DEVELOPMENT OF AMBIENT WATER QUALITY CRITERIA FOR MERCURY

A REPORT TO THE

JOINT STANDING COMMITTEE ON NATURAL RESOURCES

BY

THE DEPARTMENT OF ENVIRONMENTAL PROTECTION

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EXECUTIVE SUMMARY

The 1997 annual report of the Land and Water Resources Council, Appendix A entitled 'Mercury in Maine' published in January 1998, reviewed studies that document statewide mercury contamination of fish. The current fish consumption advisory, revised August 2000, includes all fresh waters in Maine and several species of marine fish. Studies have also determined that Maine's loons are being affected by mercury.

The 1997 report led to additional reports and legislation all oriented toward reduction of mercury contamination. Most recently, PL 1999 Chapter 500 section 6 required that "the Department of Environmental Protection shall develop proposed statewide criteria for mercury that are protective of human health, aquatic life, and wildlife".

In completion of this task, the Department of Environmental Protection (DEP) has utilized a two-stage process. Stage 1 focused on derivation of a science based criterion. Stage 2 consists of a policy and implementation strategy including available control technology and compliance.

In Stage 1, DEP reviewed all of the old and new United States Environmental Protection Agency (EPA) criteria as well as those from all New England states and some other states wrestling with the same issue. DEP then convened a meeting of the Surface Waters Ambient Toxics (SWAT) monitoring program Technical Advisory Group. They suggested two approaches that ultimately recommended similar criteria. Following EPA's new (January 8, 2001) ambient criterion, DEP recommends not a water criterion, but a Fish Tissue Residue Criterion (TRC), corresponding to the Bureau of Health's fish tissue action levels. Translation of the TRC into an equivalent instream water concentration that would be the basis for wastewater effluent limits would be accomplished by dividing the TRC by a Maine derived interim bioaccumulation factor (BAF). Although the equivalent instream water concentration would likely be below the background concentration in Maine's rivers and streams, there is a statewide fish consumption advisory at current background concentrations, and reductions are necessary.

Since a significant source of mercury to Maine's waters is likely atmospheric deposition of mercury from 'away', it will take a combination of local, statewide and national control strategies to make significant reductions in mercury contamination. DEP recognizes that it will be difficult and

perhaps impossible for many point source wastewater discharges to meet the new criterion, at least in the short-term; therefore, Maine needs a flexible management strategy that moves all facilities toward compliance in a reasonable and effective manner. Consequently, in Stage 2, DEP has sought input from potentially affected dischargers and other stakeholders on the recommended criterion. DEP presented the proposed criterion at the Maine Rural Water Association annual meeting on December 5, 2000 in Freeport. DEP then hosted a meeting for all interested parties on December 15, 2000 at which most parties agreed on a conceptual approach of pollution prevention, that will be developed by amending existing rule, Chapter 519.

Currently 38 MRSA section 420(1)(A) requires that "After October 1, 2001, a person, firm, corporation or other legal entity may not discharge mercury or any compound containing mercury, whether organic or inorganic, in any concentration that increases the natural concentration of mercury in the receiving waters". DEP recommends that this section be repealed and section 420(2)(A) be amended to include mercury that will be controlled with other toxic pollutants "at the levels set forth in federal water quality criteria as established by the United States Environmental Protection Agency pursuant to the Federal Water Pollution Control Act, Public Law 92- 500, Section 304(a), as amended". A new section 420(1-A)(E) would give municipal treatment plants authority to require reductions of mercury from their users. Other parts of 420(1) were attempts to control mercury discharges at various times and are dated, inconsistent and no longer effective. DEP proposes several other changes to bring this section up-to-date and make it coherent and comprehensive.

In 2001 DEP will be adopting the new EPA 304(a) criteria for all toxic pollutants by amending existing DEP rule at Chapter 530.5. The new EPA TRC for mercury encourages states to adopt site-specific criteria. **DEP will propose to adopt a statewide site-specific TRC and a methodology of deriving an empirical BAF to use in translation of the TRC to an instream water concentration to be used in development of effluent limits.** All facilities that cannot comply with the calculated effluent limits, would continue to use the interim limits recently established and would need an aggressive Pollution Prevention Plan with a minimum set of Best Management Practices (BMPs). Facilities would be placed into tiers by based on their impact on instream mercury concentrations and those farther from meeting the TRC will have a longer list of BMPs to conduct.

INTRODUCTION

Mercury contamination was first discovered in lake trout from Allagash Lake in the North Maine Woods in 1978 and confirmed in 1981 (Akielaszek and Haines, 1981), but as there were no known sources of mercury, no action was taken at that time. In 1992, the Maine Department of Inland Fisheries and Wildlife, University of Maine, and US Fish and Wildlife Service found the highest level of mercury ever reported in bald eagles from Chesuncook Lake (USF&WS, 1992; Welch, 1994). A study of mercury contamination of fish, snow, and peat moss across the New England states and Atlantic Canada showed increasing mercury levels on a gradient of NE to SW across the region (Mower, 1994). A comprehensive study of 125 Maine lakes in 1993-4 documented mercury contamination throughout Maine (Mower et al, 1997), and lead to issuance of a statewide fish consumption advisory for lakes by the Maine Bureau of Health in 1994.

Since then, additional studies under the Surface Waters Ambient Toxics (SWAT) monitoring program have documented similar contamination of fish from rivers and streams and estuaries (Sowles et al, 1996). As a result, the current fish consumption advisory, revised August 2000, includes all fresh waters in Maine and several species of marine fish.

Studies funded by Maine Outdoor Heritage Fund have also determined that 28% of Maine's loons are considered at risk based on levels of mercury reported to cause reproductive effects in laboratory studies (BRI, 1999). Additional studies under the SWAT program have documented a 50% reduction in the number of young hatched by adults with the highest levels of mercury (BRI, 2000). To determine a possible cause of population declines, studies of mercury contamination of mink and otter are now underway as part of the SWAT program as well.

BACKGROUND

The objective of the US Clean Water Act (CWA) is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters". National goals include 1 elimination of discharges into navigable waters, 2 interim achievement of fishable swimmable waters, and 3 prohibition of the discharge of toxic pollutants in toxic amounts. Fishable means that not only does water quality have to be suitable to support fish populations, but that the fish be safe to eat in unlimited quantities. Presence of fish consumption advisories indicates non-attainment of the water quality standards.

Section 307 of the CWA requires EPA to publish a list of toxic pollutants and section 304a requires EPA to publish ambient water quality criteria (AWQC) for the toxic pollutants listed. Federal Water Quality Standards regulations require states to develop Water Quality Standards (WQS) that include designated uses, criteria to protect those uses, and an anti-degradation statement. While criteria may be narrative or numeric, 1987 amendments to the CWA require states to adopt numerical AWQC for those toxics for which EPA has published criteria and that prevent attainment of state water quality standards. Failure to do so has resulted in promulgation of such criteria for other states by EPA.

Maine complied with this requirement by adopting EPA's AWQC by rule in 1989. Challenged on the basis of procedural grounds, the AWQC were then adopted by statute by reference in 1990. For those human health criteria based on cancer endpoints, the criteria needed level of acceptable risk to be specified, which was accomplished by DEP rule, Chapter 530.5 in 1994, except for dioxin for which no risk level was adopted at that time.

Mercury was not subject to the AWQC but rather had its own narrative criterion (38 MRSA section 420(1)(A)) since 1971, that prohibited mercury to be discharged above quantities that would cause an increase in natural concentrations in the receiving waters, except for certain grandfathered discharges, of which there was one known. The amounts allowed to be discharged by this exception was further restricted in 1998. In 1999 the whole section was temporarily repealed until October 1, 2001 and dischargers held to current discharge levels of mercury in the meantime (38 MRSA sec 420(1)&(1-A)).

The 1997 annual report of the Land and Water Resources Council, Appendix A entitled 'Mercury in Maine' published in January 1998, established a 'strategic and preliminary action plan'. The Action Plan has led to additional reports and legislation all oriented toward reduction of mercury contamination in Maine.

Most recently, PL 1999 Chapter 500 section 6 required that "the Department of Environmental Protection shall develop proposed statewide criteria for mercury that are protective of human health, aquatic life, and wildlife. In developing the criteria the department shall consider all available information, including standards developed by other states, the Great Lakes region and the United States Environmental Protection Agency and any information provided by the Department of Human Services,

Bureau of Health. The department shall submit its recommendations to the joint standing committee of the Legislature having jurisdiction over natural resources matters by January 15, 2001, together with any implementing legislation. The joint standing committee of the Legislature having jurisdiction over natural resources matters may report out legislation regarding mercury to the First Regular Session of the 120th Legislature."

DEP PROCESS

In development of proposed statewide criteria for mercury and a management strategy for implementation, DEP has utilized a two stage process, focusing on 1 development of science-based criteria and then 2 on policy and a compliance strategy.

In stage 1, DEP reviewed all of the EPA criteria as well as those from all New England states and other states wrestling with the same issue. DEP then convened a meeting of the SWAT Technical Advisory Group, that suggested two approaches ultimately recommending essentially the same criteria (see Appendix 1 for meeting summary and Appendix 6 for individual comments).

