrial Permittee

For industrial permittees, the following considerations regarding increased discharges apply:

- *Increase as a result of growth*. If the increase is due strictly to an increase in production, with the industrial activities and treatment processes remaining the same or better (thus no increase in mercury concentration is expected), then the RPTE process would be the same as described above for the growth-only municipal case.
- *Increase as a result of process change or new source*. If the increase is due to new industrial activities or processes, or new wastewater treatment processes, then the RPTE process would be the same as described above for the process-change municipal case.

6.4.2 New Discharges

The mercury RPTE process for new discharges will be the same as described above for increased discharges with the exception of some additional pre-discharge monitoring as described in the following.

Although new discharges will not have any actual effluent data, the NPDES application will require that the discharger provide an estimate of effluent quality for a list of parameters that are believed to be present. These estimates can be based on a variety of information sources, including bench, pilot or prototype data; data from similar facilities with similar processes, raw materials, and mercury sources; and best professional judgment.

Because there may not be water column or fish tissue data available for the water body affected by the discharge prior to commencement of a new discharge, any new industrial or municipal facility will be required to collect and submit water column and fish tissue mercury data from the receiving water in the vicinity of the discharge point, if such data are not already available. If possible, fish tissue monitoring may be able to be coordinated with the statewide monitoring framework as described in Chapter 4.

6.4.3 Antidegradation

Antidegradation describes policies designed to maintain water quality even if it exceeds levels necessary to support beneficial uses. Idaho's antidegradation policy is contained in IDAPA 58.01.02.051. The state antidegradation policy and implementation procedures must be consistent with the components detailed in 40 CFR 131.12. Antidegradation policies directly address requirements for new or increased discharges of pollutants, including mercury. DEQ is currently developing specific guidance for antidegradation.

7. Implications of Criterion Implementation for Aquatic Species and Aquatic-dependent Wildlife Species

7.1 Background

The 0.3 mg/kg criterion was derived by EPA to protect human health. While it was not originally derived to be protective of aquatic life and wildlife resources, this chapter examines the methylmercury human health criterion's protectiveness of aquatic life, including endangered species, in Idaho and aquatic dependent wildlife. This chapter includes a comparative evaluation of the potential effects (or protectiveness) anticipated from aquatic life exposure to the human health fish tissue criterion relative to the effects from exposure to the aquatic life criterion.

This chapter has been written for two reasons:

- First, there is concern that EPA's 2002 recommended chronic aquatic life criterion for inorganic mercury of 0.77 μg/L (dissolved) or 0.91 μg/L (total recoverable) may not be protective of some important aquatic species in Idaho.
- Second, this analysis provides additional context for ongoing consultation between EPA and U.S. Fish and Wildlife Service and NOAA fisheries regarding the protectiveness of Idaho's current criteria (2.1 μg/L acute and 0.012 μg/L chronic) for listed species in Idaho listed as endangered under the ESA.

EPA's 1995 criteria updates (EPA 1996a) estimate chronic-effect concentrations for rainbow trout of 0.36 μg/l (dissolved) or 0.42 μg/l (total recoverable), and for coho salmon of 0.31 μg/l (dissolved) or 0.37 μg/l (total recoverable). Both of these species are important in Idaho.[38]

Thus, if chronic toxicity data were available for rainbow trout and coho salmon, they might show chronic effects at concentrations lower than EPA's recommended criteria. Thus, the EPA's criterion document states this chronic criterion "might not adequately protect such important fishes as the rainbow trout, coho salmon…" and thus EPA Region 10 will not approve adoption of its 2002 criterion in Idaho.

When EPA proposed the fish tissue criterion for protection of human health in California, the agency was required to complete a biological evaluation of the effects of the proposed action on federally listed and proposed threatened and endangered wildlife species and critical habitat within California. Under an Intergovernmental Agreement, EPA Region 9

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[38] These estimated chronic values are derived from species mean acute values using an estimated acute-chronic ratio of 649 based on fish alone (Fathead minnow), rather than the final acute-chronic ratio of 3.731.

collaborated with the U.S. Fish and Wildlife Service Sacramento Fish and Wildlife Office Environmental Contaminants Division, to perform the risk analyses necessary to complete the biological evaluation. The findings of this study (USF&WS 2003) provide some insight into the potential for adverse effects on aquatic species, and aquatic-dependent wildlife species, upon adoption of the fish tissue methylmercury criterion in Idaho. This study forms the basis for the analysis provided in this section.

7.2 Protectiveness of the Bald Eagle

Among threatened and endangered aquatic-dependent wildlife species in Idaho, the bald eagle is of principal concern, so the focus here will be on the evaluation of risk to the bald eagle in California associated with implementation of the fish tissue criterion for methylmercury.

7.2.1 Methodology for Estimation of Protective Wildlife Value

In the California study, protective wildlife values were derived using Equation 7-1:

$$WV = \frac{RfD * BW}{\sum FIR_i}$$

Equation 7-1. Wildlife Value Calculation used in California.

Where:

WV = Wildlife Value (mg/kg in diet)

RfD = Reference dose (mg/kg-bw/day)

BW = Body weight (kg)

FIR_i = Food Ingestion Rate (kg food/day) from the ith trophic level.

The *Wildlife Value* (WV) is a dietary concentration of methylmercury that will result in an individual receiving the reference dose. The reference dose is defined as an acceptable dose; if dietary concentrations result in doses at or below the reference dose, it can be assumed (with some uncertainty), that the bald eagle will not be at risk for adverse effects from methylmercury toxicity.

For each species evaluated in the California study, an estimate was made of the likelihood that the WV would be exceeded under different strategies of criterion implementation. Implications of the results for the bald eagle will be discussed in the context of Idaho criterion implementation.

The most sensitive endpoints for methylmercury toxicity in birds relate to reproduction, so the reference dose derived in USF&WS (2003) was based on prevention of adverse impacts from maternally ingested mercury that could affect reproductive viability. One reference dose was used for all avian species in USF&WS (2003), based on the application of uncertainty factors to a *Lowest Observed Adverse*

Effect Level (LOAEL) test dose from a three-generation mallard duck study (Heinz, 1979). The uncertainty factors were based on an evaluation of methodology used in the *Great Lakes Water Quality Initiative* (EPA, 1995b) and the *Mercury Study Report to Congress* (EPA, 1997a,b).

The body weight used in Equation 7-1 was an average value for adult female bald eagles. The mean of average male and female body weights was used in the Great Lakes Water Quality Initiative (EPA, 1995b); however, since methylmercury toxicity is expressed through exposure to laying females, using the female weight in the equation is more appropriate.

In order to estimate *food ingestion rate* (FIR in Equation 7-1), total food ingestion rates and the trophic level distribution in the diet were obtained from the literature or estimated using allometric equations.

Determining a standard dietary composition for bald eagles is challenging. The bald eagle is generally considered a piscivorous species, but it is an opportunistic forager with a wide range of prey types as well as being a carrion scavenger. Food preferences likely exhibit spatial and temporal variation, as well, but it is possible to generalize.

A number of feeding ecology studies were evaluated in USF&WS (2003), and it was concluded that fish are generally the predominant prey item during spring and summer breeding seasons, followed in importance by birds, and then mammals. It was decided to base the diet on the main habitat of breeding birds (mountain and foothill forests and woodlands close to reservoirs, lakes and rivers), rather than wintering bird habitat because of the emphasis on reproductive toxicity. California supports both wintering and resident breeding bald eagles, as does Idaho, so the breeding bird diet approach is applicable in Idaho.

Based on a dietary analysis by Jackman *et al*.(1999) of nesting bald eagles in different areas of northern California, USF&WS (2003) conservatively determined a diet with the greatest potential for methylmercury exposure. The diet is weighted toward Trophic Level 3 and 4 fish, aquatic Trophic Level 2- and 3-consuming birds, along with a small percentage birds consuming non-aquatic food. Overall, the diet consisted of 83% fish and 17% birds. Then, using allometric equations, and estimates of bald eagle metabolic rate and the useable energy derived from the different prey items, a food ingestion rate (FIR) was estimated for Equation 1, allowing calculation of WV, the protective wildlife value.

7.2.2 Criterion Trophic Level Strategy and Risk to Bald Eagles

Dietary concentrations for the bald eagle were calculated based on the percentage of prey from each prey type and trophic level, along with estimates of methylmercury concentration in each category. Dietary concentrations were calculated for each of two criterion implementation strategies, and were then compared to the protective wildlife value, WV.

Equation 7-2 was used to calculate dietary methylmercury concentration:

$$WV = (\%TL2 \times FDTL2) + (\%TL3 \times FDTL3) + (\%TL4 \times FDTL4) + (\%OB \times FDOB) + (\%PB \times FDPB)$$

Equation 7-2. Dietary Concentrations Calculation for Bald Eagles.

Where:

WV = Wildlife value (or *dietary concentration* (DC)) of methylmercury, in mg/kg

$\%TL_i$ = Percent trophic $level_i$ x (x = 1, 2, 3, 4) organisms in diet

$FDTL_i$ = Measure of methylmercury concentration in TL_i organisms

The first value in each term represents the percentage of Trophic Level 2, 3, and 4 omnivorous birds (feeding on Trophic Level 2 organisms), and piscivorous birds (feeding on Trophic Level 3 organisms) in the diet of bald eagles. The multipliers represent the methylmercury concentrations in each food category, based on biomagnification factor estimates.

The two criterion implementation strategies were as follows:

Average Concentration Trophic Level Approach

Based on estimates of the methylmercury concentrations in fish from each trophic level consumed by humans that, when combined, would correspond to the overall dietary criterion concentration of 0.3 mg/kg. Under this strategy, fish in the highest trophic level could have methylmercury concentrations greater than 0.3 mg/kg (0.66 mg/kg for Trophic Level 4 fish in the example used by USF&WS [2003]).

Highest Trophic Level Approach

The criterion concentration of 0.3 mg/kg is the limiting concentration for Trophic Level 4 fish. Therefore, 0.3 mg/kg is the highest allowable concentration in any fish tissue, and fish in lower trophic levels would have concentrations lower than 0.3 mg/kg. Under this approach, methylmercury concentrations in omnivorous and piscivorous birds would also be lower than in the first approach.

The average concentration trophic level approach yielded a DC of 0.431 mg/kg, and the highest trophic level approach a value resulted in a *dietary concentration* (DC) of 0.196 mg/kg. The WV for bald eagle was 0.184. The DC based on the highest trophic level approach just slightly exceeded the WV, by a factor of 1.06. Considering the overall uncertainty of the analysis, it was concluded that bald eagles were not likely to experience adverse effects under this implementation strategy. The average concentration trophic level approach, on the other hand resulted in a DC value 2.34 times higher than the WV. It was concluded that this implementation approach might not be protective of the California bald eagle.

7.2.3 Uncertainty Analysis

The overall methodology used in USF&WS (2003) for California bald eagle is appropriate for estimating risk to eagles in Idaho. Idaho, like California, has habitats that support both nesting and wintering bald eagles. As in California, primary breeding habitats of Idaho bald eagles are mountain and foothill forests close to reservoirs, lakes and rivers. Basing the assessment on methylmercury exposure to egg-laying birds, the most sensitive receptors, is the best way to address potential risk to this species associated with the fish tissue-based criterion.

There are a number of uncertainties associated with calculation of the WV, and the DC. These include uncertainty in the dose-response data, appropriateness of uncertainty factors used to determine the reference dose, uncertainty in diet breakdown by prey type and trophic level, and biomagnification factors used in estimating methylmercury concentrations in different prey types.

The diet used in USF&WS (2003) was taken from the diet with the greatest potential exposure to methylmercury observed by Jackman *et al*. (1999). It was based on the diet of one eagle pair, and was composed of 39% TL4 fish, 44% TL3 fish, 10% TL2-consuming birds, 3.5% TL3-consuming birds, and 3.5% non-aquatic consuming birds. Use of this diet composition for the risk assessment is conservative, as it is based on the highest trophic level composition reasonably likely to occur. It could result in overestimation of risk to eagles with diets composed of lower percentages of aquatic and aquatic-dependent prey.

The methylmercury criterion of 0.3 mg/kg is applied to fish filets. As the highest concentrations of methylmercury are found in muscle tissue, eagles that consume whole fish will ingest fish tissue of lower concentration than if they consumed filets only. This reduction in overall tissue concentration was not accounted for in USF&WS (2003); this is another conservative assumption. The risk overestimation resulting from this assumption may not be great, as muscle tissue represents a high percentage of total body mass in fish prey of eagles.

7.2.4 Recommended Strategy

The most conservative implementation strategy in Idaho, short of conducting a study similar to USF&WS (2003), would be to apply the highest trophic level approach in known eagle nesting areas. The average concentration trophic level approach, based on consumption patterns of human receptors, could be applied in wintering areas. In the absence of detailed information on nesting locations, the more conservative strategy would be to apply the highest trophic level approach statewide.

In USF&WS (2003), the difference between the DC values resulting from the two implementation strategies, 0.436 mg/kg for the average Trophic Level approach, and 0.196 mg/kg for the highest Trophic Level approach, was approximately a factor of two. USF&WS (2003) concluded that the highest trophic level strategy is unlikely to adversely affect California bald eagle, but that the average concentration trophic level approach might adversely affect this species. Given some of the conservative assumptions incorporated in the risk assessment, it is likely that adoption of the average concentration trophic level approach would not result in risk to the Idaho bald eagle significantly different from that under the highest trophic level approach.

7.3 Protectiveness of Listed Fish Species

In contrast to the dose-based risk assessment methodology applied to aquatic-dependent wildlife, USF&WS (2003) evaluated the potential for adverse effects in fish associated with tissue methylmercury concentrations expected under the two trophic level implementation strategies. There is a substantial body of literature on bioaccumulation of mercury by fish that provides information on fish tissue concentrations associated with toxicological effects (Wiener and Spry, 1996; Jarvinen and Ankley, 1999, Wiener *et al*., 2002). In the literature review conducted by USF&WS (2003), all of the tissue concentrations associated with overt toxicity were at least an order of magnitude above the highest concentration expected in Trophic Level 4 fish (0.66 mg/kg) under the average concentration trophic level approach.

However, in a multi-generational study on the effects of dietary methylmercury in mummichogs (*Fundulus heteroclitus*), Matta *et al*. (2001) found significant mortality of males that had developed tissue concentrations of 0.2 mg/kg and 0.5 mg/kg. Under the average concentration trophic level approach presented by USF&WS (2003), Trophic Level 3 fish were assumed to have a concentration of 0.165 mg/kg, which is only slightly lower.

Another note of caution was provided by USF&WS (2003) regarding estimation of adverse effects to fish based on muscle tissue levels. It is possible that circulatory levels of methylmercury, related to current dietary exposure, may be responsible for adverse effects rather than methylmercury bound up in muscle tissue. Muscle tissue-bound methylmercury may be mobilized and able to cause toxicity only when available food declines, and the fish is required to utilize muscle tissue proteins.

Another area of uncertainty is the potential for subtle behavioral effects at low fish tissue concentrations. Methylmercury is a neurotoxin, and so might be expected to cause adverse behavioral effects, such as reduced ability to locate and capture prey, or to escape predators. Such effects have been evaluated in relation to waterborne mercury concentrations, but data have not always been provided on associated fish tissue levels.

Fjeld *et al*. (1998) showed impairment in feeding behavior of grayling (*Thymallus thymallus*) exposed as eggs to waterborne methylmercuric chloride; the LOAEC was expressed as a concentration in yolk-fry of 0.27 mg/kg. This concentration resulted from exposure to a water column concentration of 0.8 μg/L methylmercuric chloride.

Developing eggs are exposed to mercury in water and sediment as well as from maternal transfer; but maternal transfer accounts for the majority of methylmercury in developing eggs. Hammerschmidt *et al*. (1999) found the ratio of methylmercury in maternal carcass to embryolarval tissue to range from 5:1 to 20:1 in yellow perch

(*Perca flavescens*). Based on this range, the grayling LOAEC of 0.27 mg/kg would translate to maternal muscle concentrations of 1.35 to 5.4 mg/kg. At the 20:1 adult-egg ratio, methylmercury concentrations in eggs of Trophic Level 4 fish would be an order of magnitude below the LOAEC with either the highest trophic level or the average concentration trophic level approach. Under the more conservative assumption of 5:1 adult-egg ratio, USF&WS (2003) observed that the eggs of Trophic Level 4 fish could have concentrations of 0.132 mg/kg under the average concentration trophic level approach. This concentration is below but closer to the LOAEC, and given the severity of effects at the LOAEC (a 49% reduction in competitive feeding ability) there would be less certainty that no adverse effects would occur at this concentration in eggs.

In another behavioral study, Webber and Haines (2003) observed alterations in predator-avoidance behavior in golden shiners (*Notemigonus crysoleucas*) with tissue methylmercury concentrations of 0.536 mg/kg. Golden shiners are a Trophic Level 3 species. Based on these results, Trophic Level 3 species would not be expected to have adverse behavioral effects under either criterion implementation approach. Trophic Level 4 species may reach somewhat higher concentrations under the average concentration trophic level approach, and USF&WS (2003) concluded that the highest trophic level approach would be more likely to ensure protection of federally listed species.