DEP recognizes that it will be difficult and perhaps impossible for many facilities to meet this criterion, at least immediately, and needs a management strategy that moves all facilities toward compliance in a reasonable and effective manner. Consequently, in stage 2, DEP has sought input from potentially affected dischargers and other stakeholders on the recommended criterion. DEP presented the proposed criterion at the Maine Rural Water Association annual meeting on December 5 in Freeport. DEP then hosted a meeting for all interested parties on December 15 at which general consensus was reached on a conceptual approach (see Appendix 2 for meeting summary and Appendix 6 for individual comments).

DEVELOPMENT OF SCIENCE-BASED CRITERIA

There are several parts to the ambient water quality criteria (AWQC). There are both freshwater and saltwater acute and chronic aquatic life criteria designed to protect the survival, growth, reproduction, and overall health of aquatic ecosystems. There is a human health criterion for 'organisms only' designed to protect humans who consume contaminated fish. There is a 'water and organisms criterion' designed to protect humans who drink water and eat fish from waters contaminated with mercury. And there is a consideration for fish-eating wildlife species. Although all of the criteria need to be met, the lowest is usually the controlling criterion. But sometimes exposure scenarios are different, and any of the criteria may be the controlling one. For example, during storm events, a short-term occurrence, the acute aquatic life criterion is used, as the chronic aquatic life criterion is not applicable even though it is lower than the acute criterion. And for saltwater discharges, the 'organism only' criterion is used, despite the fact that it is higher than the 'water and organisms' criterion, since no one drinks salt water.

In stage 1, DEP reviewed all of the EPA criteria. There are several ambient water quality criteria (AWQC) for mercury published by EPA at different times (Table 1). A comprehensive set of AWQC for pollutants, including mercury, was published by EPA in 1986. In 1994 EPA promulgated more modern mercury criteria for the Great Lakes states under the Great Lakes Initiative (GLI), that included for the first time an AWQC based on protection of wildife. In 1995 EPA published the 1995 Updates, which adopted the GLI criteria for freshwater aquatic life as its recommendation for every state, but which did not include the wildlife based criterion. In the 1998 Mercury Study Report to Congress, EPA recommended a new and improved wildlife AWQC. However, when a new compilation of criteria was published December 10, 1998 and April 22, 1999, although the GLI freshwater aquatic life and new human health criteria were included, again there was no wildlife based criterion. Recent discussions with EPA headquarters staff in charge of developing new criteria indicate that EPA is planning on formally developing wildlife criteria in the near future.

EPA has recently (January 8, 2001) revised its recommended criteria and has taken a different approach. Rather than publishing an ambient water criterion, EPA has published a fish tissue residue criterion (TRC). EPA has also published implementation guidance that specifies how states may translate

the fish tissue criterion into an acceptable instream water concentration (AIWC) by dividing the criterion by a bioaccumulation factor (BAF). The acceptable AIWC can then be used in developing waste discharge permit effluent limits. EPA will be publishing recommended BAFs for states to use. The guidance also allows states to develop their own site-specific BAFs for use with the criterion.

AWQC published initially in 1986 are currently in effect for all New England states except Maine and Massachusetts (Table 1). Massachusetts automatically adopts the newest EPA published criteria and therefore had adopted the 1999 version and presumably now has adopted the 2001 version. Maine currently has none because the 1999 legislation repealed, until after October 1, 2001, section 420(1)(A), which prohibits a discharge of mercury that causes an increase in natural concentrations in the receiving water. In the meantime interim discharge limits have been set at historical levels to prevent an increase while Maine develops new criteria. Michigan, Minnesota, Wisconsin, and New York all have the GLI criteria for those watersheds draining to the Great Lakes. For other waters New York's wildlife criterion is 2.6 ppt, twice that of the GLI. However, New York's human health criterion is 0.7 ppt based on fish consumption. Wisconsin is waiting for results of current studies of loons before it develops a wildlife based number for its other waters. New Jersey is in the process of using EPA's GLI protocols to develop its own wildlife based criterion.

During the SWAT TAG meeting, two proposals were made, both recommending similar criteria. One proposal was to adopt the wildlife value recommended in EPA's 1998 Mercury Study Report to Congress, 0.9 ppt total mercury. The second proposal was to follow EPA's new approach and adopt a fish tissue criterion and administratively apply a BAF to translate to an AIWC that can be used to determine effluent limits in waste discharge permits. Although each recommendation protects a different use, wildlife and human health, the lowest criterion would be controlling.

Table 1.

Adopting EPA's new criterion, DEP would propose something like the following:

- The Maine Bureau of Health has developed Fish Tissue Action Levels, equivalent in concept to EPA's fish tissue residue criterion, for the protection of human consumers of mercury contaminated fish (Appendix 3). The lowest action level, that for limited consumption by sensitive populations (women of childbearing age and children under 8 years of age), is 0.2 ppm. The criteria were developed using standard EPA procedures and the EPA reference dose recently validated by the National Academy of Sciences report (NRC, 2000). DEP would recommend adoption of the Bureau of Health Fish Tissue Action Level as the human health Fish Tissue Residue Criterion (TRC).

- The Bureau of Health has also developed a range of BAFs from Maine data (Appendix 4). In order to ensure protection of the majority of Maine's citizens who may wish to eat fish from Maine's waters, DEP would use the Maine derived upper 95 percentile confidence limit BAF of 1,000,000 to develop an AIWC for use in determining effluent limits.

- Dividing the TRC by the BAF would result in an AIWC of 0.2 ppt as follows:

$$AIWC = TRC/BAF = 0.2 \text{ ppm}/1{,}000{,}000 = 0.0000002 \text{ ppm} = 0.2 \text{ ppt}$$

Although this level is below the background concentration in Maine's rivers and streams (4.5 ppt), it must be remembered that there is a statewide fish consumption advisory at current background concentrations, and reductions are necessary.

POLICY AND IMPLEMENTATION STRATEGY

Because atmospheric deposition is the primary source of mercury to many waterbodies in the US, flexibility is needed in designing control programs to meet water quality criteria (EPA, 2001). Atmospheric deposition mostly from out of state is thought to be primary source of mercury to Maine's waters also. Nevertheless, point sources and other activities do contribute some mercury to systems already overloaded and need to be controlled as much as possible. It will be difficult if not impossible for all dischargers of strictly municipal wastewater to meet the proposed criterion, at least initially. The Association of Metropolitan Sewerage Agencies (AMSA) has completed a report about mercury levels in municipal wastewater, a summary of which is reprinted below.

AMSA's Evaluation of Domestic Sources of Mercury

For many parts of the country, publicly owned treatment works (POTWs) are being faced with, or will soon be faced with, very low mercury effluent limits, due to application of very stringent water quality criteria. Many agencies are concerned that compliance will require the application of advanced treatment, and that these kinds of costly controls may not have much impact on resolving water quality issues. EPA believes that by using new analytical and sampling techniques and pollution minimization, POTWs should have no difficulty in attaining these more stringent requirements. EPA's conclusions in large part are based on a 1994 mercury sampling project that showed four of nine wastewater treatment plants had non-detectable mercury levels. This approach, however, assumes that there is no background mercury concentration in domestic wastes. Until recently there has been very little information on domestic waste concentrations, mainly due to a lack of monitoring at a sufficiently low level.

To better understand the relative contributions of mercury in domestic wastes and potential source control options, the Association of Metropolitan Sewerage Agencies initiated a study to collect information on concentrations of mercury in domestic wastewater, to identify the sources of mercury in domestic wastewater, and to evaluate the feasibility of controlling those mercury sources. Sources evaluated included common household products and food items, as well as research on mercury contributions from individuals with amalgam fillings.

The results of this study offer some important observations for sources of mercury in domestic wastewater and the feasibility of effective control options, and will soon be available in a final report from AMSA. The major findings:

- Significant amounts of mercury at the average concentration of 138 ng/L were consistently found in domestic wastewater in various parts of the country. This was wastewater that contained no industrial or commercial inputs, but included wastes from dentist offices.

- Several common household and toiletry items were found to contain substantial concentrations of mercury when examined using sensitive analytical techniques. Although these products individually do not contribute a lot to a total concentration in wastewaters, their cumulative effect accounts for approximately 15% of the mercury concentration in domestic wastewater. The feasibility of controlling these sources would require a national effort.

- Although several sources contributing to the domestic mercury concentrations have been identified, human wastes (feces and urine) from amalgam loaded individuals are believed to be the most significant source (> 80%).

- These results were corroborated by the results from chemical toilet and septic wastes that showed that a significant portion of the mercury in domestic wastewater is from uncontrollable sources such as dental amalgam fillings.

- While controlling human wastes is impractical, the long-term outlook is promising inasmuch as the trend in dental health is for fewer cavities and resulting in smaller and smaller populations of amalgam-loaded individuals over time.

Based on this information, domestic waste contributes appreciable concentrations of mercury to POTW influent wastestreams and must be considered when addressing mercury control strategies and the likelihood of virtual elimination of mercury. Background mercury concentrations averaging more than 100 ng/L can be expected in POTW wastewater influents, even if complete elimination of industrial point source discharges is accomplished.