In addition to neurotoxicity, another potential effect of methylmercury is reduced reproductive success as a result of impaired gonadal development, reduced spawning success, egg hatching or embryolarval survival. Studies that have evaluated reproductive toxicity have produced mixed results. Friedmann *et al*. (1996a) did not find a significant correlation between muscle mercury and *gonadosomatic index*, GSI (the ratio of gonadal weight to total body weight) or gonadal sex steroids in northern pike (*Esox lucius*) collected from Lake Champlain, New York. In this study the mean total mercury concentration in muscle was 0.325 mg/kg, and the range was 0.117 – 0.623 mg/kg. A limitation of this study is small sample size.

In another dietary study, this time using juvenile walleye (*Stizstedion vitreum*), Friedmann *et al*. (1996b) found testicular atrophy at a mercury tissue concentrations of 0.254 mg/kg and 2.37 mg/kg. The degree of atrophy was greater in the higher concentration group. In male largemouth bass (*Micropterus salmoides*) collected from three New Jersey water bodies of varying mercury concentration, Friedmann *et al*. (2002) did not see a substantial decrease in GSI at tissue levels as high as 5.42 mg/kg. Hammerschmidt *et al*. (2002) looked at the effects of dietary methylmercury on multiple reproductive endpoints in fathead minnows (*Pimephales promelas*). Developmental and hatching success of embryos, and larval survival and growth were not correlated with either dietary or tissue methylmercury concentrations. However, male and female fish with an average tissue concentration of 0.625 mg/kg had a spawning success rate of only 46%, compared to 75% for fish on the control diet (with an average tissue concentration of 0.08 mg/kg). This result suggests the potential for lowered spawning success by Trophic Level 4 fish under the average concentration trophic level approach.

7.3.1 Kootenai River White Sturgeon

The white sturgeon (*Acipenser transmontanus*) represents a special case because of certain life history characteristics. White sturgeon are long-lived; Paragamian et al. (2001) found Kootenai River white sturgeon of up to 49 years of age. White sturgeon are primarily bottom feeders. Small sturgeon feed on chironomid larvae; larger fish feed predominantly on fish and crayfish, but chironomids remain an important part of the diet (Scott and Crossman, 1973). Because of their benthic feeding habit, white sturgeon are likely to ingest more sediment than fish that feed primarily in the water column, and so have more exposure to mercury in the sediment. Combined with their long life span, white sturgeon have the potential for significant bioaccumulation of mercury. Tissue concentrations can increase between generations as well, as methylmercury is passed on to progeny through maternal transfer.

Data are not available on adverse effects associated with tissue residues of methylmercury in white sturgeon. Because of the potential for white sturgeon to accumulate methylmercury within and between generations, a full understanding of the relationship between tissue levels and adverse effects would require multi-generation studies. These studies have not been performed; thus there is high uncertainty regarding effects and effects levels of methylmercury in this species. It is reasonable to assume, however, that the mode of action of mercury in this species would be similar to that observed in other fishes, and that adverse effects of exposure would include neurotoxicity and reproductive toxicity.

Although they would be considered somewhere between Trophic Level 3 and Trophic Level 4 on the basis of diet, Kootenai River white sturgeon should be considered a Trophic Level 4 species for the purpose of assessing risk on the basis of tissue methylmercury residues. Furthermore, this species may have greater potential to bioaccumulate methylmercury than most other Trophic Level 4 species. This has been somewhat taken into account when developing a strategy for implementation of the methylmercury criterion by specifying that the highest trophic level approach should be applied in known areas where endangered species are present.

7.3.2 Recommended Strategy

The available studies that have evaluated neurotoxicity and reproductive impairment associated with muscle-bound methylmercury in fish have produced mixed results. In general, the adverse effects have been subtle, and have not been observed consistently in different taxa. Based on a review of the literature, USF&WS (2003) concluded that adverse effects are unlikely with the highest trophic level approach. Methylmercury muscle concentrations in Trophic Level 4 fish expected under the average concentration trophic level approach are closer to concentrations that have been associated with adverse effects in some studies. Given the uncertainty about tissue concentration thresholds for subtle toxic effects, the highest trophic level approach would increase the likelihood that the criterion is protective of listed species.

However, USF&WS (2003) concluded that either approach should be sufficiently protective of listed fish in California. This is a reasonable conclusion with regard to listed fish species in Idaho as well, with the possible exception of Kootenai River white sturgeon.

Given the absence of data on effects of methylmercury tissue concentrations on Kootenai River white sturgeon, and the potential of this species to bioaccumulate methylmercury, the more protective strategy is to adopt the highest trophic level approach where sturgeon occurs in Idaho.

Other studies using Ohio fish data have been conducted to evaluate the relationships of additive toxicity to in-field fish community responses (including deformities, fin erosions, lesions, and tumors; Dyer, White-Hull, and Shephard 2000). This study concluded that metals toxicity units benchmarked against regulatory-based limits overpredicted adverse effects to fish communities. A secondary conclusion is that the extrapolation of effects should take into account background reference sites and the role of acclimation (Dyer, White-Hull, and Shephard 2000).

7.4 Protectiveness of Other Species

Other listed aquatic species in Idaho are the Snake River snails: Snake River physa snail, Idaho springsnail, Bliss Rapids snail, Utah valvata, and Banbury Springs limpet. Little information is available on the effects of mercury on freshwater snails. Toxicity information that is available is on species not closely related to the listed species in the Snake River; these species may not be appropriate surrogates. Snails have high exposure to mercury in sediment, so tests based on water column exposure may not represent the most important exposure pathway for these species. In acute toxicity tests using mercuric nitrate, lethal concentrations that affected 50 percent of the test population (LC_{50s}) ranged from 80 µg/L in an *Amnicola* sp. adult to 2,100 µg/L in an *Amnicola* sp. embryo (U.S. EPA, 1985). An LC_{50} for the snail *Aplexa hypnorum* exposed to mercuric chloride was 370 µg/L.

These concentrations are considerably higher than EPA’s 2002 recommended acute (1.4 µg/L) and chronic (0.77 µg/L) criteria. They are also higher than water column concentrations that would be expected with either methylmercury fish tissue criterion implementation strategy. However, in view of the high uncertainty regarding mercury toxicity to freshwater snails, it would be prudent to adopt the more conservative highest trophic level approach. This would result in lower water column concentrations, and would be more protective of listed Snake River snails.

7.5 Conclusions

Because human health criteria apply to all waters in Idaho, the methylmercury fish tissue criterion covers all waters that support aquatic life, as well. DEQ believes the fish tissue methylmercury criterion of 0.3 mg/kg is likely protective of aquatic life, and aquatic-dependent life if applied to the highest trophic level of fish.

If this value were converted to an equivalent water column concentration using even worst case (low) BAFs, dissolved mercury levels would still be much lower than 0.77 μg/L. For example, there are three areas where conservative assumptions have been coupled to determine a worst-case scenario:

- Application to Trophic Level 4 vs. Trophic Level 3 species
- Application of 5th percentile BAFs vs. geometric mean BAFs
- Application of lower proportion of methylmercury to total organic mercury in the water column

Table 7-1 applies and compares each of these assumptions for easier reference.

Table 7-1. Translation of Fish Tissue to Water Column Values.

	Fish Tissue Criterion	**BAF**	**Water Column Concentration**		
				1.4% Me:T	5% Me:T
	(mg/kg MeHg)	(L/kg)	(ng/L MeHg)	(ug/L T Hg)	(ug/L T Hg)
TL3 5th %	0.30	74,000	4.0	0.29	0.08
TL3 Median	0.30	250,000	1.2	0.09	0.02
TL4 5th %	0.30	680,000	0.44	0.03	0.009
TL4 Median	0.30	2,700,000	0.11	0.01	0.002

For example, when EPA's 5th percentile draft national BAF3 of 74,000 is applied to trophic level 3 fish, water column concentrations of methylmercury would have to be approximately 4.0 ng/L to correspond to EPA’s 3.0 mg/kg fish tissue criterion. If methylmercury is only as little as 1.4 % of the total mercury (3-5% is more typical), this would in turn require total mercury concentrations be about 0.29 μg/L (see highlighted box).

A concentration of 0.29 μg/L total mercury is three times lower (more protective) than EPA's currently recommended, albeit self-questioned, chronic criterion of 0.91 μg/L. This concentration is also lower than the estimated chronic toxicity value of 0.37 μg/L for coho salmon that originally caused EPA HQ to question their 0.91 μg/L recommended chronic criterion. The predicted concentration of 0.29 ug/L also 2.5 times lower than the EPA’s currently recommended chronic aquatic life criteria of 0.77 μg/L

Thus, because the Clean Water Act requires that the most sensitive use be protected, application of the fish tissue-based human health criterion effectively offers a greater level of protectivess than either of EPA’s recommended chronic aquatic life criteria.

8. Integration with Other Programs

Mercury contamination of the aquatic environment is pervasive, complex, and its sources extend beyond those controllable under Clean Water Act programs.

For example, a primary source of mercury is aerial deposition, and the stacks that emit most of that mercury are not in Idaho. To make sizable improvement in the environmental exposure to mercury in Idaho it will be necessary to reduce airborne sources, and this will require working with neighboring jurisdictions.

In another example, the transformations of mercury from inorganic to organic forms is such that the consequences can be far removed from points of discharge into water and poorly related to the load. Most fish tissue contamination shows up in lakes and reservoirs, in warm water sport fish—not so much in remote headwater streams or even larger steams where most point source discharges occur.

Moreover, technology to remove mercury in wastewater is ineffective. Mercury must be controlled through keeping it from entering the flow of waste. For industrial sources, this may be accomplished through modification of process, but most of the mercury in municipal waste can only be reduced through pollution prevention programs.

Environmental mercury contamination is truly a multi-media problem involving water, air, and waste. Thus it is prudent to integrate Clean Water Act programs, such as TMDLs and NPDES permits addressed earlier, with other programs such as Fish Consumption Advisories, air quality regulation, waste incineration, and education programs to reduce use and promote proper disposal of mercury containing waste.

While bringing about integration is not within the scope of this document, opportunities and needs are identified that should further protection of aquatic life and human health in Idaho.

8.1 Idaho Fish Consumption Advisory Program

Idaho has an existing Fish Consumption Advisory Program (IFCAP) run by the Bureau of Community and Environmental Health (BCEH). This group is responsible for issuing advisories to the public on consumption of locally caught fish. Their concern is for any contaminant that may pose a health risk, not just mercury. Mercury, however, is a top concern and as of Spring 2004, five fish consumption advisories for mercury are in place in Idaho.

Advisories are based on limited sampling data, as only few water bodies in Idaho have been tested for mercury concentrations in fish. BCEH has received an increasing number of requests from Idaho citizens for information on consumption advisories on additional Idaho water bodies and for additional fish species.

These advisories consider not only mercury levels in fish tissue but also sensitivity of certain segments of the general population, such as pregnant women or young children, and accordingly recommend a rate of fish consumption deemed to be safe. Fish consumption advisories, while not reducing mercury contamination, are important in reducing its adverse effect on human health.

Presently, IFCAP consists of volunteer representatives from various agencies in Idaho who meet occasionally to plan fish tissue sampling, assess health risk, and decide on the nature of advisories that may be needed. They have a written protocol for sampling, analysis, assessment of risk, and formulation of advisories. The group has no specific funding and operates under the authorities of the Department of Health and Welfare to protect human health. DEQ has been a regular participant in IFCAP activities.

With the adoption of a fish tissue criterion into Idaho's water quality standards, DEQ's interest in IFCAP will become stronger, and there will arise a greater need for coordination or even partnership. To the extent DEQ undertakes monitoring of fish tissue for mercury, it would be prudent to coordinate with IFCAP and adhere to their existing sampling protocols to the extent possible so that any fish tissue mercury data would be broadly usable.

Chapter 4 speaks to the possibility of establishing a *Statewide Mercury Monitoring Cooperative*. Such an organization would likely offer greater environmental and health protection benefit by providing a better picture of mercury problem areas throughout Idaho than could be accomplished through focusing on traditional discharge monitoring. If such a cooperative comes to be, the involvement of agencies now participating in IFCAP would be important. Rather than competing, it seems best that the existing IFCAP group and emerging cooperative idea merge. DEQ will do its best to promote that end.

A fish consumption advisory says a lot about the impairment of a water body for fishing. Current guidance from EPA requires DEQ look at these advisories when formulating the list of impaired waters in the state. Idaho's *2002 Integrated Report* proposes adding Salmon Falls Creek Reservoir to the list of waters impaired due to mercury contamination. Such listing decisions should not come lightly, particularly in response to fish consumption advisories that may be based on levels of risk higher than those incorporated in the water quality criterion. A fish consumption advisory, because of differing levels of risk employed, does not necessarily mean the water quality criterion is not met. EPA's guidance allows for such a discrepancy, but any differences will surely require careful for public communication and thus close coordination between DEQ and BCEH.

8.2 Air Quality

Mercury emissions from stacks are only recently being regulated for some sources, such as power plants, under the Clean Air Act. The inorganic forms of mercury released to and found in air are not thought to pose a human health risk, in most cases, due to the very low concentrations. Mercury was until recently (1998) not even tracked for metallic mining industries. Now the EPA's *Toxics Release Inventory* (TRI) include data for these sources, and gold industry ore roasters in northern Nevada appear as one of the nations largest sources of atmospheric mercury.

It is not yet known the extent to which airborne sources of mercury across Idaho's southern border are leading to elevated deposition in Idaho. It is known that, on a national level, atmospheric deposition is the major source of mercury. Much of the atmospheric mercury originates in other regions and other countries, however elevated deposition also occurs downwind of major point sources. Once deposited, this mercury makes its way into water and eventually the food chain, where it can pose a very real and significant health risk.

The only way to deal with this source of mercury in fish tissue is to curb it at its source—mainly fossil fuel power plants, cement/lime kilns, waste incinerators, and ore roasters. This will require working with air quality regulators and the affected facilities to bring about source reductions that will ultimately be needed to bring many waters in compliance with a methylmercury fish tissue water quality criterion. DEQ can pursue this within its own jurisdiction, paying attention to cross-media pathways of contamination and factoring them into programs, such as the permitting of future fossil fuel power plants, waste incinerators, and other known sources of mercury loading to the atmosphere.

8.3 Interstate Mercury Commission

Fortunately, Idaho does not have a great many aerial sources of mercury within its boundaries. Unfortunately, this means Idaho will have to look to surrounding jurisdictions for much of the mercury load reductions needed to improve Idaho's environment. This will require government-to-government interaction at the highest level. The model for implementing such interaction is often an interstate commission. This is something that could be explored through a group such as the Western Governor's Association.

8.4 Pollution Prevention

Like any element, mercury cannot be destroyed. Unlike most metals, mercury is not easily immobilized or compartmentalized as solid waste. The volatility of mercury, its transformation from inorganic to organic forms, and ready passage, into, through, and concentration within the food chain, make mercury, once released, perhaps the most persistent of toxins in the environment. Prevention of its release is paramount.

Most (up to 90%) of the mercury in municipal wastewater comes from dental, medical, and laboratory sources. Idaho has recently implemented a statewide mercury reduction program through the Idaho State Dental Association that relies on the implementation of mercury-control BMPs. Other sources include household waste, such as thermometers, electrical switches, and compact florescent lights.

Mercury is not removed through even advanced municipal wastewater treatment. In 1997, EPA released a report on aqueous mercury treatment. While the technology for mercury treatment exists, it is not cost effective; a case study estimated treatment cost at $1/gallon. Another study by Ohio EPA (2000) estimated that the average cost to municipalities to reduce mercury to low levels is in excess of $10 million per pound of mercury removed. By far the more economical way to reduce mercury discharge is through preventing it from getting into the waste stream in the first place.

This is the essence of pollution prevention. For industrial sources, it means modification of processes to reduce mercury as a byproduct. For municipal sources, it consists of educating the public, and working with dental and medical offices and laboratories to reduce their use of mercury or mercury-containing products. It also involves providing for special collection efforts for mercury-containing wastes and their proper disposal. Waste incineration does not work, simply returning volatilized mercury to the atmospheric pool, to be deposited and enter the aquatic system.

In the bigger picture, efforts can be undertaken to encourage design of replacement products that use less or no mercury. Nationwide, a major effort is being made to phase out mercury amalgam dental fillings. Similar efforts could be undertaken to phase-out use of mercury in electrical switches and other consumer products.

Appendix A: Example Mercury Variance Application and Permit Condition Requirements

Variances apply to specific pollutants and facilities, which means that a variance for mercury would apply only to the new human health methylmercury criterion in a stated water body and specifically to the discharger requesting the variance. As specified in 40 CFR 131.10(g) and IDAPA 58.01.02.260, variances are only considered when a designated use is non-attainable because one or more of the following conditions are satisfied:

1. Naturally occurring pollutant concentrations prevent the attainment of the use
2. Natural, ephemeral, intermittent, or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met
3. Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place
4. Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use
5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses
6. Controls more stringent than those required by Sections 301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact

The Idaho approach, which is based in large part on the Ohio EPA framework, requires that the permittee submit an application for coverage. It is anticipated that this application should come with an NPDES permit modification request or renewal application.

Example Permit Application Requirements

The permit application must contain the following items:

- A certification that the permittee intends to be subject to the terms of the variance.
- A description of mercury reduction/elimination measures that have been undertaken as of the application date, if any. The permittee should also explain in the application what measures it has already taken for mercury reduction, such as information on sources of mercury, successful reduction strategies and case

studies, and suggestions for (or actual implementation) of a program. (The permittee may use existing information/literature if available.)

- A plan of study intended to identify and control sources of mercury. The plan of study must provide documentation of mercury information including, at a minimum, all of the following:
    - Data of the facility's current influent and effluent concentration
    - Identification of all known sources
    - A description of how reduction or elimination of known sources will occur
    - Other potential sources
    - A proposed schedule for evaluating potential reduction, elimination, and prevention methods
- Explanation of the basis for concluding that there are no readily available means to comply with the water quality standards without end-of-pipe controls. At this point, most permittees will not have performed a detailed investigation of mercury sources. Therefore, the explanation can consist of a list of known or suspected significant sources and an explanation of why the permittee believes that there are no measures readily available that will eliminate those sources. In addition, the permittee will probably note that there are no demonstrated cost-effective treatment technologies that can remove mercury in effluent in the low ng/L range.

Of these elements, the plan of study is the most important element of the document. For guidance purposes, the study will include the complete plan for mercury source identification and evaluation. Preliminary identification of mercury sources might entail using existing literature.

The plan of study will include a proposed schedule for evaluating mercury sources, implementing the study and the *Pollutant Minimization Program* (PMP)—discussed in further detail below)—and the date by which the permittee projects that it will be able to achieve the water quality standards. The projection might be done using existing, legitimate data and/or literature, studies, reports, etc. that relate to the type of sources, system and treatment.

For NPDES permittees who already have mercury effluent detection data and knowledge about the source of mercury in their discharges, it will be relatively easy to submit a realistic time line for the plan of study. For NPDES permittees who may not have sufficient data, an approximate time line for the plan of study would be required.

The "mercury variance" application would be considered incomplete unless a complete and acceptable schedule is included in the plan of study. Ideally, this compliance schedule would coincide with the term of the existing permit. However, the duration of the variance will not extend beyond the implemetation timeframe for a completed mercury TMDL.

Municipal Source Issues

Contributions of mercury in municipal waste streams might be raw materials, treatment chemicals (not only at the facility but also at commercial or industrial users), individual plant process flows, storm water, groundwater infiltration, dental offices, analytical laboratories, human excretion (raw domestic wastewater may contain significant concentrations of mercury), atmospheric deposition, industrial discharges, and hospitals.

After a preliminary identification of known sources, the identification of unknown but potential sources should start. A permittee might consider if there are in-place sources of mercury in sewers, storm drainage ditch sediments, or in pipelines. To investigate, the permittee may plan to monitor samples of sediments, flushed sewers, and pipelines to help in locating particular sources. This plan could be proposed in the plan of study. The permittee could then use that data to possibly focus efforts on a smaller area, or repeat the monitoring.

In the case of sewers where no sources are identified in the first round of sampling, the permittee could go to the next level of sewer size and do the process again. “Sources” may be defined geographically as sampling points in sewers if data show these locations have higher mercury concentrations.

Industrial Source Issues

The type of industrial activity at a facility may include mercury in its waste stream. For most industries, the chemical sampling database for existing pollutants in different process streams can be found in the applicable USEPA Development Document (http://epa.gov/guide/).

Effective control of mercury emissions from industrial sources may require a mix of strategies. Major types of pollution prevention measures include:

- Product substitution
- Process modification
- Materials separation.

Pollution prevention may be suitable for those processes or industries where a mercury substitute is demonstrated and available (e.g., mercury cell chlor-alkali plants). Another pollution prevention measure is material separation, which may be an appropriate approach for processes where mercury-containing products are disposed of by incineration, or where mercury can be reduced in the fuel prior to the fuel being combusted (e.g., medical waste incineration).

Conventional regulatory strategies may be applicable when mercury is emitted to the environment as a result of trace contamination in fossil fuel or other essential feedstock in an industrial process (e.g., cement manufacturing).

Cost-effective opportunities to deal with mercury during the product life-cycle, rather than just at the point of disposal, should be pursued. A balanced strategy integrates end-of-pipe control technologies with material substitution and separation, design-for-environment, and fundamental process change approaches.

Variance Permit Requirements

Once the discharger is granted a variance, a baseline set of requirements will be incorporated into its NPDES permit. The conditions specific to mercury variances that should be incorporated into the permit include the following:

- *An initial limit*. This limit represents the discharge limit that is currently achievable, but no less stringent than the level achieved under the previous permit. The limit will be expressed as a monthly average, and will be calculated using available Method 1631 effluent data.
- *Conditions to achieve reasonable progress toward meeting water quality standards through a Pollutant Minimization Program (PMP*) By reducing mercury sources up front, as opposed to traditional reliance on treatment, PMPs can overcome the need for a variance by improving the water quality and increasing the probability that the water quality standards will be achieved. PMPs are intended to be self-revising in that results and findings from the PMP can be used to address new areas of concern. PMPs consist of three elements:
    - A control strategy for locating, identifying, and—where cost-effective—reducing the sources of the pollutant that contribute to discharge levels. A PMP is not necessarily pollution prevention, but examining pollution prevention alternatives is encouraged. PMP strategies may include any cost-effective process for reducing pollutant levels, including pollution prevention, treatment, best management practices, or other control mechanisms.
    - Monitoring to track the progress of the PMP.
    - An annual report of the results of the PMP.

Note: Existing guidance on the specific elements of PMPs can be found at the Ohio EPA Division of Surface Water web site (“Pollutant Minimization Programs”, Permit Guidance Document Number 7, August 13, 1998). This guidance explains in detail how to develop and implement a PMP, what monitoring and sampling requirements will be included in the permit, and it also provides some sample permit language. http://www.epa.state.oh.us/dsw/guidance/guidance.html.

- A provision allowing the permit to be reopened and modified if the variance is revised.
- Monitoring and analysis requirements that are needed to assess impact of the variance, which may include testing of influents, effluents, fish tissue and sediment.
- A requirement to use the most sensitive EPA-approved analytical method for mercury (EPA Method 1631).

- A requirement that the permittee must submit a certification after the actions identified in the plan of study and PMP have been completed.

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Appendix B: Statewide Fish Tissue Monitoring Program

Introduction

This appendix provides a more detailed discussion of the proposed statewide fish tissue monitoring program. Idaho has developed a monitoring framework that provides both flexibility for stakeholders as well as reliable data that can be used to make informed decisions. As with any monitoring program, this framework attempts to balance the need to obtain good data against the reality of funding constraints. Mercury is currently only monitored sporadically; thus, as the mercury fish tissue criterion becomes more widely applied, this approach provides an improvement over the current situation.

Background

The monitoring framework encompasses two scales: *statewide ambient monitoring* and *facility/source monitoring*. Reliance on two scales of monitoring is important because 1) discharges of mercury to the environment need to be tracked (facility/source), and 2) impacts of those discharges on aquatic life (statewide monitoring) directly tie into existing regulatory programs, such as the TMDL program and NPDES permitting. In fact, monitoring is so closely integrated with both of these programs that the framework was developed to specifically identify how and when mercury data should be collected to support TMDL and NPDES decisions.

Because the methylmercury criterion is a fish tissue based , the statewide approach will be focused on monitoring fish tissue. The primary advantage of relying on fish tissue monitoring is that concentrations of mercury in fish tissue represent an integrated exposure to mercury throughout a water body and over the lifespan of a fish (e.g. more representative spatial and temporal scales).

USGS has collected data for mercury from many of the state’s water bodies over the last 30 years. Surface water data collected since 1995 indicate that typical total mercury concentrations in receiving waters are less than 0.025 μg/L (unpublished data from the Lower Boise River show concentrations in the 0.003-0.008 μg/L range). Because these levels are so much lower than EPA’s 2002 chronic and acute aquatic life criteria (0.77 μg/L for chronic and 2.1 μg/L for acute), compliance with Idaho’s water quality standards would likely be driven by fish tissue data even if aquatic life criteria are adopted in the future.

Benefits of a Statewide Approach

Because fish tissue collection is difficultand time consuming, thus somewhat expensive, and because a standardized approach provides better data, Idaho is proposing to develop a statewide cooperative fish tissue monitoring program. This approach is similar to programs that have been developed in other states such as Illinois, Massachusetts, South Carolina, and Wisconsin. While stakeholders will not be required to participate, it is envisioned that contributing to the statewide cooperative program will provide substantial economic benefits to dischargers while providing substantial techincal and environmental protection advantage to all.

A major advantage of this program is that more cost-effective and reliable data are produced through a standardized statewide program that relies on strict adherence to established methods for sample collection and analysis. The National Air Deposition Program for Mercury has adopted a similar approach, with all samples collected using a standard method and all analyses run within a single lab (http://nadp.sws.uiuc.edu/mdn).

The statewide approach is evolving in parallel with this guidance document. Many important details, such as allocation of costs, remain to be resolved. The statewide fish tissue monitoring program has been designed to dovetail as closely as possible with the existing programs, which are described in the guidance document.

Program Framework

The Idaho statewide cooperative monitoring program is currently envisioned to rely on a tiered monitoring approach. The reason that a statewide program is critical to this implementation framework is that it will allow limited resources to be used in the most efficient manner, while still providing reliable data that can be used to prioritize control activities. If the new criterion were a water column number, a statewide collection approach might be considered to be a step away from the Idaho approach of biomonitoring to assess impairment. Ambient monitoring for concentrations of specific chemicals in fish tissue is not a return to traditional receiving water monitoring, but rather an advancement to monitoring of a new media more relevant to use protection.

Although ambient monitoring will not be conducted as frequently as traditional ambient receiving water monitoring, this approach has been designed to provide reliable and applicable data (that is, to avoid wasted monitoring, not to avoid monitoring waste). Although participation in the program is voluntary (facilities may elect to conduct facility-specific ambient monitoring), the statewide program is expected to provide a substantial cost incentive to dischargers due to sample collection efficiency. Primary elements of the program include the following:

- **The monitoring program will include both *deterministic* (targeted) and *probabilistic* (random) monitoring**, which will vary depending upon water body type, size, and levels of fishery use. Opportunities to review and modify the structure of the fish tissue monitoring program will be available throughout the life of the program, ensuring that data remains useful for identifying impaired waters and establishing fish consumption advisories, and ensuring that the protocol is adapted as necessary to meet additional or modified goals.

- **The monitoring program will produce data from a multitude of water body types** (i.e., reservoirs/lakes, streams, rivers, warm and cold water systems, etc.), which are located across a large and varied land area (i.e., mountain, high desert, etc.).
- **The monitoring program will use Hydrologic Unit Codes (HUCs)** established by the USGS to create a manageable sampling framework that is consistent with the WBAG process, which relies on the *Idaho Water Body Identification System* (WBID) The Idaho WBID is a geo-referenced network of Idaho water bodies in which each cataloging unit (4th field HUC or 8-digit code) is numbered starting at the pour point.

Selection of Sites

For the statewide fish tissue monitoring program, 4th field HUCs have been aggregated into regional basins. Within each regional basin, watersheds will be prioritized by considering the following:

1. Potential or actual mercury contamination in the water body
2. Frequency of fishing activities
3. NPDES discharger requirements
4. Public interest in the water body

Sampling locations will be identified to support multiple programs based on the needs of the water body (e.g. coordination with statewide chemical and biological monitoring), in addition to sampling in waters of known or suspected mercury contamination (e.g. historical gold placer mined waters; lakes and reservoirs with previously observed elevated mercury concentrations; lakes and reservoirs with significant sport fisheries).

Monitoring Tier 1: Aggregating HUCs into Regional Basins and Prioritizing Watersheds

Within each regional basin, watersheds will be sampled at least once every 5 years on a rotating schedule. According to avaiable monitoring data collected within Idaho, more frequent monitoring does not appear to be warranted. Figure B-1 presents data collected from sites within the Salmon River basin in the vicinity of an active mining facility and includes monitoring data for three species collected at the same sites at varying frequencies of 3 months to 2 years.

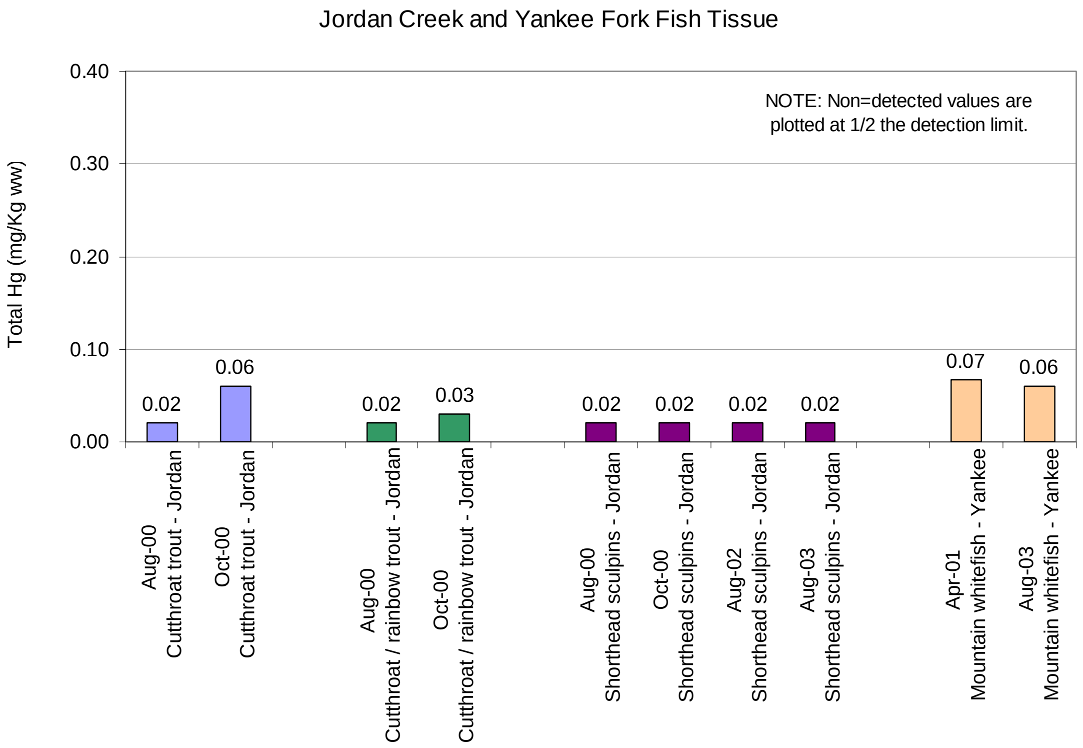

Figure B-1. Data showing relative consistency between years for fish tissue monitoring in Jordan Creek and Yankee Fork (Salmon River basin)

These data show that fish tissue data are an integrative measure over time, as within-year variability and year-to-year variability is minimal (largest variability is 0.04 mg/kg within a given species over a 3-month period). In addition, sampling at these frequencies is consistent with other state monitoring programs (e.g.,Illinois, Massachusettes, South Carolina, Wisconsin).

Within the first part of a 5-year cycle higher-priority watersheds will be sampled, while lower-priority watersheds will be targeted for the latter part of a 5-year cycle. As data become available over a longer time period, this monitoring framework will be adapted so that resources are shifted from lower-priority watersheds to higher-priority watersheds that contain impaired waters and/or receive larger discharges of mercury. This means that following the initial 5-year monitoring cycle some watersheds will be monitored more frequently than 5 years and others will be monitored less frequently than 5 years.

Initially (prior to the development of a statewide monitoring database), the number of sites sampled per 4th level HUC watershed is between 1 and 3, depending upon the size of the watershed and number of potential mercury sources. Within each watershed, water bodies will be further prioritized, with reservoirs/lakes having highest priority, then large rivers (5th order and higher), and lastly streams (4th order and lower unless intensive fishing uses are present).

Monitoring Tier 2: Deterministic and Probabilistic Monitoring

Both deterministic and probabilistic monitoring will be conducted.

Monitoring Tier 2a: Deterministic Monitoring

Deterministic monitoring will be conducted at reservoirs/lakes and large rivers. These stations have been prioritized based on whether elevated fish tissue mercury concentrations have been observed or are suspected, whether NPDES discharges that are currently required to monitor for mercury are present, whether the waterbodies have particular public interest or fisheries uses (e..g, Henry's Fork and heavily-used reservoir fisheries), and whether the sites correspond to USGS biomonitoring stattions. Lower scores were assigned to those waterbodies that have been monitored for fish tissue mercury concentrations within the last five years.

In each regional basin, two "core" stations have also been identified as annual trend sites. These core stations will be monitored every year to track mercury trends in the same fish species that are present within that region.