In EPA's cost analysis for the Great Lakes Water Quality Initiative, and in subsequent discussions with wastewater

representatives, the Agency has supported the use of pollutant minimization programs as a way for achieving compliance. AMSA strongly endorses and promotes pollution minimization efforts, but is concerned that these efforts may not be adequate to produce the desired level of permit compliance sought by regulatory authorities, highlighting the need for a national compliance strategy for POTWs.

DEP agrees with the AMSA concept of using pollutant minimization as a means for moving toward compliance and feels that there must be strong incentives and an aggressive schedule to catalyze significant progress. DEP proposes to accomplish such through existing administrative authority and continuing with modifications of the current DEP rule, Chapter 519: "Interim Effluent Limitations and Controls for the Discharge of Mercury".

DEP is exploring a number of administrative procedures that could be used to ensure that as long as facilities met the license limits and conditions, they would be exempt from enforcement against the new TRC. Each facility must have an aggressive Pollution Prevention Plan approved by DEP with a minimum set of required activities or Best Management Practices (BMPs). The pollution prevention activities/BMPs would be developed in modifications to Chapter 519 that would be created using a stakeholder process led by DEP. In these rule changes, DEP would propose to segregate the dischargers into various tiers, based on their interim mercury limit or the facility's impact on the receiving water concentration of mercury. DEP would then establish pollution prevention activities that would need to be undertaken by facilities in each tier. Due to the diverse nature of the municipalities and industries that would be affected by the mercury effluent limit rule, flexibility will need to be built into the proposed regulation. The goal of the new regulations will be to establish a process to incrementally lower the amount of mercury discharged. The activities to be undertaken by the facilities would be developed into categories and facilities would be able to select from the choices in each category. The categories might be something like the following:

Educational Activities

Education sessions for staff to address customer questions
Pamphlets
Articles in newspapers
Regular columns in local or regional newspapers

Informational mailings to businesses by category
(metal fabrication, wood products facilities etc)
Conference or technical session for sewer customers

Technical Assistance Activities

Provide in-house training to staff to look for opportunities
Encourage businesses, sewer users, to develop their own pollution prevention plan to support the work being done at the waste water facility
Provide work sessions with customers to assist them in doing pollution prevention (how to audit facility, what to look for, questions to ask, etc)
Perform a walk through of one of the customer's facilities using business people from around the community

These activities will rely on a commitment from both the waste water facility and the regulated businesses and general public. Any and all efforts would be based on the standard hierarchy of pollution prevention activities which is as follows;

Substitution
Change work practices
Close loop recycling
Recycling
Treatment
Disposal

This hierarchy has an increasing amount of liability and regulation for the business as one moves down through the list of activities outlined above. The proposed regulations would seek to design tiers of dischargers and allow them the flexibility to choose activities from a list that is associated with their level of discharge. The higher their discharge limit, the more activities that would have to be undertaken.

Each category would have to contain activities that would apply to both large and small municipalities and industries. This will provide a significant challenge to the developers of the rule, those stakeholders, due to the diverse nature of the businesses and communities located in Maine.

COMPLIANCE

The current Chapter 519 contains provisions for responding to instances of non-compliance with effluent limits for mercury. DEP will revise these to include the tiered pollution prevention responses discussed above. DEP may also use its enforcement authority for facilities that fail to undertake required mercury reduction activities or BMPs specified in their license.

PROPOSED LEGISLATION

Currently 38 MRSA section 420(1-A)(A) requires that "after October 1, 2001, a person, firm, corporation or other legal entity may not discharge mercury or any compound containing mercury, whether organic or inorganic, in any concentration that increases the natural concentration of mercury in the receiving waters". DEP recommends that this section be repealed and section 420(2)(A) be amended to include mercury that will be controlled with other toxic pollutants 'at the levels set forth in federal water quality criteria as established by the United States Environmental Protection Agency pursuant to the Federal Water Pollution Control Act, Public Law 92- 500, Section 304(a), as amended'.

In 2001 DEP will be adopting the new EPA 304(a) criteria by amending existing DEP rule at Chapter 530.5, considered a routine technical rule-making. The new EPA criterion for mercury recommends that states adopt site-specific criteria. Maine will propose to adopt a TRC at or near 0.2 ppm and a methodology of deriving an empirical BAF to use in translation of the TRC to an AIWC and effluent limits. A new section 420(1-A)(E) is also proposed that would give municipal treatment plants the authority to require reductions in mercury discharge to their facilities by upstream users. Other parts of 420(1-A) are attempts at various times to address this problem and therefore are dated, inconsistent and no longer effective. DEP proposes several other changes to bring this section up-to-date and make it coherent and comprehensive. A copy of the proposed changes is attached (Appendix 5).

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APPENDIX 1.

SUMMARY OF AMBIENT WATER QUALITY CRITERIA FOR MERCURY SWAT TECHNICAL ADVISORY GROUP MEETING

November 3, 2000

SUMMARY OF AMBIENT WATER QUALITY CRITERIA FOR MERCURY SWAT TECHNICAL ADVISORY GROUP MEETING
November 3, 2000
Attendees:

SWAT committee: Stewart Holm, Harry Russell, Terry Haines, Nick Bennett, Bill Zarolinski
Staff: Barry Mower (DEP), Andrew Smith (DHS), Eric Fromberg(DHS), Hal Winters (DMR)
Other: Vivian Matkivich(MWWCA), Gerry Kamke (MRWA)

Barry Mower handed out an agenda that was an outline of issues to be discussed as attached. He then gave an overview of the requirement from the legislature to produce a report with a recommendation for an ambient water quality criterion (AWQC) for mercury and any necessary implementing legislation by January 15, 2001. He also discussed federal Clean Water Act (CWA) goals, requirements for water quality standards, which include both narrative and numeric criteria in Maine statutes and rules. Amendments to the CWA in 1997 required states to adopt numeric AWQC for toxic pollutants. EPA criteria include aquatic life criteria for both freshwater and saltwater (acute and chronic), and human health criteria (organisms only and water and organisms). It is also DEP's belief that there needs to be consideration for wildlife as well. Maine first adopted EPA's AWQC by rule in 1989 and the legislature adopted the AWQC in 38 MRSA section 420(2)(A) in 1990. It is DEP's position that US EPA AWQC that were recommended on August 13, 1997, the last time DEP made changes to Chapter 530.5, are Maine's current criteria.

Barry then read 5 possible options listed on the agenda.
There was then discussion of an attached table which gave various versions of EPA AWQC, the GLI (Great Lakes Initiative) criteria, EPA's criteria on 8/13/97, a wildlife criterion from EPA's 1998 Mercury Study Report to Congress, and current EPA recommended AWQC (4/22/99). It was pointed out by Nick that this table was incomplete in that there are human health criteria in the Mercury Study Report to Congress. Nick and Stewart also questioned the statement made by Barry in earlier emails and again today that EPA has a new approach which is to develop a fish tissue action level rather than water criteria. We decided to question EPA again on this issue.

Next followed a lengthy discussion of the human health issue with a presentation of analyses of Maine fish and water mercury

data by Andy and Eric. The discussion focused on development of a statewide BAF, bioaccumulation factor, that could be applied to the Bureau of Health's Fish Tissue Action Level for mercury (0.2 ppm) in order to develop an AWQC for human health. Terry felt that there is not a consistent relationship between total mercury and fish tissue and that methylmercury water concentrations are too variable with time and dependent on site-specific conditions to develop a BAF for Maine. Although a BAF for total to fish for Hodgdon Pond and Seal Cove Pond (300,000?) at Acadia National Park were close to estimates calculated by Andy and Eric (400,000-600,000), Terry felt BAF's for other lakes might be much lower. BAFS based on methylmercury to fish concentrations were on the order off 800,000-10,000,000. Andy pointed out that in risk assessment an order of magnitude is as good as we often achieve and usually acceptable. Andy also pointed out that since the route of exposure is through the food, then temporal fluctuations in water concentrations get dampened out. Terry agreed.

Andy proposed that we adopt a human health criterion of 1 ng/l based on BOH's FTAL (0.2 mg/kg) divided by a BAF of 600,000 assuming consumption of 32 g/d fish by the 95th percentile of anglers as determimned from DIFW's 199? Survey of fish consumption in Maine. Bill questioned what this means if background is higher. Barry replied maybe it means DEP would recommend that Maine keep the current law (38MRSA section 420) that requires allows no discharge that increases the natural concentration of mercury in the receiving waters.

Barry asked for other recommendations. Terry suggested that maybe no AWQC should be developed, but instead follow the dioxin issue and focus on using an Above/Below test. Not discussed at the meeting but important is the fact that DEP has not yet succeeded to develop a suitable Above/Below test for dioxin.

Finally there was a brief discussion of wildlife criteria. Nick proposed that Maine adopt the criteria in the 1998 Mercury Study Report to Congress. There were no other suggestions, but Stewart made the comment that since it is below background in Maine, it doesn't matter.

Bill asked what would happen if these criteria could not be met. Barry replied that was an issue for the next meeting which will be open to any interested party and not restricted to discussion of development of a science based recommendation as was this meeting.