Monitoring Tier 2b: Probabilistic Monitoring

Probabilistic monitoring will be conducted in those HUCs that do not contain deterministic sites and in other smaller streams. The streams to be sampled will be selected randomly to be representative of varied conditions (for example, natural geologic background, pristine areas subject to regional air deposition, etc.). Within each sampling year, at least 20 probabilistic statewide sites will be selected on a random basis. Although BURP monitoring activities are not conducive to fish tissue monitoring, these probabilistic sites should consider BURP monitoring stations so that the use of available information is maximized. For example, confirming that low mercury concentrations coincide with high biological integrity indices may provide useful information for future prioritization of monitoring efforts.

Sampling Sites and Schedule

Fourth level HUCs have been aggregated into three regions:

- Panhandle / Clearwater
- Salmon / Southwest
- Upper Snake / Bear River

There are a total of 84 4th-level HUCs within Idaho. Between the three regions, this translates into 24 HUCs (Panhandle / Clearwater Region), 32 HUCs (Salmon / Southwest Region), and 28 HUCs (Upper Snake / Bear River). A summary of HUCs that may be sampled each year by region is provided in Table B-1.

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Table B-1. Preliminary Proposed Sampling Scheme for Statewide Cooperative Program.

		Target Station ID by HUC	#	CORE?		Year 1	Year 2	Year 3	Year 4	Year 5					
Panhandle / Clearwater												Station ID	Station Name	HUC	Score
17010101	Upper Kootenai	A, B	2						B	A		H	SF Cd'A nr Pinehurst	17010302	9
17010104	Lower Kootenai		1				random					R	Clearwater River at Lewiston	17060306	8
17010105	Moyie		0									F	NF Cd'A at Enaville	17010301	7
17010213	Lower Clark Fork		1							random		L	St. Joe at Calder	17010304	6
17010214	Pend Oreille Lake	C	1				C					G	SF Cd'A nr Kellogg	17010302	6
17010215	Priest	D, E	2				E		D			E	Priest nr. Priest River	17010215	6
17010216	Pend Oreille		1						random			C	Lake Pend Oreille	17010214	6
17010301	Upper Coeur d'Alene	F	1			F						S	Dworshak Reservoir	17060308	5
17010302	South Fork Coeur d'Alene	G, H	2			H						O	Spokane nr Post Falls	17010305	5
						G						N	Spokane nr Coeur d'Alene	17010305	5
17010303	Coeur d'Alene Lake	I, J	2	I		I	I	I	I	I		K	St. Joe at Red Ives	17010304	5
									J			J	Cd'A at Rose Lake	17010303	5
17010304	St. Joe	K, L	2			L		K				D	Priest Lake	17010215	4
17010305	Upper Spokane	M, N, O	3					O		M		B	Kootenai at Copeland	17010101	4
								N				A	Kootenai at Porthill	17010101	4
17010306	Hangman		0									I	Lake Cd'A	17010303	3
17010308	Little Spokane		0									Q	Clearwater River at Orofino	17060306	3
17060108	Palouse		1			random						M	Hayden Lake	17010305	3
17060109	Rock		0												
17060301	Upper Selway		1				random								
17060302	Lower Selway		0												
17060303	Lochsa		0												
17060304	Middle Fork Clearwater		1					random							
17060305	South Fork Clearwater		1						random						
17060306	Clearwater	Q, R	2	R		R	R	R	R	R					
										Q					

		Target Station ID by HUC	#	CORE?		Year 1	Year 2	Year 3	Year 4	Year 5					
17060307	Upper North Fork Clearwater		1					random							
17060308	Lower North Fork Clearwater	S	1				S								
				2		7	7	7	7	6					

Salmon / Southwest												Station ID	Station Name	HUC	Score
17050101	CJ Strike Reservoir	T, LLL	2			T			LLL			II	Brownlee Reservoir	17050201	9
17050102	Bruneau		1				random					BB	Snake at Nyssa	17050115	7
17050103	Middle Snake-Succor	U, MMM	2				MMM			U		GG	Weiser River	17050124	7
17050104	Upper Owyhee		0									T	CJ Strike Reservoir	17050101	6
17050105	South Fork Owyhee		0									AA	Boise at Parma	17050114	6
17050106	East Little Owyhee		0									DD	Payette nr Payette	17050122	6
17050107	Middle Owyhee		0									HH	Snake at Weiser	17050201	6
17050108	Jordan	NNN	1						NNN			MMM	Swan Falls Reservoir	17040103	5
17050111	North and Middle Forks Boise		0									X	Arrowrock Reservoir	17050112	5
17050112	Boise-Mores	W, X	2				X			W		CC	Payette nr Emmett	17050122	5
17050113	South Fork Boise		0									P	Snake at Pittsburg Landing	17060101	5
17050114	Lower Boise	Y, Z, AA	3			AA		Y				NN	Salmon near Clayton	17060201	5
								Z				PP	Salmon at Whitebird	17060209	5
17050115	Middle Snake-Payette	BB	1			BB						Z	Lake Lowell	17050114	4
17050120	South Fork Payette		1					random				LLL	Snake nr King Hill	17040101	4
17050121	Middle Fork Payette		0									V	Jordan Creek (Salmon)	17060201	3
17050122	Payette	CC, DD	2			DD	CC					Y	Boise at Glenwood Br.	17050114	3
17050123	North Fork Payette	EE, FF	2	FF		FF	FF	FF	FF	FF		EE	Payette Lake	17050123	3
									EE			FF	Cascade Reservoir	17050123	3
17050124	Weiser	GG	1			GG						JJ	Redfish Lake	17060201	3
17050201	Brownlee Reservoir	HH, II	2	II		II	II	II	II	II		KK	Squaw Creek	17060201	3
							HH					LL	Thompson Creek	17060201	3
17060101	Hells Canyon	P	1				P					MM	Yankee Fork	17060201	3

		Target Station ID by HUC	#	CORE?		Year 1	Year 2	Year 3	Year 4	Year 5					
17060103	Lower Snake-Asotin		1							random		OO	Napais Creek	17060203	3
17060201	Upper Salmon	JJ, KK, LL, MM, NN, V	6					NN	JJ	MM		W	Boise nr Twin Springs	17050112	2
								V	KK	LL		NNN	Jordan Creek (Oywhee)	17050108	2
17060202	Pashimeroi		0									U	Snake at Murphy	17050103	-1
17060203	Middle Salmon-Panther	OO	1							OO					
17060204	Lemhi		1						random						
17060205	Upper Middle Fork Salmon		1			random									
17060206	Lower Middle Fork Salmon		1						random						
17060207	Middle Snake-Chamberain		0												
17060208	South Fork Salmon		1							random					
17060209	Lower Salmon	PP	1					PP							
17060210	Little Salmon		0												
				2		8	8	8	9	9					
Upper Snake/Bear River												Station ID	Station Name	HUC	Score
16010102	Central Bear		1							random		BBB	Portneuf at Pocatello	17040208	10
16010201	Bear Lake	QQ	2						QQ	RR		VV	Henry's Fork nr Rexburg	17040203	8
16010202	Middle Bear	RR	1						random			HHH	Rock Creek at Daydream	17040212	7
16010203	Little Bear-Logan		1			random						UU	Snake nr Idaho Falls	17040201	6
16010204	Lower Bear-Malad		0									XX	SF Teton River at Rexburg	17040204	5
16020309	Curlew Valley	SS	1				SS					ZZ	Snake nr Blackfoot	17040206	5
17040104	Palisades	TT	1					TT				GGG	Snake nr Kimberly	17040212	5
17040105	Salt		0									SS	Black Pine	16020309	4
17040201	Idaho Falls	UU	1			UU						AAA	Portneuf at Topaz	17040208	4
17040202	Upper Henry's		1					random				EEE	Snake nr Burley	17040209	4
17040203	Lower Henry's	VV	1			VV						FFF	Snake nr Buhl	17040212	4
17040204	Teton	XX	1				XX					III	Salmon Falls Creek Reservoir	17040213	4

		Target Station ID by HUC	#	CORE?		Year 1	Year 2	Year 3	Year 4	Year 5					
17040205	Willow		0									TT	Palisades Reservoir	17040104	3
17040206	American Falls	YY, ZZ	2	ZZ		ZZ	ZZ	ZZ	ZZ	ZZ		YY	American Falls Reservoir	17040206	3
								YY				DDD	Rock Creek at Twin Falls	17040209	3
17040207	Blackfoot		1						random			JJJ	Big Wood nr Bellevue	17040219	3
17040208	Portneuf	AAA, BBB	2			BBB	AAA					QQ	Bear Lake	16010101	2
17040209	Lake Walcott	CCC, DDD, EEE	3	EEE		EEE	EEE	EEE	EEE	EEE		RR	Bear River at Stateline	16010202	1
									DDD	CCC		CCC	Milner Lake at Milner Dam	17040209	1
17040210	Raft		1							random		KKK	Silver Creek at Picabo	17040221	0
17040211	Goose		0												
17040212	Upper Snake-Rock	FFF, GGG, HHH	3			HHH	GGG	FFF							
17040213	Salmon Falls	III	1					III							
17040214	Beaver-Camas		0												
17040215	Medicine Lodge		1							random					
17040216	Birch		0												
17040217	Little Lost		1					random							
17040218	Big Lost		1			random									
17040219	Big Wood	JJJ	1						JJJ						
17040220	Camas		1				random								
17040221	Little Wood	KKK	1							KKK					
				2		8	7	8	7	8					
TOTALS				6		23	22	23	23	23					

Within any given year of the 5-year rotational cycle, this table shows that 23 HUCs will be sampled on a statewide basis (6 to 9 HUCs per region per year). Of these HUCs, the majority will contain targeted sites (deterministic), while others will contain random sites (probabilistic).

Table B-2 provides the prioritization of preliminary targeted sites within each region (these sites are subject to change depending on the evolution of the program and input obtained from the public comment process). Many of these sites correspond to collection stations visited by USGS to support the USGS/DEQ Trend Monitoring Network or other USGS monitoring sites.

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Table B-2. Preliminary Proposed Targeted Sites and Ranking for Statewide Cooperative Program

Region	Site Name	USGS or BURP Number	HUC	Score	Actual Mercury Contamination	Potential Mercury Contamination	NPDES Discharger	Public Interest/ Fishing	Other:		CORE?
A- Panhandle/Clearwater	SF Cd'A nr Pinehurst	12413470	17010302	9	3	2		2	2	(f)	
A- Panhandle/Clearwater	Clearwater River at Lewiston	13343000	17060306	8		2	3	3		(t)	YES
A- Panhandle/Clearwater	NF Cd'A at Enaville	12413000	17010301	7	3			2	2	(f)	
A- Panhandle/Clearwater	SF Cd'A nr Kellogg	12413210	17010302	6		2	4			(m), (r)	
A- Panhandle/Clearwater	St. Joe at Calder	12414500	17010304	6	2			2	2	(f)	
A- Panhandle/Clearwater	Priest nr. Priest River	12395000	17010215	6	2			2	2	(f)	
A- Panhandle/Clearwater	Lake Pend Oreille		17010214	6			3	3		(w)	
A- Panhandle/Clearwater	St. Joe at Red Ives	12413875	17010304	5	3			2			
A- Panhandle/Clearwater	Spokane nr Coeur d'Alene	12415500	17010305	5		2	3			(l)	
A- Panhandle/Clearwater	Spokane nr Post Falls	12419000	17010305	5	3			2			
A- Panhandle/Clearwater	Cd'A at Rose Lake	12413810	17010303	5		2		3			
A- Panhandle/Clearwater	Dworshak Reservoir		17060308	5		2		3			
A- Panhandle/Clearwater	Priest Lake		17010215	4		1		3			
A- Panhandle/Clearwater	Kootenai at Porthill	12322000	17010101	4		1		3			
A- Panhandle/Clearwater	Kootenai at Copeland	12318500	17010101	4		1		3			
A- Panhandle/Clearwater	Lake Cd'A		17010303	3	3			3	-3	(b)	YES
A- Panhandle/Clearwater	Hayden Lake		17010305	3				3			
A- Panhandle/Clearwater	Clearwater River at Orofino	1334000	17060306	3				3			

Region	Site Name	USGS or BURP Number	HUC	Score	Actual Mercury Contamination	Potential Mercury Contamination	NPDES Discharger	Public Interest/ Fishing	Other:		CORE?
B- Salmon/Southwest	Brownlee Reservoir	13289700	17050201	9	3		3	3			YES
B- Salmon/Southwest	Snake at Nyssa	13213100	17050115	7	3			2	2	(f)	
B- Salmon/Southwest	Weiser River	13266000	17050124	7		2	3	2			
B- Salmon/Southwest	CJ Strike Reservoir	13171500	17050101	6	3			3			
B- Salmon/Southwest	Payette nr Payette	13251000	17050122	6			4	2		(k)	
B- Salmon/Southwest	Boise at Parma	13213000	17050114	6			4	2		(a),(i)	
B- Salmon/Southwest	Snake at Weiser	13269000	17050201	6			4	2		(o)	
B- Salmon/Southwest	Salmon at Whitebird	13317000	17060209	5	3			2			
B- Salmon/Southwest	Salmon near Clayton		17060201	5			3	2		(x)	
B- Salmon/Southwest	Arrowrock Reservoir		17050112	5		2		3			
B- Salmon/Southwest	Payette nr Emmett	13250000	17050122	5			3	2		(n)	
B- Salmon/Southwest	Snake at Pittsburg Landing		17060101	5	2			3			
B- Salmon/Southwest	Swan Falls Reservoir		17050103	5	2			3			
B- Salmon/Southwest	Snake nr King Hill	13154500	17050101	4	2			2			
B- Salmon/Southwest	Lake Lowell		17050114	4	3			3	-2	(d)	
B- Salmon/Southwest	Redfish Lake		17060201	3				3			
B- Salmon/Southwest	Napais Creek	13306385	17060203	3			3			(u)	
B- Salmon/Southwest	Squaw Creek	13297355	17060201	3			3			(x)	
B- Salmon/Southwest	Thompson Creek	13297330	17060201	3			3			(x)	
B- Salmon/Southwest	Payette Lake		17050123	3				3			

Region	Site Name	USGS or BURP Number	HUC	Score	Actual Mercury Contamination	Potential Mercury Contamination	NPDES Discharger	Public Interest/ Fishing	Other:		CORE?
B- Salmon/Southwest	Cascade Reservoir		17050123	3				3			YES
B- Salmon/Southwest	Boise at Glenwood Br.	13206000	17050114	3			4	2	-3	(a),(i)	
B- Salmon/Southwest	Yankee Fork		17060201	2			3	2	-3	(c), (q)	
B- Salmon/Southwest	Jordan Creek (Salmon)		17060201	2			3	2	-3	(c), (q)	
B- Salmon/Southwest	Jordan Creek (Owyhee)		17050108	2		2					
B- Salmon/Southwest	Boise nr Twin Springs	13185000	17050112	2	3			2	-3	(a)	
B- Salmon/Southwest	Snake at Murphy	13172500	17050103	-1				2	-3	(a)	
C- Upper Snake/Bear	Portneuf at Pocatello	13075500	17040208	10	2		4	2	2	(f),(g)	
C- Upper Snake/Bear	Henry's Fork nr Rexburg	13056500	17040203	8	3			3	2	(f)	
C- Upper Snake/Bear	Rock Creek at Daydream	13092747	17040212	7	3			2	2	(f)	
C- Upper Snake/Bear	Snake nr Idaho Falls	13057155	17040201	6			3	3		(s)	
C- Upper Snake/Bear	Snake nr Blackfoot	13069500	17040206	5	3		3	2	-3	(a),(h)	YES
C- Upper Snake/Bear	Snake nr Kimberly	13090000	17040212	5			3	2		(y)	
C- Upper Snake/Bear	SF Teton River at Rexburg	13055340	17040204	5			3	2		(v)	
C- Upper Snake/Bear	Black Pine		16020309	4		2		2			
C- Upper Snake/Bear	Portneuf at Topaz	13073000	17040208	4	2			2			

Region	Site Name	USGS or BURP Number	HUC	Score	Actual Mercury Contamination	Potential Mercury Contamination	NPDES Discharger	Public Interest/ Fishing	Other:		CORE?
C- Upper Snake/Bear	Snake nr Burley	13082030	17040209	4	0	1	3			(j)	YES
C- Upper Snake/Bear	Snake nr Buhl	13094000	17040212	4	2			2			
C- Upper Snake/Bear	Salmon Falls Creek Reservoir		17040213	4	3			3	-2	(e)	
C- Upper Snake/Bear	American Falls Reservoir		17040206	3				3			
C- Upper Snake/Bear	Palisades Reservoir		17040104	3				3			
C- Upper Snake/Bear	Big Wood nr Bellevue	13140800	17040219	3			4	2	-3	(a),(p)	
C- Upper Snake/Bear	Rock Creek at Twin Falls	13092753	17040209	3	3						
C- Upper Snake/Bear	Bear Lake		16010101	2				2			
C- Upper Snake/Bear	Milner Lake at Milner Dam	13087900	17040209	1		1					
C- Upper Snake/Bear	Bear River at Stateline	10092700	16010202	1		1					
C- Upper Snake/Bear	Silver Creek at Picabo	13150430	17040221	0				3	-3	(a)	
TOTAL COUNT	65										
NOTES:											
(a)	USGS sampling in 2004										
(b)	EPA sampling in 2003										
(c)	Hecla sampling from 1999-2004										

Region	Site Name	USGS or BURP Number	HUC	Score	Actual Mercury Contamination	Potential Mercury Contamination	NPDES Discharger	Public Interest/ Fishing	Other:		CORE?
(d)	USFW sampling in 2001										
(e)	IFCAP sampling in 2001										
(f)	USGS sampling 2005 or 2006										
(g)	Astaris Idaho (FMC), Pocatello WWTP										
(h)	Blackfoot WWTP										
(i)	Boise WWTP/MS4, Caldwell WWTP, Meridian WWTP, Nampa WWTP										
(j)	Burley WWTP										
(k)	Chiquita Foods, Fruitland WWTP, New Plymouth WWTP, Payette WWTP										
(l)	Coeur d'Alene WWTP										
(m)	Coeur Silver Valley Inc.										
(n)	Emmett WWTP										
(o)	Fruitland WWTP, Weiser WWTP										
(p)	Hailey Woodside WWTP, Ketchum WWTP										
(q)	Hecla Mining Co. - Grouse Creek										
(r)	Hecla Mining Co. - Lucky Friday										
(s)	Idaho Falls WWTP										

Region	Site Name	USGS or BURP Number	HUC	Score	Actual Mercury Contamination	Potential Mercury Contamination	NPDES Discharger	Public Interest/ Fishing	Other:		CORE?
(t)	Lewiston WWTP										
(u)	Meridian Beartrack Mine										
(v)	Rexburg WWTP										
(w)	Sandpoint WWTP										
(x)	Thompson Creek Mining Co.										
(y)	Twin Falls WWTP										
SCORING:											
Actual	1 = 0.10 mg/Kg										
	2 = 0.20 mg/Kg										
	3 = 0.30 mg/Kg										
Potential	1 = Other sites in basin have low mercury levels, or spotty dissolved mercury in water column										
	2 = High likelihood of mercury from legacy mining issues, or lake/reservoir										
NPDES Discharger	3 = Mercury monitoring currently required										
	4 = Multiple dischargers with mercury monitoring requirements										

Region	Site Name	USGS or BURP Number	HUC	Score	Actual Mercury Contamination	Potential Mercury Contamination	NPDES Discharger	Public Interest/ Fishing	Other:		CORE?
Interest/Fishing	1 = Low fishing pressure										
	2 = Moderate fishing pressure OR river fishing										
	3 = High fishing pressure/trophy fishery OR lake/reservoir fishing										
Other	-2 = Older data exist										
	-3 = Recent data exist										

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NPDES Implications

Traditionally, ambient monitoring is conducted by a discharger below a facility's mixing zone, in close proximity to the point of discharge. With a fish tissue criterion the traditional approach does not make the most sense.

For example, some facilities will discharge to small streams that do not hold edible-sized fish. For these discharges fish tissue sampling would necessarily occur further downstream than would typically occur with water chemistry monitoring. This may also mean sampling in a much larger confluent stream where the discharge load is mixed with greater loads from other sources. Even if edible size fish do occur in the receiving stream, fish movement and the nature of mercury transport and methylation may mean that more distant sampling is best for assessing environmental effect.

Furthermore, because mercury in most waters is likely not primarily related to point source discharges, and because high fish tissue levels of methylmercury may not manifest themselves local to a point source, fish tissue monitoring close to a discharge point could miss important environmental and human health problem areas.

DEQ believes the money spent on traditional discharge-related ambient monitoring offers greater environmental and human health benefit if pooled into a statewide monitoring effort as described earlier. Such a cooperative effort would also offer benefits in more consistent, thus comparable, fish tissue mercury data across the state for assessment and reporting purposes.

Field Sampling Protocols

Field sampling protocols will help ensure that mercury data are valid to be used in making management decisions. Mercury poses a specific challenge in that contamination from sampling or analytical techniques is quite common. In addition, the availability of low-level analytical methods means that contamination can easily provide data that are not valid.

Monitoring protocols for fish tissue sampling generally follow the protocols developed by IFCAP. The only deviations from these protocols are related to needing to apply fish tissue data to the TMDL and NPDES programs.

Some of Idaho's water bodies are home to threatened and endangered species of fish, as listed under the ESA. In areas where these fish are present, surrogate species for analysis must be used to determine assessment of the biological community. The best surrogate species likely are fish resident to the water body (for example, Mountain whitefish), as these fish are more exposed to local mercury concentrations.

Sample Target Species: Bass

Certain fish species, such as larger predatory species, are known to bioaccumulate higher concentrations of mercury and should be targeted for monitoring purposes. As a result, bass have been selected as the best target species for fish tissue monitoring within reservoirs/lakes.

Note: A mercury bioaccumulation study was performed by USGS in the South Yuba River, Deer Creek and Bear River Watersheds in the northwestern Sierra Nevada in California (May et al. 2000). The highest mercury concentrations were found in the upper-trophic-level predators (bass), with 88 percent of bass containing mercury concentrations greater than 0.3 mg/kg. Brown trout collected from streams were found to have generally much lower mercury concentrations (average total mercury of 0.16 mg/Kg wet weight) than bass and catfish collected from reservoirs (0.68 mg/Kg and 0.40 mg/Kg, respectively; May et al. 2000).

The primary target size range ideally should include larger specimens typically harvested at each sampling site, as larger (older) fish within a population generally bioaccumulate the most methylmercury and are generally the preferred catch of fishermen.

If these data indicate that fish tissue concentrations are nearing the fish tissue criterion, then additional confirmatory sampling may be required to assess the general fish population. Consistent with fish advisory protocols, additional fish species that will be targeted, if available, include bottom feeders and game fish. Other popular game species targeted by IFCAP include trout, perch, crappie, and kokanee, with a particular focus on predators (Trophic Level 4 fish including walleye and crappie) and bottom feeders (catfish, suckers, and carp).

For rivers and streams, the target species will vary depending upon fishery use within each system, but the highest trophic level present will be targeted. Regional fishery biologists from each *Idaho Department of Fish and Game* (IDFG) region will be consulted in order to designate appropriate target species for monitoring. A preliminary list of major species noted by regional biologists include crappie, bass, trout, catfish, northern pike, perch, and kokanee. Appendix D of this guidance provides a summary of regional fishery patterns and species.

Note: Bull trout will specifically **not** be collected as part of this monitoring because of their protected status and because they are not legally consumed by humans. This is consistent with NOAA’s support of sampling resident species as surrogates for listed salmonids (D. Mabe, pers. comm. 2004). In addition, Section 10 permitting allowing sampling threatened and endangered species would be difficult to obtain for this purpose.

Regionally-stocked populations will be avoided for monitoring because they would represent only a relatively short period of exposure to ambient conditions. IDFG provides a comprehensive list of where and when fish are stocked on a statewide basis (http://imnh.isu.edu/digitalatlas/geog/fishery/fishyfr.htm and http://fishandgame.idaho.gov/fish/stocking/); thus, stocked fish will be excluded from collection upon consultation with the Regional Fisheries Biologist.

Subsistence Issues

Tribal fish harvesting, or subsistence harvesting, primarily occurs within the Panhandle and Salmon Regions and the McCall Subregion and mainly includes steelhead, chinook, and kokanee. Assessing the health risk for subsistence fishers is complicated by the fact that collection and testing of these species is generally prohibited under the ESA due to listing as threatened or endangered. The statewide fish tissue monitoring program will target fish species that are predators and which demonstrate the highest levels of bioaccumulation of mercury. For example, mercury concentrations of kokanee samples collected from Lake Coeur d'Alene in 2002 are well below mercury concentrations in other predator species such as largemouth bass. Although subsistence harvesting usually targets specific anadromous species and is associated with more frequent consumption, available data indicate that resident species provides a conservative estimate of mercury exposure for subsistence populations.

Sample Timing: July-September

EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1 (Section 6.1.1.5, EPA 2000a) and Idaho’s 1999 Beneficial Use Reconnaissance Project, Work Plan for Wadeable Streams (DEQ 1999) provides recommendations for when to sample fish tissue. In fresh waters, EPA guidance recommends that the most desirable sampling period is from late summer to early fall. Water levels are typically lower during this time, thus simplifying collection procedures. Fish lipid content is generally highest in late summer, allowing these samples to also provide conservative information on other contaminant levels as well.

Although in Idaho the latter part of the growing season is from September through early November, USGS typically perform their monitoring between July and early September. In order to take advantage of existing monitoring activities, this will be the targeted period for this monitoring program, as well.

Note: EPA guidance recommends against the late summer to early fall sampling period only if it is not a legal harvest season for the target species or if the target species spawns during this period. However, if the target species can be legally harvested during its spawning period, then sampling to determine contaminant concentrations should be conducted during this time. Exceptions may be made for various target species if the IDFG Regional Fishery Biologist recommends otherwise.

Sample Number and Size: 10 Samples per Location

Mean values of fish tissue methylmercury levels provide meaningful estimates of human health risk because exposure to the methylmercury reference dose would take the consumption of many fish with tissue levels near criterion concentrations. Variability in fish tissue mercury levels among individual fish limits the confidence that results from analysis of single fish will be reprsentative of mean exposure. Thus, in accordance with generally accepted practice, at least 10 samples (per species if more than one species is collected) should be collected per sample location in order for the sample mean to be representative of the true mean. A sample of this size should provide high confidence in the mean fish tissue levels (see Attachment A).

A sample mean value may come from compositing tissue from 10 fish or averaging 10 individual measurements. Both provide equally valid measures of the mean concentration. The former entails only a single analysis thus less analytical cost, but only individual measurements can provide an estimate of variability necessary for establishing confidence limits on the mean value. The need for confidence limits depends on the use of the data, and the desire to make statements on the probability that the true mean is different from the sample mean.

Idaho DEQ believes that composite mean values (N=10) will generally be adequate for 303(d) listing decisions, effluent limit calculations, and TMDL development, but recognizes there may be situations in which it it is deirable to estimate the sample variability. Therefore, at least 10 fish of adequate size should be collected for fish tissue samples at each sampling location. This preference will depend somewhat on the allowable amount per collection permits and the target water body. Individual samples should be preserved. Initially, in order to control monitoring costs, a composite analysis should be obtained. If the composite mean value is within 20% of the 0.3 mg/kg fish tissue criterion, or if it is desired to estimate variability for other purposes (RPTE or fish consumption advisories), analysis of individual fish should be performed.

Size requirements vary somewhat by region because, in some cases, there are very specific size requirements for harvesting a particular species. The IDFG Regional Fishery Biologists will be consulted to recommend fish size requirements for their regions, targeted species, and applicable fishing regulations should be considered in modifying this protocol for sample collection. Generally, specimens collected for analysis should at least meet IFCAP 10-inch minimum length and contain enough fillet tissue to meet the sample mass required by the lab (generally 2 grams at a minimum). In addition, to avoid large variances, IFCAP requires that the smaller fish should be no less than 50 percent of the largest individual (for example, the smallest fish should be no less than 10 inches if the largest fish is 20 inches).

If it is not possible to follow these protocols, this protocol may be modified in such a manner that is appropriate to the situation and does not degrade data quality.

Sample Handling: IFCAP Protocols

All fish samples will be handled according to the protocols outlined in the IFCAP program, which were adopted from IDFG and USGS sampling techniques (IFCAP 2004). The field biologist identifies the fish species, weighs and measures the species, tags the species, and ships each fish in foil to the analytical laboratory. The majority of samples will be analyzed by the state laboratory that supports the IFCAP program, unless analytical capacity is available via the USGS program.

Detailed IFCAP procedures are reproduced in Attachment A to this appendix (see specifically Appendix B of the IFCAP protocols for additional sample handling information). Attachment A presents the relevant information from the IFCAP protocols related to sample collection and handling (other risk assessment protocols related to issuing fish advisories have been deleted but can be obtained upon request from the IFCAP program).

Preparation Method: Skinless Fillets

All fish tissue will be collected as individual, skinless fillet samples Because mercury is differentially concentrated in muscle tissue, analyzing fillets provides a conservative approach for subsistence fishers, who generally eat more of the fish (gutted carcass), because the fillets provide higher mercury concentrations. Moreover, leaving the skin on the fish fillet results in a lower mercury concentrationper gram (EPA 2001a), so using skinless fillets is a more conservative approach for addressing mercury exposures for members of the general population and most recreational fishers.

However, to preserve resources, Idaho will split available fillets so that one half is retained for individual analysis and the other half is used for compositing with other samples from the same species.

Note: The following text contains the Idaho Fish Consumption Advisory Program (IFCAP) protocol. Brackets "[]" surround text that has been modified to adapt the original protocol to this document.

ATTACHMENT A:
IDAHO FISH CONSUMPTION ADVISORY PROGRAM PROTOCOL

Preface

The goal of the Idaho Fish Consumption Advisory Program (IFCAP) is to protect the public from adverse health risks associated with consuming contaminated fish from Idaho and Tribal waters. The program follows the fish advisory guidelines from the U.S. Environmental Protection Agency (EPA 1994, 1995, 1996, 1999) with additional decision-making rules to maximize the limited resources of Idaho's health and environmental agencies. This protocol documents the additional details specific to the Idaho program and is a general guideline for IFCAP. The protocol intends to capture rules that apply to different water types in the State and it is not meant to be a water body specific protocol.

IFCAP Program Organization

Chair:
Bureau of Community and Environmental Health, Division of Health, Idaho Department of Health and Welfare.

Participants:
Bureau of Laboratories, Division of Health, Idaho Department of Health and Welfare
Idaho Department of Environmental Quality
Idaho Department of Fish and Game
Idaho Department of Agriculture
US Geological Survey

Liaison:
Governor's Office

Project Contacts Year 2003:
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Target Water Body Selections

Prioritization of water bodies must consider the following factors: (1) potential contaminants of concern in the water body; (2) frequent fishing activities; and (3) public interest in the water body. IFCAP plans to target one to five water bodies per year depending on the size of the selected water body and the resources available to IFCAP.

Sampling and Analysis Techniques

Fish Species Selection

Selection of target fish and shellfish species should involve consideration of the following criteria. (1) Target species should be abundant enough to provide for an adequate fishery and large enough to provide for adequate tissue samples for chemical analysis. (2) The species selected should be those commonly consumed in the area by recreational or subsistence anglers. (3) The species selected should be those that potentially bioaccumulate high concentrations of chemicals.

IFCAP targets popular game species for particular water bodies of interest. Bottom feeders and predator species are particularly of interest. Examples of popular freshwater game species in Idaho are: trout, perch, crappie, bass, and kokanee. Examples of freshwater predatory species are: bass, walleye and crappie. Examples of freshwater bottom feeders are: catfish, sucker, and carp.

Fish Size Requirement

Fish size and age are major factors in contamination uptake and accumulation. IFCAP targets adult fish that are commonly harvested by anglers. To avoid large variances, IFCAP requires that the smallest fish should be no less than 50% of the largest individual. That is, if the largest fish was 16 inches, then the smallest should be at least 8 inches.

Sampling Time

Fish species and time of sampling is determined by field biologists on a site-by-site basis. In general, IFCAP attempts to sample fish late in the growing season, which in the State of Idaho is from September through early November. For most species, their lipid content is the highest late in the growing season. Since most organic pollutants tend to accumulate in fat, sampling the fish when their lipid content is the highest gives a more protective measure of contaminant accumulation.

Sample Locations

The sampling location is determined by field biologists on a site specific basis. For larger water bodies, multiple sampling locations may be required to represent the entire water system. Sampling location determination should consider the following factors. (1) The common locations where the fish are present and caught. (2) When narrow-ranging fish are the target species, multiple locations may be needed per water body. Narrow-ranging fish are those species that tend to be more territorial or less mobile, therefore, lives in a smaller area within large water (e.g., Largemouth bass).

Sample Number Requirement

A certain level of statistical confidence is required to make an informed decision to release an advisory. This confidence depends on the number of fish sampled. The focus of IFCAP is to protect public health; therefore the primary interest is to control the error for not issuing an advisory when advisory is needed. IFCAP determined that 10 fish per target species, per sampling location is needed to reach approximately 90% confidence that an advisory will be correctly issued. The detailed statistical method is described in [Addendum A].

Fish Sampling Techniques and Field Protocols

Idaho Fish and Game and the US Geological Survey are the primary agencies collecting fish for the IFCAP. Their field sampling techniques and protocols were adopted by IFCAP. The field biologist identifies the fish species, weights, measures, tags, and wraps each fish separately in foil. Fish are then shipped in a frozen state to the Bureau of Laboratories for holding and analysis.