AMBIENT WATER QUALITY CRITERIA FOR MERCURY
SWAT TECHNICAL ADVISORY GROUP MEETING
November 3, 2000

AGENDA

1. Task-to recommend an ambient water quality criterion (AWQC) for mercury

2. Background
   - CWA- goals, fishable swimmable
     - WQS=
       - designated uses fishable, swimmable, habitat,
       - criteria,
         - narrative DO , pH, E coli
         - numeric-NTPTA
       - Antidegradation
     - 1987 amendments numeric criteria for toxics
     - EPA AWQC, Gold Book
   - Maine- Statutes similar to CWA
     - WQS=statutes + rules
     - Rule AWQC 1989
     - 38 MRSA Sec 420(2)A AWQC 1990
     - Chapter 530.5,Surface Water Toxics Control Program 1994,

3 EPA AWQC
   - Aquatic life
     - Freshwater- CMC and CCC
     - Saltwater- CMC and CCC
   - Human health
     - Organisms only
     - Water and organisms
     - Drinking water MCL and MEGs are different
   - Wildlife

4 Maine AWQC current version Aug 13, 1997-table
   - 2000 law allows current discharges to continue

5 Options for AWQC
   - a. keep current version-out of date
   - b. GLI-for only Great Lakes states
   - c. EPA 1999- no wildlife number

d. EPA new fish tissue action level by December, but we have our own, guidance final this week
e. Other states
f. Invent our own mix and match
    Aquatic life
    Human health-BAF for Maine??
    Wildlife-GLI vs Hg study report
        What are the differences?

APPENDIX 2

SUMMARY OF MERCURY AMBIENT WATER QUALITY CRITERION STAKEHOLDERS MEETING

DECEMBER 15, 2000

SUMMARY OF DECEMBER 15, 2000 MERCURY AMBIENT WATER QUALITY CRITERION STAKEHOLDERS MEETING

Attendees: see attached list

Agenda
1. INTRODUCTIONS (5 MIN)
2. STATEMENT OF THE PURPOSE OF THE MEETING (5 MIN)
3. LEGISLATIVE REQUIREMENTS (5 MIN)
4. BACKGROUND (5 MIN)
5. DEP PROCESS AND PROGRESS- (10 MIN)
   EPA
   SWAT MEETING-RECOMMENDATION
   MRWA MEETING, TODAY'S MEETING
6. PRESENTATIONS BY ANYONE (45 MIN TOTAL, MAX 10 MIN EACH)
7. GENERAL DISCUSSION (30 MIN)
8. NEXT STEPS (15 MIN)
9. ADJOURN

Barry Mower of DEP conducted the meeting with assistance from the other DEP staff. The agenda was followed relatively closely. Introductions were made initially and those that arrived late introduced themselves to the group. A sign-in sheet was circulated which most, but not everyone, signed.

Mower then stated that the purpose of the meeting was primarily to hear from those present about the issue in general, DEP's progress so far, and what should be done next.

The requirement of PL 1999 Chapter 500 section 6, to 'develop proposed statewide criteria for mercury that are protective of human health, aquatic life, and wildlife' was then discussed briefly.

Mower then briefly reviewed the background of the need for an ambient water quality criterion (AWQC) following a handout outlining key requirements of state and federal laws and regulations. The conclusion was that Maine is required to have numerical AWQC for mercury, and could not simply adopt them as goals, as has been suggested by some. And it is DEP's position that, because there is a statewide fish consumption advisory based on mercury, Maine needs such criteria.

Next DEP's process for meeting the legislative mandate was outlined. DEP has followed a two step process, focusing on 1. scientific/technical issues and 2. policy and compliance. In

step 1, DEP sought existing criteria from EPA, the other New England states, and other states progressively addressing this issue. Then DEP held a meeting November 3, 2000 with the Surface Water Ambient Toxics (SWAT) monitoring program Technical Advisory Group (TAG). During that meeting two proposals were made, each recommending an AWQC in the range of 0.1-1 ng/l (ppt-part per trillion). Andy Smith, State Toxicologist, gave a brief summary of the derivation of one recommendation based on the Bureau of Health's Fish Tissue Action Level and an Maine empirically derived bioaccumulation factor (BAF). A summary of that meeting was distributed to attendees at this meeting as well as to others in the meantime. Step 2 was this meeting in which DEP sought imput from all interested parties.

Next the agenda allowed time for formal presentations, but as there were none, we immediately launched into an open discussion. Mower said that it was DEP's position that the current mercury AWQC was the one EPA had published before August 13, 1997, the last time Chapter 530.5 of the DEP's rules was amended. Bill Taylor said that 38 MRSA section 420(1) addresses mercury separately and that there is currently no numerical AWQC for mercury. DEP does not disagree.

Sandy Perry was concerned that adoption of an AWQC places the burden on dischargers for a problem that might not be primarily theirs, and suggested that only a narrative criterion be developed.

Taylor did agree that a numerical AWQC was probably required and suggested that facilities be licensed using the interim effluent limits recently developed. Facilities that accomplished certain pollution prevention and reduction activities specified by the DEP, would be exempt from enforcement of causing or contributing to exceedance of the AWQC.

David VanWie developed the idea further, and suggested that DEP might consider a statewide TMDL for mercury with a compliance schedule for those facilities that would not be in compliance with the new AQWC. Facilities could be placed in categories depending on the level of mercury in their discharge. All facilities would have to do some things to lower the level of mercury in their discharge to come into compliance with the AWQC. Those with higher levels would have a longer list of things to do.

Analeis Hafford said that we must consider that background is higher than the proposed limit. She also asked how DEP would

handle spikes and storm events, to which Dennis Merrill replied that there have not been many and DEP considers frequency of violations in its enforcement.

Nick Bennet was concerned that we not diminish the significance or need for an AWQC just because background concentrations in Maine's rivers and streams is higher than the recommended AWQC, feeling that it is important to remember the legislative mandate to develop criteria protective of human health, aquatic life, and wildlife. He stated that he thought that many facilities were close and could meet the criteria, and stated that NRCM favors source reduction over waste treatment and would not object to an approach something like that proposed by VanWie. In fact NRCM is working with hospitals to reduce their contribution of mercury to the wastestreams.

Representative Scott Cowger asked if POTWs couldn't just pass restrictions back to their contributors through the pretreatment program. Vivian Matkivich replied that for Lewiston Auburn as well as for most strictly municipal treatment plants, most of the mercury comes from households, which are exempt from the pretreatment program, and that there is not much assimilative capacity left for industry.

Bill Zarolinski reminded all that there is no safe amount of mercury. There is pending EPA rule-making that may not allow dilution with the receiving water to meet an AWQC and that there is treatment to reduce mercury levels, although quite complex and costly.

Bruce Nicholson thought that maybe the existing law of no discharge would be preferred over the proposed AWQC. He asked about the need for a different AWQC for marine discharges. Mower replied that there are fish consumption advisories for marine fish as well, so we need to decrease discharges there as well. While mercury is methylated to a lesser degree in salt water, we can't quantify the difference. DEP's position is that like, BPT, all facilities should strive to reduce, but if categories of POTWs are adopted, marine dischargers might be in one all their own.

Brad Moore asked about atmospheric deposition that could cause influent to POTW's to cause an exceedance of the AWQC. Mower replied that Maine's 4 Mercury Deposition Network stations show that mercury levels in rain are greater than background levels in rivers and streams, since some mercury is bound to the soils.

Brad mentioned a problem with spikes when cleaning the sewers of historical accumulations.

Doug Barton asked about development of site-specific criteria (SSC). Mower replied that use of a Maine BAF was in fact a statewide SSC, and that we don't have the data to support dozens of SSC in Maine.

Chris Hall asked about how to accommodate new sources, but thought that overall VanWie's idea was a good beginning.

The meeting concluded with DEP stating that it would now draft a report to the legislature and agreeing to share the draft with anyone so interested as much as time permits.

DEP MERCURY AWQC MEETING DECEMBER 15, 2000 ATTENDEES

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APPENDIX 3.

Bureau of Health Fish Tissue Action Levels

Bureau of Health Fish Tissue Action Levels
Updated: 1/29/01

Following USEPA's three volume Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, (EPA 1993, 1997) the Maine Bureau of Health uses action levels as a guide to determine the need for developing fish consumption advisories. Action levels are concentrations of a contaminant in fish tissue below which there should be negligible risk of toxicity at a consumption rate of one meal a week. Action levels may be developed for several different toxicological endpoints (cancer, developmental, and other non-cancer effects). Concentrations of contaminants in fish tissue are compared to the appropriate action levels. When fish tissue concentrations exceed action levels, the development of Fish Consumption Advisories are considered. This document briefly describes the derivation of fish tissue action levels and includes a tabulated summary of chemical specific fish tissue action levels currently in use by the Bureau of Health. For more details on risk based approaches for developing fish consumption advisories consult EPA's three volume Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories (EPA 1993, 1997).

Derivation of Action Levels for Noncarcinogenic Toxicological Endpoints

Fish Consumption Advisories based on noncarcinogenic toxicological endpoints are set at a level believed to represent a minimal risk of a deleterious effect from lifetime exposure even for sensitive subpopulations. It is assumed that noncarcinogenic toxicological endpoints have a threshold response (i.e., there is a dose below which toxic effects will not occur). Fish Consumption Advisories are set such that total exposure from eating on average one 8 ounce fish meal per week will result in a daily dose below the threshold.