Tissue Preparation Requirement

IFCAP follows most EPA fish sample handling and analysis procedures (EPA 1999). Fish wet weight and total length should be measured and recorded. For most species, fish fillets are analyzed because the fillet is the primary part of a fish the general public consumes. For fish that are known to be canned and eaten whole (e.g., kokanee and crappie), are gutted and de-headed and the body carcasses are analyzed. IFCAP believes that this preparation best represents the edible portions of those specific fish. Ideally, 10 fish per species per location are collected and analyzed. When there are enough samples, one whole fish is analyzed to gather additional information for ecological risk assessment. The detailed descriptions regarding how to prepare fish tissue and how many fish to analyze are in [Addendum B.]

Target Analytes Selection and Laboratory Analytical Requirement

IFCAP targets mercury and chlorinated pesticides including total polychlorinated biphenyls as contaminants for selected water bodies unless specially noted. IFCAP follows the chemical analytical protocol used by the Bureau of Laboratories. For all target analytes, the Bureau of Laboratories follows EPA recommended sample holding times except for mercury. The maximum holding time for mercury recommended by EPA has changed from 6 months to 28 days. However, the EPA holding times are based on the potentially volatile nature of mercury in (unfrozen) water samples and do not pertain to frozen tissue.

Washington Department of Fish and Wildlife analyzed frozen fish tissue six times ranging from 4 to 86 days without a significant change in mercury concentrations. The data are unpublished but have been reviewed by EPA and the Puget Sound Estuary Program (PSEP, 1996). IFCAP believes that using a 6-month sample holding time for mercury will not decrease the data quality.

Health Education

The goal of the fish advisory is to protect the public from adverse health effects due to consumption of contaminated fish. The objectives of public health education, with regard to the advisory, are as follows:

- the public will check for and heed the advice of the advisory;
- the public will catch and keep only those fish that are deemed safe for consumption for the water body from which they were caught;
- the public will clean and cook the fish in a manner consistent with the advisory;
- the public will limit consumption of fish from certain water bodies as detailed by the advisory; and
- the public will not substitute fish caught in Idaho with commercial fish.

The purpose of fish advisories is to inform the public which fish may be contaminated, which are safe, and which fish should be consumed in limited quantities. The advisory is not mandatory and carries no regulatory authority. It is issued merely as a precautionary message in order to protect public health and safety.

The advisory will contain a section outlining the health benefits of fish consumption. It will also counsel the public not to substitute fish caught in Idaho with store bought fish. The advisory will be widely accessible to the Idaho and Tribal public. Anglers and those consuming the fish anglers bring home will be reached through a variety of sources. IFCAP will utilize signs at fishing locations, posters, pamphlets and handouts, booklets, and online information sources. These materials will be distributed by license agents, retailers, Fish and Game representatives, angler clubs and organizations, and others as identified on a site-specific basis.

The detailed advisory will provide information about the consumption classification of each species for each water body. The advisory will also inform the public that larger, older and predatory fish will have higher levels of contaminants than smaller, younger fish which will eat less contaminated prey. The advisory will present information about contaminants detected in fish tissue in Idaho and Tribal waters such as the sources, environmental fate, and human health effects due to exposure. Additionally, the advisory will contain language contained in the EPA *National Advice on Mercury in Freshwater Fish for Women Who Are or May Become Pregnant, Nursing Mothers, and Young Children* fact sheet. This fact sheet provides recommended fresh water fish consumption rates for those sensitive populations.

In addition to consumption rates for freshwater fish, the advisory will contain information about how to clean and cook fish. Certain pollutants will concentrate in the fat or organs of fish. Consequently, it is important to remove the organs and skin and cut away the fat and dark, fatty tissue from fish fillets. When cooking, it is best to bake, broil, or grill the fish on a rack so that the fat will drip off. The fat should be discarded and not used for basting, gravies, sauces, or soup. Frying fish is not recommended because frying will seal in the pollutants concentrated in the fat of the fish.

References:

BVRHS 2001. Idaho Behavioral Risk Factors. Bureau of Vital Records and Health Statistics, Idaho Department of Health and Welfare, Boise ID.

EPA 1999. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume I: Fish Sampling and Analysis. 3rd edition – Draft. Office of Water EPA823-R-99-007.

EPA 1994. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume II: Risk Assessment and Fish Consumption Limits. Office of Water EPA823-B-94-004.

EPA 1996. Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories. Volume III: Risk Management. Office of Water EPA823-R-95-00x.

EPA 1995. Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories. Volume IV: Risk Communication. Office of Water EPA823-R-95-001.

EPA, 2000. PCB Risk Assessment Review Guidance Document. Interim draft.

White and Delahunt 2000. March 1 2000 letter to Jim Johnston. State of Washington Department of Health, Office of Environmental Health Assessments. Olympia, Washington.

[ADDENDUM A] - FISH SAMPLE NUMBER RECOMMENDATION

There are two scenarios for making incorrect decisions regarding issuing a fish advisory that have different consequences. The focus of IFCAP is to protect public health; therefore the primary interest is to control the error for not issuing an advisory when advisory is needed.

		Truly Needs	
		Advisory	No Advisory
IFCAP's Decision	Yes	Correct decision	Advisory Not Needed Over Protection, Economical loss
	NO	Advisory Needed Failed to Protect Public Health	Correct decision

IFCAP's statistician utilized historical mercury fish tissue data from the Brownlee Reservoir, randomly sampled "n" data points for 10,000 times (Monte Carlo Analysis, 10,000 trial) from the log-normal distributed initial data set (true mean = 0.34 ppm), and compared the sample mean to mercury action level (action level in ID is 0.3 ppm). The percent chance of the sample mean from the sample size "n" that would result in an incorrect decision is presented in the following table.

Percent chance of error resulting from different sample sizes

Sample number	**% chance of error** (when advisory is needed, but not issued)
n = 5	21.8 %
n = 10	12.4 %
n = 15	7.9 %
n = 20	4.7 %

IFCAP has a certain degree of confidence that this example can be extrapolated and further applied to different types of water bodies and chemicals as long as the fish tissue contaminant concentrations from the selected waters are log-normally distributed (typical for most environmental data). The true mean in this example is relatively close to the contaminant action level and that provides us a protective estimate for the percent chance of error. For the same sample size n, the percent chance of error decreases when the true mean departs further from the action level. In other words, when n = 10 and the action level is lower than 0.3ppm, the percent chance of error would be less than 10%. Therefore, IFCAP recommends collecting 10 fish per species per location for having a 90% confidence of issuing an advisory when needed. Fish should be analyzed individually to obtain variance for each species and size class from each location.

The Washington Department of Health (WDOH) also reviewed historical data from the State of Washington and took a different approach for determining fish sampling number. Based on published mean and standard deviation values for mercury in fish tissue, it was determined by WDOH that 10 specimens from each sub-population of fish would be needed to provide 95% confidence intervals about the mean that were no more than ± 20 -30% of the mean. WDOH considers this sample size necessary to generate useful tissue concentration estimates which can be used with consumption data for a health risk assessment (White and Delahunt 2001). Its recommendation corresponds with IFCAP's decision.

[ADDENDUM B] - FISH PREPARATION TECHNIQUES

Fish Measurement

If the weight and length of fish were not measured on site prior to refrigeration, frozen fish should be measured in the lab using the following method. Maximum body length (head-to-tail length) should be measured rather than fork length. The maximum body length is the length from the anterior-most part of the fish to the tip of the longest caudal fin ray. Frozen fish should be weighed in clean container if they will thaw before the weighing can be completed (unlikely). Liquid from the thawed whole fish sample will come not only from the fillet tissue but also from the gut cavity, which is not part of the final fillet sample. Nevertheless, it is recommended that all liquid from the thawed whole fish sample be kept as part of the sample.

Scaling, Skinning, and Filleting

Fish with scales should be scaled and any adhering slime removed prior to filleting. Fish without scales (e.g., catfish) should be skinned prior to filleting. However, for certain fish species that is known to be canned as a whole (e.g., kokanee), fish head, tail, and internal organs (except kidney) should be removed and the rest of the fish will be analyzed. These methods are recommended because it is believed that they are most representative of the edible portions of fish. Since the fish have been frozen, they should not be allowed to thaw completely prior to filleting. Fish should be thawed only to the point where it becomes possible to make an incision into the flesh. The tissue to be analyzed should be rinsed in deionized distilled water and blotted dry. It is especially important if the tissue were contaminated with material released from inadvertent puncture of internal organs.

Number of Sample Needed

Ideally IFCAP proposes to have a minimum of 10 fish fillets and one whole fish per specie per location analyzed. However, it might not be possible to collect 10 samples for all fish species and every sampling event. In order to provide the most information for all involved agencies (whole fish analyzed for ecological risk assessment), the following adjustments have been made.

- When there are less than 10 fish collected, all fish should be filleted and analyzed; and
- When there are more than 10 fish collected, 10 fish (random sample) should be filleted and one additional fish should be analyzed as a whole.

Note: Number of fish collected per species per location.
Kokanee partial body should be analyzed instead of fillet (see previous description).

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Appendix C: Preliminary Assessment of USGS Mercury Data from Idaho

The following four tables summarize mercury data from Idaho:

- Table C-1 one summarizes the proportion of observations with mercury values above Idaho Department of Health and Welfare, EPA and Idaho Water Quality Standards criteria. The criteria maximum (CMC) and criteria continuous concentrations (CCC) are listed.
- Table C-2 summarizes the USGS unfiltered water sample localities. This table lists 105 sampling localities, provides the number of observations with values above the EPA CMC and the number of years spanned by the period of record and lists the total number of observations for each locality.
- Table C-3 summarizes the USGS filtered water sample localities. This table lists 156 sampling localities, provides the number of observations with values above the EPA CMC and the number of years spanned by the period of record and lists the total number of observations for each locality.
- Table C-4 provides mercury concentration ranges in the IDHW-BEHS fish tissue analyses from five water bodies in Idaho.

Table C-1. Observations with mercury values above Idaho standards.

Criteria	proportion above
IDHW tissue (0.3 ug/g)	0.20
EPA CMC (unfiltered water - 1.4 ug/l)	0.04
EPA CCC (unfiltered water - 0.77 ug/l)	0.07
ID CMC (filtered water - 2.1 ug/l)	0.01
ID CCC (filtered water 0.012 ug/l)	0.39

Table C-2. USGS unfiltered water sample localities.

Station ID	Locality	Obs above EPA CMC/yrs	Total obs
12316800	MISSION CREEK NR COPELAND	0 in 1	5
12318500	KOOTENAI RIVER NR COPELAND	1 in 12	43
12392050	CLARK FORK AT CLARK FORK I	0 in 2	6
12392155	LIGHTNING CREEK AT CLARK F	0 in 1	9
12392300	PACK RIVER NR COLBURN ID	0 in 1	1
12395000	PRIEST RIVER NR PRIEST RIV	0 in 1	1
12395500	PEND OREILLE RIVER AT NEWP	0 in 1	24
12395502	PEND OREILLE RIVER AT US H	1 in 7	56
12413000	NF COEUR D ALENE RIVER AT	1 in 25	76
12413020	SF COEUR D ALENE RIVER AB	0 in 1	24
12413080	SF COEUR D ALENE RIVER NR	2 in 2	15
12413100	BOULDER CREEK AT MULLAN ID	0 in 1	1
12413105	SF COEUR D ALENE RIVER NR	1 in 1	1
12413125	CANYON CREEK AB MOUTH AT W	2 in 1	2
12413130	NINEMILE CREEK AB MOUTH AT	2 in 1	2
12413140	PLACER CREEK AT WALLACE ID	0 in 1	1
12413152	SF COEUR D ALENE R BL LAKE	3 in 1	3
12413175	SF COEUR D ALENE R AT TERR	1 in 1	1
12413250	SF COEUR D ALENE T AT KELL	3 in 8	4
12413300	SF COEUR D ALENE RIVER AT	4 in 2	5
12413470	SF COEUR D ALENE RIVER NR	0 in 2	23
12413490	SF COEUR D ALENE RIVER AT	11 in 9	76
12413600	COEUR D ALENE RIVER AT CAT	3 in 1	3
12413700	LATOUR CREEK ABV BALDY CRE	0 in 1	3
12413810	COEUR D ALENE RIVER AT ROS	8 in 9	117
12413875	ST. JOE RIVER AT RED IVES	0 in 1	7
12414400	EF BIG CREEK NR CALDER ID	0 in 1	2
12414900	ST MARIES RIVER NR SANTA I	0 in 1	1
12415075	ST JOE RIVER AT ST MARIES	0 in 7	32
12415300	MICA CREEK NR COEUR D ALEN	0 in 1	2
12416000	HAYDEN CREEK BL NORTH FORK	0 in 12	33
12417598	SPOKANE RIVER AT LAKE OUTL	0 in 1	10
12419000	SPOKANE RIVER NR POST FALL	2 in 27	131
13037500	SNAKE RIVER NR HEISE ID	0 in 7	33
13057000	SNAKE RIVER NR MENAN ID	0 in 6	53
13057100	SNAKE RIVER NR GRANT ID	0 in 2	35
13060000	SNAKE RIVER NR SHELLEY ID	0 in 6	4
13069500	SNAKE RIVER NR BLACKFOOT I	0 in 1	4
13073120	PORTNEUF/MARSH VALLEY CANA	1 in 1	4
13073743	MARSH CREEK AT RED ROCK PA	1 in 1	4
13073750	MARSH CREEK AT HWY 191 XIN	1 in 1	4
13074810	MARSH CREEK AB HAWKINS CRE	2 in 1	4
13075000	MARSH CREEK NR MCCAMMON ID	0 in 1	4

13075050	MARSH CREEK AB MOUTH NR IN	0 in 1	4
13075910	PORTNEUF RIVER NR TYHEE ID	0 in 1	1
13077000	SNAKE RIVER AT NEELEY ID	1 in 6	66
13081500	SNAKE R NR MINIDOKA ID (AT	1 in 1	10
13082030	SNAKE RIVER NR BURLEY ID	0 in 6	57
13084990	SNAKE RIVER AT HWY 30 BRID	0 in 1	1
13085990	SNAKE RIVER AB MILNER DAM	0 in 1	1
13087900	MILNER LAKE AT MILNER DAM	0 in 11	75
13088020	WRONG NO – TWIN FALLS MAIN	0 in 1	4
13088400	DRY CREEK NR ARTESIAN CITY	0 in 1	2
13088510	COTTONWOOD CREEK NR OAKLEY	0 in 1	2
13092000	ROCK CREEK NR ROCK CREEK I	0 in 1	4
13092710	ROCK CREEK NEAR 3200 EAST	0 in 1	4
13092747	ROCK CREEK AB HWY 30/93 XI	1 in 1	4
13093095	ROCK CREEK NR MOUTH NR TWI	1 in 1	4
13093100	ROCK CREEK AT MOUTH NR TWI	0 in 1	1
13093394	CRYSTAL SPRING AT HEAD NR	0 in 1	1
13093470	CEDAR DRAW AB LOW LINE CAN	1 in 1	1
13093475	CEDAR DRAW BL LOW LINE CAN	0 in 1	3
13093500	CEDAR DRAW NR FILER (OLD S	0 in 1	4
13093530	CEDAR DRAW AB MOUTH NR FIL	0 in 1	4
13116970	BIRCH CREEK NR KAUFMAN GS	0 in 1	2
13116990	BIRCH CREEK AT HWY 28 XING	0 in 1	2
13154500	SNAKE RIVER AT KING HILL I	1 in 8	30
13169500	BIG JACKS CREEK NR BRUNEAU	1 in 11	23
13172850	SNAKE RIVER AT MARSING ID	0 in 9	69
13185000	BOISE RIVER NR TWIN SPRING	0 in 1	1
13204300	BOISE RIVER AB PUMP STATIO	0 in 1	1
13204400	51N STORMDRAIN AT WALNUT	0 in 1	3
13205300	44S STORM DRAIN @ BOISE ST	0 in 1	3
13205505	39N STORM DRAIN AT 9TH STR	0 in 1	3
13205518	43 ST. STORM DRAIN AT GARD	0 in 1	3
13205524	31N STORM DRAIN AT AMERICA	0 in 1	5
13206000	BOISE RIVER AT GLENWOOD BR	0 in 1	1
13213000	BOISE RIVER NR PARMA ID	1 in 10	48
13240000	LAKE FORK PAYETTE RIVER AB	0 in 1	1
13250600	BIG WILLOW CREEK NR EMMETT	0 in 1	1
13269000	SNAKE RIVER AT WEISER ID	1 in 12	59
13289220	SNAKE RIVER BL BROWNLEE DA	0 in 1	1
13289720	SNAKE RIVER AT BROWNLEE DA	0 in 1	11
13293800	SALMON RIVER @ HWY 93 ABV	0 in 6	13
13293900	REDFISH LAKE CREEK BL LAKE	0 in 1	3
13296000	YANKEE FORK SALMON RIVER N	0 in 2	6
13297450	LITTLE BOULDER CREEK NR CL	0 in 1	1
13298000	EF SALMON RIVER NR CLAYTON	0 in 1	1
13303300	LEMHI RIVER NEAR LEADORE I	0 in 1	2
13304185	BIG SPRINGS CREEK BEL BIG	0 in 1	2
13307000	SALMON RIVER NR SHOUP ID	0 in 1	1
13317000	SALMON RIVER AT WHITE BIRD	1 in 8	28
13339500	LOLO CREEK NR GREER ID	1 in 1	5

13341300	BLOOM CREEK NR BOVILL ID	0 in 1	1
13341500	POTLATCH RIVER AT KENDRICK	0 in 1	1
13342450	LAPWAI CREEK NR LAPWAI ID	0 in 1	1
13342500	CLEARWATER RIVER AT SPALDI	1 in 5	19
13344800	DEEP CREEK NR POTLATCH ID	0 in 1	1
13345000	PALOUSE RIVER NR POTLATCH	0 in 1	2
13346800	PARADISE CR AT UNIVERSITY	0 in 1	1
422750/1142512*	HIGH LINECANAL NEAR TWIN	0 in 1	2
473328/1155456*	BEAVER CR. AB FERGUSON CR	0 in 1	2
473732/1155130*	PRICHARD CR AT MURRAY, ID	0 in 1	2
473930/1155301*	EF EAGLE CR ABV FANCY GULC	0 in 1	2
474017/1155306*	WF EAGLE CR ABV NOCELLY GU	0 in 1	2
			1487

*latitude longitude coordinates formatted as: ddmmss/dddmmss

Table C-3. USGS filtered water sample localities.

Station ID	Locality	Obs above EPA CMC/yrs	Total obs
10092700	BEAR RIVER AT IDAHO-UTAH S	2 in 4	8
12316800	MISSION CREEK NR COPELAND	0 in 1	5
12318500	KOOTENAI RIVER NR COPELAND	1 in 13	60
12322000	KOOTENAI RIVER AT PORTHILL	0 in 9	15
12391950	CLARK FORK RIVER BELOW CAB	0 in 5	15
12392000	CLARK FORK AT WHITEHORSE R	0 in 5	15
12392050	CLARK FORK AT CLARK FORK I	0 in 2	17
12392300	PACK RIVER NR COLBURN ID	0 in 1	1
12395000	PRIEST RIVER NR PRIEST RIV	0 in 14	10
12395500	PEND OREILLE RIVER AT NEWP	0 in 3	6
12413000	NF COEUR D ALENE RIVER AT	0 in 13	10
12413080	SF COEUR D ALENE RIVER NR	2 in 1	2
12413100	BOULDER CREEK AT MULLAN ID	0 in 1	1
12413105	SF COEUR D ALENE RIVER NR	1 in 1	1
12413125	CANYON CREEK AB MOUTH AT W	2 in 1	2
12413130	NINEMILE CREEK AB MOUTH AT	1 in 1	1
12413140	PLACER CREEK AT WALLACE ID	0 in 1	1
12413175	SF COEUR D ALENE R AT TERR	2 in 1	2
12413250	SF COEUR D ALENE T AT KELL	1 in 8	2
12413300	SF COEUR D ALENE RIVER AT	3 in 1	5
12413470	SF COEUR D ALENE RIVER NR	0 in 5	17
12413490	SF COEUR D ALENE RIVER AT	3 in 8	4
12413500	COEUR D ALENE RIVER NR CAT	0 in 6	24
12413700	LATOUR CREEK ABV BALDY CRE	0 in 1	3
12413810	COEUR D ALENE RIVER AT ROS	3 in 1	6
12414350	BIG CREEKAB EAST FORK NR	0 in 1	6
12414400	EF BIG CREEK NR CALDER ID	0 in 1	2
12414500	ST JOE RIVER AT CALDER ID	0 in 4	6
12414900	ST MARIES RIVER NR SANTA I	0 in 11	5
12415075	ST JOE RIVER AT ST MARIES	0 in 1	1
12415300	MICA CREEK NR COEUR D ALEN	0 in 1	2
12416000	HAYDEN CREEK BL NORTH FORK	0 in 11	51
12417598	SPOKANE RIVER AT LAKE OUTL	0 in 1	1
12419000	SPOKANE RIVER NR POST FALL	0 in 13	15
13037500	SNAKE RIVER NR HEISE ID	0 in 16	68
13038500	SNAKE RIVER AT LORENZO ID	0 in 5	12
13055000	TETON RIVER NR ST ANTHONY	0 in 4	8
13056500	HENRYS FORK NR REXBURG ID	0 in 5	11
13057000	SNAKE RIVER NR MENAN ID	0 in 1	1
13057100	SNAKE RIVER NR GRANT ID	0 in 1	1
13058000	WILLOW CREEK NR RIRIE ID	0 in 4	8
13060000	SNAKE RIVER NR SHELLEY ID	0 in 19	14
13068500	BLACKFOOT RIVER NR BLACKFO	0 in 6	24
13069500	SNAKE RIVER NR BLACKFOOT I	0 in 18	16
13069532	CRYSTAL WASTE NR SPRINGFIE	0 in 1	3
13069540	DANIELSON CREEK NR SPRINGF	0 in 1	2
13069565	ABERDEEN WASTE NR ABERDEEN	0 in 1	3

13073120	PORTNEUF/MARSH VALLEY CANA	0 in 1	1
13073743	MARSH CREEK AT RED ROCK PA	0 in 1	1
13073750	MARSH CREEK AT HWY 191 XIN	0 in 1	1
13074810	MARSH CREEK AB HAWKINS CRE	0 in 1	1
13075000	MARSH CREEK NR MCCAMMON ID	0 in 15	13
13075050	MARSH CREEK AB MOUTH NR IN	0 in 1	1
13075500	PORTNEUF RIVER AT POCATELL	0 in 5	12
13075700	SF POCATELLO CREEK NR POCA	0 in 1	1
13075909	PORTNEUF RIVER AT SIPHON R	0 in 1	1
13075910	PORTNEUF RIVER NR TYHEE ID	0 in 7	15
13075960	ROSS FORKNR FORT HALL ID	0 in 1	3
13075983	SPRING CREEK AT SHEEPSKIN	0 in 1	2
13076200	BANNOCK CREEK NR POCATELLO	0 in 1	2
13076500	AMERICAN FALLS RES AT AMER	0 in 1	2
13077000	SNAKE RIVER AT NEELEY ID	0 in 1	3
13081500	SNAKE R NR MINIDOKA ID (AT	0 in 5	11
13087900	MILNER LAKE AT MILNER DAM	0 in 2	23
13087995	SNAKE RIVER GAGING STATION	0 in 1	4
13088000	SNAKE RIVER AT MILNER ID	0 in 3	8
13090000	SNAKE RIVER NR KIMBERLY ID	0 in 5	12
13091500	BLUE LAKES OUTLET NR TWIN	0 in 13	5
13093000	ROCK CREEK BELOW POLELINE	0 in 5	12
13094000	SNAKE RIVER NR BUHL ID	0 in 5	12
13095200	BRIGGS CREEK NR BUHL ID	0 in 5	2
13108150	SALMON FALLS CREEK NR HAGE	0 in 5	12
13108900	CAMAS CREEK AT RED ROAD NR	0 in 4	8
13113000	BEAVER CREEK AT SPENCER ID	0 in 4	8
13117000	BIRCH CREEK NR RENO ID	0 in 1	1
13117020	BIRCH CREEK AT BLUE DOME I	0 in 1	1
13119000	LITTLE LOST RIVER NR HOWE	0 in 1	1
13122000	THOUSAND SPRINGS CREEK NR	0 in 1	1
13124030	HAMILTON SPRINGS NR MACKAY	0 in 1	1
13127000	BIG LOST RIVER BL MACKAY R	0 in 4	8
13132500	BIG LOST RIVER NR ARCO ID	0 in 1	1
13132520	BIG LOST RIVER BL INEEL DI	0 in 13	4
13136500	WARM SPRINGS CR AT GUYER H	0 in 1	1
13141000	BIG WOOD RIVER NR BELLEVUE	0 in 5	11
13150430	SILVER CREEK AT SPORTSMAN	0 in 4	8
13152500	MALAD RIVER NR GOODING ID	0 in 4	8
13154500	SNAKE RIVER AT KING HILL I	0 in 18	67
13168500	BRUNEAU RIVER NR HOT SPRIN	0 in 4	8
13169500	BIG JACKS CREEK NR BRUNEAU	0 in 20	31
13172500	SNAKE RIVER NR MURPHY ID	0 in 4	8
13172800	LITTLE SQUAW CREEK TRIB NR	0 in 1	2
13172850	SNAKE RIVER AT MARSING ID	0 in 2	22
13185000	BOISE RIVER NR TWIN SPRING	0 in 4	9
13203510	BOISE R BL DIVERSION DAM N	0 in 4	8
13206000	BOISE RIVER AT GLENWOOD BR	0 in 6	23
13210050	BOISE RIVER NR MIDDLETON I	0 in 4	8
13211440	INDIAN CREEK AT CALDWELL I	0 in 1	1

13213000	BOISE RIVER NR PARMA ID	0 in 22	50
13213100	SNAKE RIVER AT NYSSA OR	0 in 4	8
13235000	SF PAYETTE RIVER AT LOWMAN	0 in 4	8
13239000	NF PAYETTE RIVER AT MCCALL	0 in 4	7
13240000	LAKE FORK PAYETTE RIVER AB	0 in 1	1
13245000	NF PAYETTE RIVER AT CASCAD	0 in 5	12
13250600	BIG WILLOW CREEK NR EMMETT	0 in 1	1
13251000	PAYETTE RIVER NR PAYETTE I	0 in 4	11
13266000	WEISER RIVER NR WEISER ID	0 in 4	8
13269000	SNAKE RIVER AT WEISER ID	0 in 23	58
13294500	SALMON RIVER AT STANLEY ID	0 in 1	1
13295000	VALLEY CREEK AT STANLEY ID	0 in 1	7
13296500	SALMON RIVER BL YANKEE FOR	0 in 3	11
13297300	HOLMAN CREEK NR CLAYTON ID	0 in 1	1
13297320	PAT HUGHES CREEK NR CLAYTO	0 in 1	1
13297330	THOMPSON CREEK NR CLAYTON	0 in 1	3
13297350	BRUNO CREEK NR CLAYTON ID	0 in 3	10
13297355	SQUAW CREEK BL BRUNO CREEK	0 in 1	3
13297380	SALMON RIVER AB EAST FORK	0 in 2	10
13297396	WEST PASS CREEK NR CLAYTON	0 in 1	1
13297400	EF SALMONRIVER BL BOWERY	0 in 1	2
13297404	GERMANIA CREEK NR CLAYTON	0 in 1	1
13297425	EF SALMON RIVER BL WICKIUP	0 in 2	10
13297440	LTL BOULDER CREEK AB BAKER	0 in 7	27
13297445	L BOULDER C BL BO. CHAIN L	0 in 7	28
13297450	LITTLE BOULDER CREEK NR CL	0 in 9	33
13297480	BIG BOULDER CR AT LIVINGST	0 in 7	29
13297485	JIM CREEK AT LIVINGSTON MI	1 in 4	29
13297500	BIG BOULDER CREEK NR CLAYT	0 in 2	5
13297600	HERD CREEK NR CLAYTON ID	0 in 1	1
13298000	EF SALMON RIVER NR CLAYTON	0 in 9	12
13298400	BAYHORSE CREEK NR CHALLIS	0 in 1	1
13298500	SALMON RIVER NR CHALLIS ID	0 in 3	11
13301535	SULPHUR CREEK AT ROAD XING	0 in 1	1
13301595	PATTERSON CREEK BL INYO CR	0 in 1	1
13301600	PATTERSON CREEK AT PATTERS	0 in 1	1
13301700	MORSE CREEK AB DIV NR MAY	0 in 1	1
13302005	PAHSIMEROI RIVER AT ELLIS	0 in 4	8
13302500	SALMON RIVER AT SALMON ID	0 in 4	8
13305000	LEMHI RIVER NR LEMHI ID	0 in 4	8
13306500	PANTHER CREEK NR SHOUP ID	0 in 6	13
13313000	JOHNSON CREEK AT YELLOW PI	0 in 4	8
13316500	LITTLE SALMON RIVER AT RIG	0 in 4	8
13317000	SALMON RIVER AT WHITE BIRD	0 in 20	73
13336300	GEDNEY CREEK NR SELWAY FAL	0 in 1	6
13338500	SF CLEARWATER RIVER AT STI	0 in 4	8
13339500	LOLO CREEK NR GREER ID	0 in 1	5
13341300	BLOOM CREEK NR BOVILL ID	0 in 1	1
13341500	POTLATCH RIVER AT KENDRICK	0 in 1	1
13342450	LAPWAI CREEK NR LAPWAI ID	0 in 13	9

13342500	CLEARWATER RIVER AT SPALDI	0 in 15	57
13343100	CLEARWATER RIVER AT 18TH S	0 in 1	11
13344800	DEEP CREEK NR POTLATCH ID	0 in 1	1
13345000	PALOUSE RIVER NR POTLATCH	0 in 13	9
13346800	PARADISE CR AT UNIVERSITY	0 in 1	1
473328/1155456*	BEAVER CR. AB FERGUSON CR	0 in 1	2
473732/1155130*	PRICHARD CR AT MURRAY, ID	0 in 1	2
473930/1155301*	EF EAGLE CR ABV FANCY GULC	0 in 1	2
474017/1155306*	WF EAGLE CR ABV NOCELLY GU	0 in 1	2
			1550

*latitude longitude coordinates formatted as: ddmmss/dddmmss

Table C-4. IDHW-BEHS fish tissue analyses from five water bodies in Idaho.

Date	Location	Species	Hg Range (mg/kg)	No. of Fish	% above 0.3
2001	Boise R. @ Gleenwood Bridge	brown trout	0.13 - 0.14	2	0
2001	Boise R. @ Gleenwood Bridge	sucker	0.12 - 0.54	8	25
2001	Boise R. @ Gleenwood Bridge	mountain whitefish	0.0 - 0.15	8	0
4/20/1994	Brownlee Reservoir	black crappie	0.08 - 0.8	19	16
1971	Brownlee Reservoir	bluegill	0.6	1	100
4/6/1994	Brownlee Reservoir	carp	0.22 - 0.6	14	71
4/20/1994	Brownlee Reservoir	channel catfish	0.17 - 0.67	47	55
4/11/1995	Brownlee Reservoir	crappie	0.25 - 0.95	15	87
1971	Brownlee Reservoir	largemouth bass	0.37	1	100
1997	Brownlee Reservoir	largescale sucker	0.11	1	0
4/5/1994	Brownlee Reservoir	rainbow trout	0.13 - 0.21	7	0
1997	Brownlee Reservoir	smallmouth bass	0.29 - 0.86	32	97
1971	Brownlee Reservoir	northern pikeminnow	0.73	1	100
1971	Brownlee Reservoir	sucker	0.3	1	100
4/20/1994	Brownlee Reservoir	white crappie	0.16 - 0.94	24	75
4/14/1995	Brownlee Reservoir	yellow perch	0.26 - 0.63	15	80
2001	CJ Strike Main Reservoir	rainbow trout	0.0 - 0.17	11	0
2001	CJ Strike Main Reservoir	smallmouth bass	0.1 - 0.24	10	0
1998	Lake Lowell	bluegill	0.02 - 0.08	18	0
1999	Lake Lowell	carp	0.042 - 0.36	38	18
1999	Lake Lowell	catfish	0.05 - 0.52	4	25
1998	Lake Lowell	crappie	0.03 - 0.03	2	0
1998	Lake Lowell	largemouth bass	0.02 - 0.22	16	0
1999	Lake Lowell	smallmouth bass	0.03 - 0.36	35	3
1999	Lake Lowell	sucker	0.03 - 0.515	40	30
1999	Lake Lowell	yellow perch	0.03 - 0.06	5	0
2001	Salmon Falls Creek Res.	kokanee	0.17 - 0.25	2	0
2001	Salmon Falls Creek Res.	rainbow trout	0.0 - 0.24	11	0
2001	Salmon Falls Creek Res.	smallmouth bass	0.44 - 0.66	2	100
2001	Salmon Falls Creek Res.	walleye	0.25 - 1.08	12	92
2001	Salmon Falls Creek Res.	yellow perch	0.2 - 0.48	10	80
				412	

Appendix D: Common Fish Species by Region

According to the *Idaho Department of Fish and Game* (IDFG) Southwest Region fishery biologist and local fisheries biologists at CH2M HILL, there is no standardized system for organizing fish species into trophic levels. Therefore, before target species are selected, the fish species identified by the IDFG Regional Fisheries Biologist should be categorized into a standardized trophic level system. The table below provides a preliminary list of fish species by water system that are most prevalently caught and consumed within Idaho.

In addition, regionally stocked populations will not be targeted for monitoring because they would represent only a relatively short period of exposure to ambient conditions. IDFG provides a comprehensive list of where and when fish are stocked on a statewide basis (http://imnh.isu.edu/digitalatlas/geog/fishery/fishyfr.htm and http://fishandgame.idaho.gov/fish/stocking/). Thus, these species will not be targeted for collection as determined in consultation with the Regional Fisheries Biologist.