The equation (EPA 1997) for determining action levels for noncancer toxicological endpoints is:

$$AL = \frac{(RfD \times BW)}{FC}$$

Where,

AL = Action Level (mg/kg)
RfD = Reference Dose (mg/kg-day)
BW = Body Weight (kg)
FC = Fish Consumption Rate (kg/day)

The *reference dose* (**RfD**) is defined by the EPA (1997) as an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure level (mg/kg-day) for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. The value of the RfD is chemical and toxicological endpoint specific. The lower the value of the RfD, the more toxic the substance.

USEPA maintains databases of RfDs the Agency has derived over the years. USEPA's premier database for toxicological data including RfDs is called IRIS (Integrated Risk Information System). RfDs listed on IRIS have undergone an Agency wide review and are viewed as USEPA's preferred toxicological data. RfDs for chemicals not listed in the IRIS database can sometimes be found in the USEPA's Superfund Program HEAST (Health Effects Assessment Summary Tables) database. USEPA's Office of Pesticide Programs (OPP) also maintains a database for RfDs and other toxicological data for pesticides. It is the Maine Bureau of Health's preference to look first to IRIS as a source for toxicological data, followed by HEAST and OPP listings. Absent toxicological data on IRIS, HEAST, or OPP databases, the Bureau of Health will consider other sources (such as the Agency for Toxic Substances and Disease Registry *Minimal Risk Levels*) or derive RfDs directly from the primary toxicity data following standard risk assessment methods as described in USEPA Guidance (EPA 1997). Additionally, the Bureau of Health may derive RfDs if existing USEPA RfDs are considered outdated or do not reflect important new information.

The estimated *body weight* (**BW**) of the exposed individual is required in the action level calculation since the RfD is expressed on a "per kilogram body weight" basis. The average body weight for adult males and females combined is assumed to be 70 kilograms (kg). For adult females, the average body weight is assumed to be 60 kg. These values are supported by the following sources:

- EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (1993) recommends a mean body weight of 70 kgs for all adult and a body weight of 65 kgs for adult females.

- EPA's Draft Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (1999b) recommends a mean body weight of 72 kgs for all adult and a body weight of 65 kgs for adult females. It further recommends a value of 64 kgs for women of reproductive age.

- EPA's Exposure Factors Handbook (1999a) recommends an adult body weight of 71.8 kgs. Body weights for women in various age groups include 65.4 kgs for women 18 to 75; 60.6 kgs for women 18 to 25; and 64.2 for women 25 to 35.

The 70 kg adult general population body weight is used for all action level calculations except for chemicals in which the RfD is based on reproductive or development effects. The 60 kg adult female body weight is used for calculating action levels for reproductive and developmental toxicants. The Bureau of Health plans to review these values when EPA's draft guidance becomes finalized.

A *fish consumption rate* (**FC**) of one eight ounce (227 grams) meal per week is used to derive action levels (EPA 1997). One fish meal per week is equivalent to an average daily fish consumption rate of 0.0324 kg/day. This consumption rate is an upper estimate of sport fish consumption and is supported by the following sources.

- EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (EPA 1997) recommends a meal size of eight ounces (227 grams) as an average meal size for adults in the general population eating noncommercial caught fish.

- This same guidance (EPA 1997) also recommends a consumption rate of 0.0065 kg/day in calculating action levels, but states this value is under review. The new draft guidance (EPA 1999b) has increased the consumption rate to 0.016 kg/day for recreational fishers. They explicitly state, however, that these are recommended default rates and when local consumption rate data are available they should be chosen preferentially.

- EPA's Exposure Factors Handbook (EPA 1999a) recommends a consumption rate of 0.025 kg/day as a 95th percentile value for recreational anglers. This is based several individual studies of Maine and Michigan sports anglers (Ebert et al. 1993; West et al. 1989 and West et al. 1993).

- The 95th percentile values from these individual studies range from 0.026 kg/day for Maine anglers (Ebert et al. 1993 and Chemrisk 1992) to 0.039 kg/day for Michigan anglers (West 1989).

Based on this data, it is judged that a meal size of 0.0324 kg/day is conservatively representative of an upper level fish ingestion rate for Maine recreational anglers.

Derivation of Action Levels for Carcinogenic Effects

Fish Consumption Advisories based on cancer effects are set at a level believed to represent a minimal risk of cancer from a lifetime of exposure. The Bureau of Health estimates a lifetime of 70 years (EPA 1993). There is data that suggests the upper bound estimate of residency for a particular location may be 30 years (EPA 1999a), however, the same source acknowledges that the majority of moves are less than 100 miles from the previous residence. This suggests that while an estimate of residency may only be 30 years, one may still live within commuting distance to favorite fishing sites.

Carcinogens are assumed to act in a non-threshold manner - in that any amount of exposure to a carcinogen can cause an increase in risk. Historically, incremental lifetime risk levels that have received regulatory attention range from 1 in 10,000 to 1 in 1,000,000 (EPA 1997). The Maine Bureau of Health has historically based Fish Consumption Advisories on a 1 in 100,000 Acceptable Risk Level[1] for individual chemicals.

The equation for determining action levels for cancer effects is:

$$AL = \frac{(RSD \times BW)}{FC}$$

[1] Acceptable Risk Level is the terminology used by EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (EPA 1997). Other EPA documentation identifies this as the Incremental Lifetime Cancer Risk.

Where,

AL = Action Level (mg/kg)
BW = Body Weight (kgs)
FC = Fish Consumption Rate (kg/day)
RSD = Risk Specific Dose (mg/kg-day)

and,

$$RSD = \frac{ARL}{CSF}$$

Where,

ARL = Acceptable Risk Level (unitless)
CSF = Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$

Body weight and fish consumption rate are previously defined. The acceptable risk level is defined above as (1 in 100,000).

The *cancer slope factor* (**CSF**) is derived by USEPA, usually but not always, as the 95th percent upper confidence limit of the low-dose linear slope of the dose response curve and is expressed in units of $(mg/kg\text{-}day)^{-1}$. The CSF is most often derived from studies of laboratory animals, traditionally by application of dose-response models that assume no threshold for carcinogenic effects (i.e., any dose, no matter how small, will result in some risk) and allow for linearity in response at low dose. The value of the CSF is chemical-specific. The greater the value of the CSF, the greater the carcinogenic potency of the substance.

As with RfDs, IRIS is viewed as the primary database for obtaining estimates of cancer slope factors, with HEAST and OPP databases being used in the absence of an IRIS value. As with RfDs CSF's can be derived using standard EPA (1997) methodologies.

Action Levels

The following table identifies current action levels used by the Maine Bureau of Health for screening evaluations.

Environmental Toxicology Program, Maine Bureau of Health

UPDATED: 12/00

FISH TISSUE ACTION LEVELS FOR SCREENING EVALUATIONS (Fillet, wet weight).					
	Reference D (RfD) (mg/kg/	Cancer Pote Factor (C (mg/kg/d)$^{-1}$	Risk Specific D (RSD) (mg/kg/d)	Cancer Act Level (µg/kg)	NonCancer Act Level (µg/kg)
Chlorinated Biphenyls, Diox and Furans				(ppb)	(ppb)
PCBs	$2.0X10^{-5}$	2	$5.0 X 10^{-6}$	11	43
Dioxin [a]	$1.0 X 10^{-9}$	14000	$7.1 X 10^{-10}$	0.0015	0.0019
Chlorinated Pesticides				(ppb)	(ppb)
Hexachlorobenzene	$8.0 X 10^{-4}$	1.6	$6.3 X 10^{-6}$	14	1728
Heptachlor	$5.0 X 10^{-4}$	4.5	$2.2 X 10^{-6}$	5	1080
Aldrin	$3.0 X 10^{-5}$	17	$5.9 X 10^{-7}$	1.3	65
Mirex	$2.0 X 10^{-4}$				432
Lindane	$3.0 X 10^{-4}$	1.3	$7.7 X 10^{-6}$	17	648
Heptachlor/Epoxide	$1.3 X 10^{-5}$	9.1	$1.1 X 10^{-6}$	2.4	28
Toxaphene	$3.6 X 10^{-4}$	1.1	$9.1 X 10^{-6}$	20	778
Chlordane/Nonachlor	$6.0 X 10^{-5}$	1.3	$7.7 X 10^{-6}$	17	130
Dieldrin	$5.0 X 10^{-5}$	16	$6.3 X 10^{-7}$	1.4	108
DDT	$5.0 X 10^{-4}$	0.34	$2.9 X 10^{-5}$	64	1080
Endosulfan	$6.0 X 10^{-3}$				12963
Metals				(ppm)	(ppm)
Arsenic (inorganic) [b]	$3.0 X 10^{-4}$	1.5	$6.7 X 10^{-6}$	0.014	0.6
Cadmium	$1.0 X 10^{-3}$				2.2
Chromium VI	$5.0 X 10^{-3}$	$3.0 X 10^{-3}$	$3.3 X 10^{-3}$	7	11
Lead [c]					
Manganese	$1.4 X 10^{-1}$				302
Methylmercury – developmen	$1.0 X 10^{-4}$				0.2
Methylmercury – ac (paraesthesia)	$3.0 X 10^{-4}$				0.6
Nickel	$2.0 X 10^{-2}$				43
Silver	$5.0 X 10^{-3}$				11
Tributyl Tin (Oxide)	$3.0 X 10^{-4}$				0.6
Vanadium [d]	$3.0 X 10^{-3}$				6

RfD: reference dose
RSD: risk specific dose
CPF: cancer potency factor
NB: Action levels are the fish tissue concentration that allow a consumption rate of one 8 ounce meal per week for an adult without exceeding either an Rfd or a 10^{-5} Acceptable Risk Level
[a] These are BOH derived values (Frakes 1990) scheduled for review upon completion of EPA's draft health assessment for dioxin.
[b] The action levels are for inorganic arsenic. Fish tissue data are usually given as total arsenic, the BOH uses FDA's (1993) assumption that 10% of the total arsenic in fish is inorganic arsenic.
[c] For lead, action level derived by using EPA's IEUBK model for lead, with fish 17% of dietary meal intake; 95% prob. blood lead < 10 μg/dL in children.
[d] For vanadium, RfD based on ATSDR's intermediate-duration MRL.

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APPENDIX 4

Derivation of Empirical Bioaccumulation Factors For use in deriving an Ambient Water Quality Criteria for Mercury

Derivation of Empirical Bioaccumulation Factors
For use in deriving an Ambient Water Quality Criteria
for Mercury

DRAFT

December 29, 2000

Prepared for:

Maine Department of Environmental Protection

Prepared by:

Environmental Toxicology Program
Bureau of Health
Department of Human Services

Summary

Bioaccumulation factors (BAF) reflect the accumulation of chemicals by aquatic organisms such as fish from all surrounding media (water, food, sediment). A BAF may be empirically estimated as the ratio of the concentration of a contaminant in fish divided by its concentration in water. The DEP is interested in using a BAF to derive an Ambient Water Quality Criterion for mercury.

Using Maine empirical data on concentrations of total mercury in water and fish, BAFs for smallmouth bass ranging from 1.4×10^5 L/kg to 2.1×10^6 L/kg can be derived. Most data support BAFs within a narrower 3-fold range: 2.2×10^5 L/kg to 7.3×10^5 L/kg. These estimates are supported by other Maine data for predatory fish (trophic level 4), as well as data from water bodies outside Maine. Using BAFs ranging from 2.2×10^5 to 7.3×10^5 L/kg, along with the Bureau of Health's current fish tissue action level for mercury of 0.2 mg/kg, yields ambient water quality criteria ranging from 0.3 ng/L to 0.8 ng/L (parts per trillion).

In selecting a point estimate of a BAF for use in deriving a statewide ambient water quality guideline, DEP is encouraged to give careful consideration to the apparent variability in BAFs. One view might be that the variation is primarily a consequence of uncertainty (e.g., measurement error) about some general tendency that current data does not allow to be estimated with much precision. Under this view, a reasonable point estimate would be the mean, or perhaps some upper confidence limit on the mean to account for uncertainty in estimating this quantity. An alternative view is that the variation reflects heterogeneity in water-body specific BAFs. Under this view, DEP is confronted with a policy issue in selecting a point estimate: what fraction of water bodies does it want to cover with its default statewide BAF.

The Environmental Toxicology Program recommends that a point estimate of a ${}_{T}BAF_4$ should be no less than 5×10^5 L/kg, and believes an argument can me made for a ${}_{T}BAF_4$ as high as 1×10^6 L/kg (either as a UCL on mean or as a $90^{th} - 95^{th}$ percentile waterbody BAF). We also recommend that efforts be made to obtain additional data to improve confidence in estimates of a BAF.

1.0 Introduction

The Bureau of Health's Environmental Toxicology Program (ETP) was asked by the Maine Department of Environmental Protection (DEP) to review available data for deriving a bioaccumulation factor (BAF) for mercury in fish. The DEP is interested in using a BAF to derive an Ambient Water Quality Standard for mercury.

BAFs reflect the accumulation of chemicals by aquatic organisms such as fish from all surrounding media (water, food, sediment). A BAF may be empirically estimated as the ratio of the concentration of a contaminant in fish divided by its concentration in water. USEPA has indicated a preference for direct measurement from chemical residues in fish and water (EPA, 1997; Nichols et al., 1999). EPA's Mercury Report to Congress (EPA, 1997) developed a total dissolved mercury bioaccumulation factor (5×10^5 L/kg) for trophic level 4 fish ($_{TD}BAF_4$) from data on three different water bodies. While EPA's goal was to develop national estimates of bioaccumulation factors (and hence, chose studies from across the US), the Agency now appears to favor more site specific BAFs.

There are a number of issues that complicate deriving a single estimate of a BAF to be used statewide. BAFs for total mercury are expected to vary among water bodies because of differences in the conversion (methylation) of inorganic forms of mercury into the organic form (i.e., methylmercury) that accumulates in fish. Factors such as water pH and dissolved organic carbon, percent wetlands in a watershed, and others may influence conversion rates. To the extent that this variability can be described, a question arises as to how to select a single value (e.g., use a measure of central tendency such as a mean or median, or select some upper percentile value). In theory, a BAF for methylmercury ought to exhibit less variability. However, measurement of trace levels of methylmercury in water can be subject to considerable analytical uncertainty as well as temporal variability (Haines, 2000). It is also currently the case that there are considerably less Maine specific data available for estimating a BAF for methylmercury than there is for estimating a total mercury BAF. For these reasons, the present discussion focuses on derivation of a total mercury BAF.

BAFs are expected to vary among trophic levels of fish (e.g., trophic level 4 fish such as bass and pickerel have higher mercury content on average than trophic level 3 fish such as white perch and suckers). Even different species of fish within a trophic level may have different BAFs. In response to this variation one could either develop separate species-specific BAFs or select a BAF for a single indicator species. Because of data availability, the present analysis focuses primarily on BAFs for smallmouth bass. Current Maine fish tissue data for smallmouth bass indicate a statewide average of 0.7 mg/kg mercury based on data from 32 lakes (lake averages ranged from 0.3 to 2.1 mg/kg). While only pickerel had a higher average (0.9 mg/kg), this estimate was based on sampling from only 7 lakes. Thus, a BAF for smallmouth bass can reasonably be viewed as a high end accumulator.

This document is organized as follows. Section 2 describes currently available Maine data for estimating BAFs and presents several analyses of these data to estimate BAFs. Section 3 compares the BAF estimates derived for smallmouth bass from Maine data to Maine data for

other fish species, as well as data reported elsewhere for trophic level 4 fish. Section 4 provides a discussion of these different estimates of a BAF for mercury along with an explicit description of some of the associated uncertainties. Section 4 additionally provides calculations of AWQCs associated with a range of BAFs.

2.0 Derivation of BAFs from Maine Data

2.1 Description of available Maine data

The analysis of mercury BAFs in EPA's Report to Congress identified criteria for evaluating the quality of data from which to develop BAFs. For example, multi-season averages of ambient water mercury concentration are preferred over single measurements in a particular water body. Additionally, a good representative age class of the available fish in the waterbody is preferred over fish samples that may be biased towards older or younger fish. These criteria need to be kept in mind when reviewing the Maine data.

There are three Maine specific data sets that can be used to estimate a total mercury bioaccumulation factor for trophic level 4 fish (${}_{T}BAF_{4}$). The three data sets are briefly reviewed below and include data from Burgess (1997), unpublished data supplied by Terry Haines (2000) of the University of Maine at Orono, and data from the DEP's Surface Water Ambient Toxics (SWAT) monitoring program. All three of these data sets report total unfiltered mercury.

Burgess (1997) conducted a study of Hodgdon and Seal Cove Ponds located in Acadia National Park. Both fish tissue and unfiltered water total mercury concentrations were determined. Surface (0.5 meters) and subsurface (5.5 or 13 meters) measurements were made of water mercury concentrations in each of two seasons (spring and summer). Subsurface measurements were close to the bottom of the ponds (Hodgdon Pond is 6.7 meters deep, Seal Cove Pond is 13.4 meters deep). An analysis of the relationship between sampling location (surface or near-bottom) and seasonal differences, shows near-bottom total mercury measurements had the greatest seasonal change compared to surface measurements. Seasonal differences in surface water mercury levels for Hodgdon Pond and Seal Cove Pond were 30 and 80%, respectively, while seasonal differences for near-bottom water mercury levels were 2 to 5-fold, respectively. For the derivation of a BAF, seasonal averages of surface water total mercury concentrations were used. Figures 6 and 7 of Burgess (1997) suggest near-bottom locations become anoxic during the summer and fall, preventing fish from inhabiting these areas. Trophic level 4 fish sampled included smallmouth bass and pickerel. Age classes (when determined) ranged from 5 to 12 years old for smallmouth bass at Hodgdon Pond (n=8), 5 to 9 years old from smallmouth bass at Seal Cove (n=10), and 2 to 5 years old for pickerel at both Hodgdon Pond (n=15) and Seal Cove (n=11). Mean fish tissue mercury concentrations were used in calculating the BAF.