Panhandle Region	
Lakes and Rivers	• Cutthroat trout – diverse predator/planktivore/insectivore • Brook trout – zooplanktivore/insectivore
High/Mountain Lakes	• Kokanee – plankton eater • Large mouth bass- predator • Bullhead – bottom feeders • Northern pike- top level predator • Lake trout - zooplanktivore/insectivore
Lowland Lakes	• Yellow perch- primarily planktivore • Black crappie • Bullhead catfish – predator/opportunistic • Channel catfish - predator/opportunistic
Clearwater Region	
Lakes and Rivers	• Small mouth bass - predator • Channel catfish - predator/opportunistic • Whitefish (not prevalent)- benthic feeder • Chinook (anadromous) • Steelhead (anadromous)
High/Mountain Lakes	• Trout - zooplanktivore/insectivore • Kokanee – plankton eater

Lowland Lakes	• Crappie • Blue gill bass • Rainbow trout (hatchery) – zooplanktivore/insectivore
Upper Snake Region	
General Area	• Trout (Brown and Rainbow) - zooplanktivore/insectivore • Yellow perch - primarily planktivore • Kokanee – plankton eater • Suckers (occasionally)
Magic Valley Region	
General Area	• Bass – predator • Walleye – • Perch -primarily planktivore
Salmon Region	
General Area	• Steelhead (anadromous) • Cutthroat trout- zooplanktivore/insectivore • Rainbow trout- zooplanktivore/insectivore
High/Mountain Lakes	• Cutthroat trout– zooplanktivore/insectivore • Rainbow trout– zooplanktivore/insectivore • Golden trout– zooplanktivore/insectivore • Grayling • Eastern brook trout– zooplanktivore/insectivore
Lowland Lakes	• Rainbow trout– zooplanktivore/insectivore • Eastern brook trout– zooplanktivore/insectivore
Southwest Region	
General Area	• Black and White crappie • Channel catfish- predator/opportunistic • Small mouth bass- predator • Yellow perch- primarily planktivore • Trout (hatchery) – zooplanktivore/insectivore
McCall Subregion (part of Southwest Region)	
General Area	• Steelhead (anadromous) • Chinook (anadromous)
Lowland Lakes	• Large and small mouth bass- predator • White and black crappie • Catfish- predator/opportunistic • Rainbow trout (stocked) – zooplanktivore/insectivore
High/Mountain Lakes	• Rainbow trout (hatchery) – zooplanktivore/insectivore • Cutthroat trout– zooplanktivore/insectivore

Appendix E: List of Recommended Low-Level Analytical Laboratories

Idaho does not provide certification for its mercury program. However, other states (including Wisconsin and Florida) have developed lists of commercial and other laboratories that meet the performance criteria for low-level mercury Method 1631 and Method 245.1/245.7.

Laboratory	**EPA Method**
Idaho Bureau of Laboratories 2220 Old Penitentiary Road Boise, Idaho 83712 (208) 334-2235	245.1
Northern Lake Service 400 North Lake Avenue Crandon, WI 54520 (715) 478-2777	245.7 mod, 1631
S-F Analytical Laboratories 6125 West National Avenue Milwaukee, WI 53214-3255 (414) 474-6700	245.1
En Chem, Inc. 1090 Kennedy Ave. Kimberly, WI 54136 (920) 469-2436	1631

Frontier Geoscience 1631
414 Pontius Avenue N Suite B
Seattle, WA 98109
(206) 622-6960

Battelle Marine Sciences 1631
1529 West Sequim Road
Sequim, WA 98382
(360) 681-3650

Brooks Rand LTD 1631
3950 Sixth Avenue NW
Seattle, WA 98107
(206) 632-6206

North Shore Analytical, Inc. 1631
5612 Miller Trunk Hwy, Suite 1
Duluth, MN 55811
(218) 729-4658

STL - North Canton 1631
4101 Shuffel Drive NW
North Canton, OH 447 20
(330) 966 –9281

Appendix F: Clean Sampling Techniques for Low-Level Sampling

The Florida Department of Environmental Protection has developed the following guidelines for clean sampling techniques for low-level mercury sampling (http://www.dep.state.fl.us/water/wastewater/merc.htm *).* Additional information can be found in *DEP-SOP-001/01: FS 8200 Clean Sampling For Ultratrace Metals in Surface Waters* and *EPA Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Level*s (EPA-821-R-96-011).

> "Clean sample handling techniques should be used when collecting samples for low-level mercury analysis to preclude false positives arising from sample collection, handling, or analysis. Because FS 8200 and Method 1669 are performance-based procedures, sample collection personnel may modify these procedures or eliminate steps if the modification does not lead to unacceptable contamination of samples or blanks. Any modifications should be thoroughly evaluated and demonstrated to be effective before field samples are collected. This may be accomplished through documentation of uncontaminated samples, equipment blanks and/or other quality control samples.
>
> In order for a permittee to justify a claim that any reported mercury is due to outside contamination, a blank must have been collected. For this reason, permittees should consider collecting at least one blank at each site for each day a sample is collected. If more than one sample is collected in a day, at least one blank for each 10 samples collected on that day should also be collected. The blank may either be an equipment blank or a field blank. Once a permittee demonstrates the ability to collect samples from a given site using an established procedure that prevents contamination, the permittee may choose to decrease the number of blanks being taken..
>
> Field blanks should be collected only if no equipment other than the sample container is used to collect samples. If the sampling procedure involves the use of additional equipment, such as a peristaltic pump and pump tubing, equipment blanks should be collected. All blanks are subject to the same preservation, digestion, and analysis protocols as regular samples and should have a concentration at least five times lower than the sample concentration. The permittee may not subtract field blank concentrations when reporting sample results.
>
> Sample collection, preservation, and shipping requirements should be discussed with contract laboratories to ensure the requirements of Method 1631E are met."

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Appendix G: Procedures for Determining Aquatic Life Criteria RPTE and Establishing Numeric Permit Limits for Mercury

Determining Aquatic Life RPTE

The necessary RPTE statistical analysis compares the mercury concentration in a facility's effluent to the ambient stream concentration to determine whether the effluent may cause or contribute to an exceedance of aquatic life water quality standards. The determination of RPTE is a critical component of the process of setting permit limits. If the discharge either causes, has the reasonable potential to cause, or contributes to an excursion that exceeds water quality criteria or a narrative standard, a limit must be set (40 CFR 122.44 (d)(1)). If it is shown that a RPTE is present, the permit must include *water quality-based effluent-limits* (WQBELs) for mercury.

To determine if reasonable potential exists, the characteristics and variability of the effluent and receiving stream are evaluated to determine the effluent mercury concentration that can be discharged and still maintain the water quality standards. RPTE will be calculated based on steady-state modeling assumptions.

Wasteload Allocations

A WLA equation is a steady-state mass balance using single-point values for effluent and receiving water flows, receiving water background values, and the selected criterion. The WLA is set up to calculate the allowable discharge concentration to maintain the criterion. The general mass balance, steady-state equation used for calculating the WLA for mercury discharged to receiving waters (river, stream, or uni-directional reservoir) is shown in Equation G-1:

$$\text{WLA} = \frac{(WQC * (Q_e + (Q_r * M)) - (C_r * Q_r * M))}{Q_e}$$

Equation G-1. WLA Equation.

Where:

WLA = Wasteload allocation for a point source discharge, calculated separately for each type of WQC (i.e., acute, chronic) concentration

WQC = Water quality criterion, concentration

Q_e = Effluent design flow

Q_r = Receiving water design flow

C_r = Background concentration in the receiving water

M = Fraction of receiving water flow allowed for mixing (25 percent criteria default, mixing zones can be used provided the other limiting conditions are met as defined in IDAPA 58.01.02.060.01)

Types of WLAs include:

WLA_a = WLA for aquatic life acute WQC

WLA_c = WLA for aquatic life chronic WQC

For discharges to lakes and multi-directional reservoirs, Equation G-2 applies:

$$WLA = (D + 1)(WQC) - D * C_r$$

Equation G-2. WLA for discharges to lakes and multi-directional reservoirs.

Where:

D = Dilution factor at mixing zone boundary (no default mixing zones exist for lakes and multi-directional reservoirs, should be determined on case-by-case basis by DEQ)

WQC = Water quality criterion, concentration

C_r = Background concentration in the receiving water

Water Quality Standards

Currently, EPA’s 2002 aquatic life water quality criteria for mercury are 1.4 µg/L for acute and 0.77 µg/L for chronic. DEQ is electing to reserve both the acute and chronic criterion pending ongoing Section 7 consultation with NOAA Fisheries and U.S. Fish and Wildlife. If these values change, the most current standards should be used in the RPTE process.

Receiving Water Flows

The values for Q_r (receiving water design flow) for the WLA calculations depending on the type of WQC being considered as follows,:

- *Q_r for Acute WQC*. The minimum 1-day flow that occurs once in 10 years on average (1Q10), or, if sufficient information is available to calculate a biologically based receiving water design flow, the flow that prevents an excursion from the criterion or secondary value using a duration of 1 day and a frequency of less than once every 3 years (1-day, 3-year biological flow or 1B3).
- *Q_r for Chronic WQC*. The minimum 7-day flow that occurs once in 10 years on average (7Q10) or, if sufficient information is available to calculate a biologically based receiving water design flow, the flow that prevents an excursion from the criterion or secondary value using a duration of 4 days and a frequency of less than once every 3 years (4-day, 3-year biological flow or 4B3).

Receiving Water Background Concentrations

The default background concentration for Idaho is calculated as the geometric mean of the data. The geometric mean is specified as the default value for estimating the central tendency of the background concentrations. The geometric mean is appropriate for this purpose because typically environmental data (including mercury) are log-normally distributed (Grigal 2002). (If distributions are more nearly normal, the geometric and arithmetic means are numerically similar.)

In the event that no receiving water data are available, EPA typically recommends that background concentrations be set to zero in the RPTE calculations (EPA 1991). This application is protective because surface water data collected in Idaho since 1995 indicate that typical mercury concentrations in receiving waters are less than 0.025 µg/L (USGS 2004)—levels that are much lower than current aquatic life criteria (1.4 µg/L for acute). (Unpublished data from the Lower Boise River show concentrations in the 0.002-0.008 µg/L range.)

Effluent Design Flows

The effluent design flow for RPTE WLA calculations is defined in this guidance as the following, based on the Wisconsin baseline:

- **Municipalities.** The annual average design flow for the facility unless it is demonstrated that this is not representative of projected flows. Exceptions might include, but are not limited to, high-growth areas and those with design capacities well in excess of flows anticipated during the permit duration. These exceptions should be implemented on a case-by-case basis using the permit writer's best professional judgment (BPJ).
- **Industrial Discharges.**
    - For calculations related to aquatic life chronic and human health criteria—the actual annual average flow that represents normal operations
    - For calculations related to acute aquatic life criteria—the maximum effluent flow, expressed as a daily average, that represents normal operations

DEQ may also consider a projected increase in effluent flow that will occur when production is increased or modified or another wastewater source is added to an existing facility.

For seasonal or intermittent discharges, the effluent design flow is to be determined on a case-by-case basis.

RPTE Evaluation

A reasonable potential to exceed a criterion is present if *any* one of the following apply:

- The effluent concentration for any day exceeds $\text{WLA}_{\text{acute}}$

- The arithmetic average discharge concentration for any consecutive 4 days exceeds $\text{WLA}_{\text{chronic}}$
- At least 11 effluent data points are reported above[39] the MDL and the upper 99th percentile (P_{99}) of the:
    - Daily discharge concentration exceeds $\text{WLA}_{\text{acute}}$
    - Four-day average discharge concentration exceeds $\text{WLA}_{\text{chronic}}$
- Fewer than 11 effluent data points are reported above the MDL, the maximum effluent value multiplied by the Reasonable Potential Multiplier (RMP) [for the 95 percent probability basis and 95 percent confidence limit, using a coefficient of variation (CV) of 0.6] exceeds any of the WLAs.

If numeric mercury limits are required because of the RPTE process, setting these limits will depend on the RPTE pathway. That is, numeric permit limits based on the fish tissue criterion may be different from numeric permit limits based on aquatic life criteria. If both types of data are available, permit limits will be calculated using both RPTE analyses. The more conservative of the two derived permit limits will become the final permit limit.

Establishing Fish Tissue Based Numeric Limits

As outlined in Chapters 5 and 6, additional methylmercury monitoring may be conducted to confirm that fish tissue levels are above 0.3 mg/kg. If this is the case, and the additional data confirm impairment, then permit limits will be based on the percent reduction required to achieve the 0.3 mg/kg.

For example, if average watershed fish tissue mercury concentrations are determined to be 0.40 mg/kg, this would mean that water concentration of mercury would need to be reduced by 30 percent (25 percent to improve from 0.40 to 0.30 mg/kg, plus another 5 percent reduction as an explicit margin of safety).

To simplify the application of a fish tissue value to water column-based effluent limits, this would effectively mean that levels of mercury in the effluent would be required to be reduced by 30 percent, as well.

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[39] If non-detect data are observed and an approved analytical method was used, Idaho will follow the convention recommended in EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1, (Section 9.1.2, EPA 2000a). This convention recommends using one-half of the MDL for non-detects in calculating mean values. This guidance also recommends that measurements that fall between the MDL and the *Method Quantitation Limit* (MQL) be assigned a value of the MDL plus one-half the difference between the MDL and MQL. If the analytical methods used are not the approved methods, all values reported less than the MDL should be discarded from the dataset.

Establishing Aquatic Life (Water Column) Numeric Limits (WQBELS)

Water quality based effluent limits (WQBELs) calculations shown below are in accordance with Chapter 5 of the Technical Support Document (EPA 1991). WQBELs for acute and chronic criteria are calculated using the *Long-Term Average* (LTA) of the effluent concentration that will meet the acute and chronic WLAs (LTAa, LTAc).

$$\mathrm{LTA}_a = \mathrm{WLA}_a \text{ x } \mathrm{EXP}(0.5\,\sigma^2 - \mathrm{Z}_{99}\sigma)$$

$$\mathrm{LTA}_c = \mathrm{WLA}_c \text{ x } \mathrm{EXP}(0.5\sigma^2{}_n - \mathrm{Z}_{99}\sigma_n)$$

Where:

EXP = Base e (or approximately 2.718) raised to the power shown between the parentheses

σ^2 = LN(CV^2 + 1)

σ = Square root of σ^2

$\sigma^2{}_n$ = LN[CV^2/(n + 1)]

σ_n = Square root of $\sigma^2{}_n$

Where:

LN = Natural logarithm (base e)

CV = Coefficient of variation = s/m

Where:

m = Mean of samples above the LOD in data set = ΣXi/k

s = Standard deviation of the samples above the LOD in data set
= $[\Sigma(X_I - m)^2/(k-1)]^{0.5}$

X_i = Each individual data point

k = Total number of samples in data set

n = 4 for 4-day chronic criteria, and 30 for 30-day chronic criteria

Z_{99} = Z score for the 99th percentile probability basis = 2.326

The lowest LTA (LTAa or LTAc) is used to calculate the Maximum Daily Limit (MDL) and the Average Monthly Limit (AML). The MDL and AML are calculated from the following formulas shown below.

$$\mathrm{MDL} = \mathrm{LTA}_{\mathrm{low}} \text{ x } \mathrm{EXP}(Z_{99}\sigma - 0.5\sigma^{2})$$

$$\mathrm{AML} = \mathrm{LTA}_{\mathrm{low}} \text{ x } \mathrm{EXP}(Z_{95}\sigma_{n} - 0.5\sigma^{2}{}_{n})$$

Where:

EXP = Base e (or approximately 2.718) raised to the power shown between the parentheses

σ^2 = $\mathrm{LN}(CV^2 + 1)$
σ = Square root of σ^2

$\sigma^2{}_n$ = $\mathrm{LN}[CV^2/(n + 1)]$

σ_n = Square root of $\sigma^2{}_n$

Where:

CV = Coefficient of variation = s/m

m = Mean of samples above the LOD in data set = $\Sigma Xi/k$

s = Standard deviation of the samples above the LOD in data set
= $[\Sigma(X_I - m)^2/(k-1)]^{0.5}$

X_i = Each individual data point

k = Total number of samples in data set

LN = Natural logarithm (base e)

n = number of samples per month

Z_{99} = Z score for the 99th percentile probability basis = 2.326

Z_{95} = Z score for the 95th percentile probability basis = 1.645

The TSD (Table 5-2), provides LTA multipliers for different CVs that can be used instead of calculating $\mathrm{EXP}(Z_{99}\sigma - 0.5\sigma^2)$ and $\mathrm{EXP}(Z_{95}\sigma_n - 0.5\sigma^2{}_n)$. However, these tables range from CVs equal to 0.1 to 2.0 and show only CVs to the 0.1 place. Therefore, table multipliers should not be used if the CV is other than an exact value given in the table.

Generally, numeric permit limits are expressed as both MDL and AML.

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Guidance Index