Dr. Haines generously supplied several unpublished data sets generated by his research group that included concentrations of total unfiltered mercury coupled with fish tissue concentrations. Water mercury data consisted of open water and littoral sampling at surface and bottom depths collected in three seasons (spring, summer, fall). Seasonal differences

were modest when compared among surface sampling location (ranging up to 15% for open vs. littoral water) and by depth for littoral samples (less than 40% for surface vs. bottom). As with Burgess (1997), seasonal differences were far more substantial for the open water bottom locations (with, in some cases, over a tripling of the total mercury concentration from season to season with the greatest differences found in summer). There were only minor differences between open and littoral surface water samples (less than 25%). For computing a BAF, the seasonal average of open water surface samples were used. Again, it is assumed fish will not be found in the expected anoxic open water bottom conditions, and there is not a significant difference between littoral and open surface water measurements. Most of the fish tissue data reflected sampling of smaller, trophic level-3 fish, such as white perch, yellow perch, fallfish and brown bullhead. Age classes were not reported however, the fish tended to be smaller fish as they were chosen to represent fish likely to be eaten by bald eagles. Samples sizes for fish were generally around 9 to 10 individual fish per lake, though some had as many as 21 fish. Mean fish tissue mercury concentrations were used in calculating the BAF.

SWAT 1998 (MeDEP 2000) reported total unfiltered mercury water concentrations for a number of Maine rivers. The water sampling locations were typically upstream "background" locations. For each water sampling location, total mercury was measured twice: once during a low flow period (August or September), and again during either a medium or high water flow period (October or December). Differences in mercury concentrations between low versus medium or high flows ranged from 9 to 170%, with a typical variation of 70%. For estimating a BAF, the two measurements at different flows were averaged to give a single value. Paired fish samples were not available for these data. For several of these same rivers however, fish tissue data from downstream or upstream sampling locations were available from previous SWAT studies. Some fish sampling locations were as much as 15 miles downstream. Barry Mower of the Maine DEP identified fish sampling locations that were considered not to have potential mercury point source discharges between the water and fish sampling locations, and these data are reported. The fish tissue data generally consisted of two composite samples, each composite representing 4 to 5 individual fish. Information on age classes are not available, though weight and length information suggested mixed age classes. Mercury content of composites differed by less than 30%. Composite values were averaged to obtain a single fish tissue level for use in estimating a BAF.

2.2 Estimation of BAFs

From the three data sets described above, 10 independent measures of total mercury in water (i.e., different water bodies) coupled with measurements of mercury levels in smallmouth bass tissue were extracted and used to estimate a trophic level 4 BAFs ($_{T}BAF_{4}$). These data along with their associated BAFs are summarized in Table 1.

Both lakes and rivers are included in this data set, though the majority of waters (7 of 10) were rivers. In the full data set (rivers and lakes) there was a 10-fold difference in fish mercury concentrations (0.2 to 2.2 mg/kg), a 15-fold difference in total mercury water concentrations (0.2 to 3.1 ng/L), and about a 15-fold difference in the calculated BAFs (1.36×10^5 to 2.05×10^6 L/kg). The highest calculated BAF was for Sebago Lake – which was

based on only a single water measurement obtained in mid-October. The second highest was for St. Croix River with an estimated BAF of 1.26×10^6. Sandy River had the lowest BAF at 1.36×10^5.

The 15-fold variation in estimated BAFs for these 10 water bodies can be well described by a lognormal distribution, as evidenced by standard tests for normality of the raw data and its log-transform (using the Shapiro-Wilks test for normality) and by inspection of a normal probablity plot of the log-transformed BAFs (see Figure 1). The geometric mean (GM) of this lognormal distribution was 4.66×10^5 L/kg and its geometric standard deviation (GSD) is 2.3. The arithmetic mean was 6.47×10^5 L/kg with a standard error of the mean of 1.88×10^5 L/kg and an approximate 90% confidence interval for the mean of 2.02×10^5 to 9.91×10^5 L/kg. The mean for the seven river water-bodies was 4.82×10^5 L/kg (90% CI: 1.97×10^5, 7.66×10^5 L/kg). The limited data to not allow any conclusions to be drawn about a systematic difference in BAFs for rivers versus lakes.

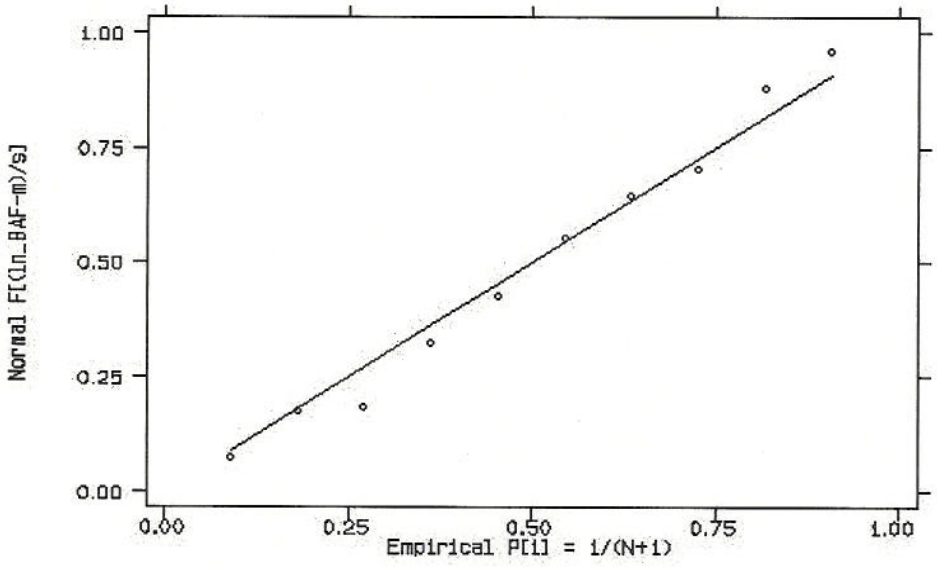
Table 1: Total Mercury Bioaccumulation Factors for Smallmouth Bass

MeHg Fish Conc. (mg/kg)	Total Hg Water Conc (ng/L)	$_TBAF_4$ (L/kg)	Waterbody	Comments
2.25	3.08	7.31×10^5	Hodgdon Pond	2 season average for water. Fish 5 – 12 yrs old. 8 fish sampled. (Burgess, 1997)
0.73	2.31	3.16×10^5	Seal Cove Pond	2 season average for water. Fish 5 – 9 yrs old. 10 fish sampled. (Burgess, 1997)
0.40	1.90	2.11×10^5	Androscoggin River	1 water measurement in Fall. 2 fish composites sampled. (SWAT)
0.53	1.34	3.96×10^5	E. Br. Penobscot River	2 water measurements in Fall. 2 fish composites sampled. (SWAT)
0.24	1.10	2.18×10^5	Kennebec River	2 water measurements in Fall. 2 fish composites sampled. (SWAT)
0.20	1.48	1.36×10^5	Sandy River	2 water measurements in Fall. 2 fish composites sampled. (SWAT)
0.45	0.22	2.05×10^6	Sebago Lake	1 water measurement (October, 98). 10 individual fish sampled. (SWAT)
0.98	1.55	6.34×10^5	Souadabscook Stream	2 water measurements in Fall. 2 fish composites sampled. (SWAT)
0.80	0.64	1.26×10^6	St. Croix River	2 water measurements in Fall. 2 fish composites sampled. (SWAT)
0.53	1.03	5.17×10^5	Webb River	2 water measurements in Fall. 1 fish composite sampled. (SWAT)

Given the observed 15-fold variation in empirical estimates of BAFs, it is of interest to examine whether there was any systematic relationship between water mercury concentrations and fish mercury concentrations (e.g., evidence for a common statewide $_TBAF_4$). Figure 2 shows a scatter plot of the natural logarithm of fish mercury against water mercury, along with the best fitting linear model for these data. The log-transform of fish

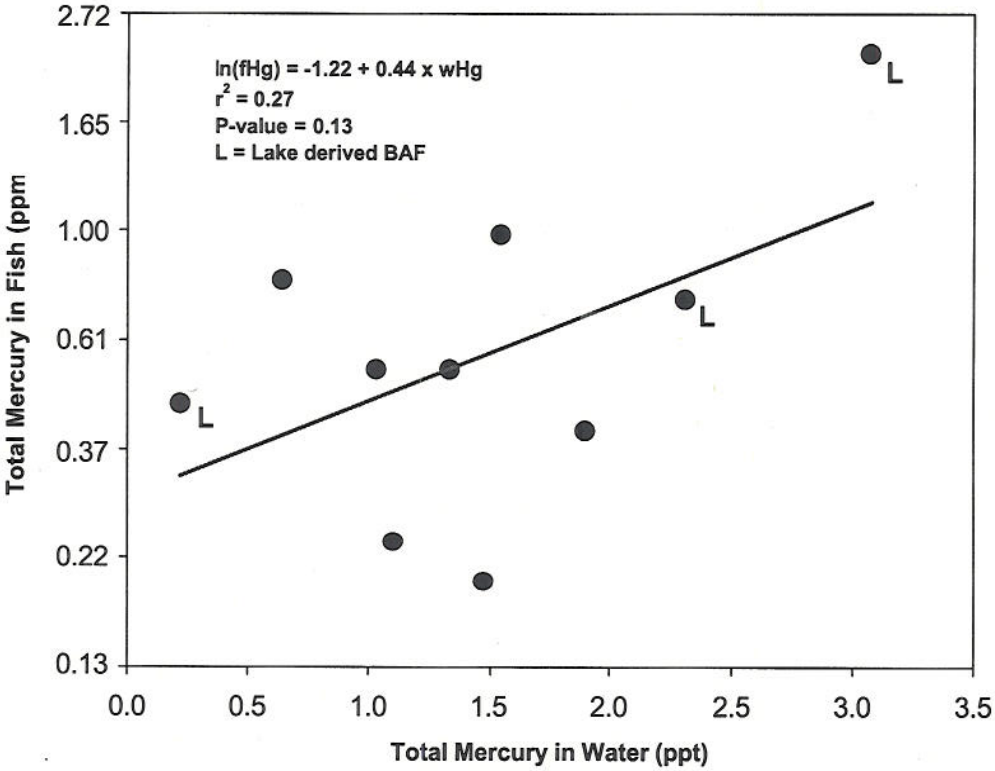
mercury was made because normality of the raw data was rejected, whereas normality of the natural logarithmic transform was not. A simple linear model with intercept was not statistically significant (p=0.12) using conventional measures of significance, and explained less than 30% of the variance in the log-transform of fish mercury. The regression model was additionally heavily influenced by a single observation (i.e., data point with highest mercury water and fish concentration had high leverage). The limited data to not allow any strong conclusions to be made. The data provide little evidence for a common statewide BAF.

Figure 1: Normal probability plot of natural log-transformed BAFs[2]



[2] Prepared using STATA V4.0. Plot of normal cumulative probabilities $F((x_i - \mu)/\sigma)$ against the empirically observed cumulative $p_i = i / (N+1)$.

Figure 2. Regression analysis of water and smallmouth bass mercury data.



3.0 Comparsion of Maine Smallmouth Bass BAF to Other Estimates

The estimated BAFs derived above can be compared to Maine data for other trophic level 4 fish and trophic level 3 fish, as well as to data from studies in other states.

3.1 Comparison to other Maine data

Table 2 summarizes estimated BAFs from Maine data for other fish species. The lowest BAF was 7.5 x 10^4 L/kg for brown trout collected from the Piscataqua River. However, these are likely to be stocked fish (this river was stocked with 10-12 inch fish in October of 1996, these fish ranged from 7 to 11 inches long). Stocked fish have been shown to have lower mercury levels as compared to native populations (Stafford and Haines, 1997 and MeDEP, 1999). The highest BAF was again estimated for Sebago Lake – 2.36 x 10^6 L/kg for lake trout. The remainder of the data resulted in estimated BAFs ranging from 1 x 10^5 to 4 x 10^5 L/kg.

Table 2: Total Mercury bioaccumulation factors for various species.

Species	MeHg Fish Conc. (mg/kg)	Total Hg Water Conc (ng/L)	$_{T}BAF$ (L/kg)	Waterbody	Notes
Pickerel	0.33	3.08	1.06×10^5	Hodgdon Pond	2 season average for water. Fish 2 – 5 yrs old. 15 fish sampled. (Burgess, 1997)
Pickerel	0.67	2.31	2.90×10^5	Seal Cove Pond	2 season average for water. Fish 2 – 5 yrs old. 11 fish sampled. (Burgess, 1997)
White Perch	0.49	3.96	1.24×10^5	Chesuncook Lake	3 season average for water. Fish 3-6 yrs old. 9 fish sampled. (Haines, 2000)
White Perch	0.38	3.10	1.22×10^5	Sebois Lake	3 season average for water. Fish 3-5 yrs old. 10 fish sampled. (Haines, 2000)
White Perch	0.40	3.34	1.20×10^5	Lobster Lake	3 season average for water. 21 fish sampled. (Haines, 2000)
White Perch	0.38	3.08	1.24×10^5	Hodgdon Pond	2 season average for water. Fish 6-7 yrs old. 4 fish sampled. (Burgess, 1997)
White Perch	0.99	2.31	4.28×10^5	Seal Cove Pond	2 season average for water. Only 1 white perch, no age. (Burgess, 1997)
Brown Trout	0.08	1.07	7.51×10^4	Piscataqua River	2 water measurements in Fall. A composite of 4 stocked fish (SWAT)
Brook Trout	0.33	0.89	3.73×10^5	Pleasant River	2 water measurements in Fall. 2 composites sampled. (SWAT)
Lake Trout	0.52	0.22	2.36×10^6	Sebago Lake	1 water measurement. 26 fish sampled. (SWAT)
Landlocked Salmon	1.16	3.96	2.92×10^5	Chesuncook Lake	3 season average for water. Fish 3-6 yrs old. 10 fish sampled. (Haines, 2000)

3.2 Comparison to data outside Maine

EPA's (1997) Mercury Report to Congress developed total *dissolved* mercury bioaccumulation factors for trophic level 4 fish ($_{TD}BAF_4$) for three different water bodies. These studies are briefly summarized below. EPA's goal was to develop national estimates of bioaccumulation factors (and hence, chose studies from across the US). The following table summarizes the studies discussed in the Mercury Report to Congress.

Table 3: Total mercury BAFs from the Mercury Report to Congress

BAF (L/kg)	Waterbody	Age Classes and Species	Water Averaging Time	Source
4.19×10^5	Onandaga Lake, NY	6 to 9 yrs for SMB,. Unknown for Walleye	One season, one year	Becker and Bingham (1995), Henry et al. (1995)
5.0×10^5	Clear Lake, CA	LMB "fairly representative"	Not reported	Suchanek et al. (1993)
5.84×10^5	Lake Michigan	Unknown LKT	3 season, 2 year avg.	Mason and Sullivan (1997)

Becker and Bingham (1995) and Henry et al. (1995 aci EPA 1997) provided data from which a $_{TD}BAF_4$ was estimated for Onandaga Lake in New York by the EPA. EPA's estimate was 4.19×10^5 L/kg. Becker and Bingham (1995) provided the average predator concentration of 1.1 mg/kg (species included smallmouth bass and walleye). A good range of age classes (6 to 9 yrs) were sampled for smallmouth bass. The age classes for walleye were not reported. Sample size range from 20 to 30 fish and fish were sampled only in the summer (July and August) of 1992. Henry et al's. (1995 aci EPA 1997) water concentration (2.625 ng/L total dissolved mercury in water) is an average across three seasons (spring, summer and fall) for one year. In is unclear from a review of Henry et al. (1995a) as well as supporting papers (Jacobs et al. 1995 and Henry et al. 1995b) how EPA derived the estimate of an average water mercury level.

Suchanek et al. (1993) reported data that EPA (1997) used to estimate a $_{TD}BAF_4$ of 5.0×10^5 L/kg for largemouth bass in Clear Lake, California. Fish concentrations were estimated from figures in Suchanek (1993 aci EPA 1997) for two locations within the lake. These concentrations were divided by averaged dissolved total mercury concentrations in the surface water at these same areas. EPA (1997) describes the age classes as "fairly representative."

Mason and Sullivan (1997) report data for lake trout in Lake Michigan that EPA (1997) used to estimate a $_{TD}BAF_4$ of 5.84×10^5 L/kg. Surface water concentrations were based on a two year, three season (spring, summer, fall) average. It is unknown whether a broad range of age classes are represented in this study.

These three estimates from three different water-bodies in three different states are in surprising agreement with the estimates derived above for smallmouth bass in Maine. In part, this is surprising considering the variation in species, location, and in the measure of total mercury in water. The water data reported by the Mercury Study Report to Congress (EPA 1997) are all measures of dissolved mercury in water (filtered water) while Maine specific data are total mercury in water (unfiltered water). One study, (Jacobs et al. 1995) reports that dissolved mercury in water was typically 40 to 50% of total mercury in water. If this ratio approximately holds for all water bodies, then $_{TD}BAF_4$s reported in the Table 3 could be divided in half to estimate $_{T}BAF_4$s to compare to Maine generated data. Under this assumption, these estimated $_{T}BAF_4$s still fall within the range of Maine estimated BAFs, although towards the lower values.

4.0 Discussion

Using Maine empirical data, $_{T}BAF_4$s for smallmouth bass ranging from 1.4×10^5 L/kg to 2.1×10^6 L/kg can be derived. Most data support $_{T}BAF_4$s within a 3-fold range: 2.2×10^5 L/kg to 7.3×10^5 L/kg (i.e., approximate interquartile range). Such estimates are supported by other Maine data for trophic level 4 fish, as well as data from water bodies outside Maine.

There is, however, considerable uncertainty and/or variability associated with both the inputs for deriving a BAF (water and fish mercury concentrations) and in the final BAF itself. First

and foremost it needs to emphasized that the present analysis is based on a small sample size (i.e., 10 independent water bodies). Confidence in derivation of a BAF would be greatly enhanced by increasing the number of water bodies for which we have paired smallmouth bass fish tissue data and total mercury water data. Some of the sources of uncertainty and variability in the inputs for deriving a BAF have been alluded to above. The objective of developing a statewide BAF requires careful thought to the impact of these factors when deriving an AWQC. Additionally, any future data collected should be collected in such a manner as to address these concerns.

Sources of uncertainty and/or variability in estimates of water total mercury concentration include temporal (seasonality, water flow periods) and spatial variability (surface versus measurements at depth, open water versus shoreline), differences in measures of total mercury (filtered vs. unfiltered), and differences in ecosystems (e.g., lake vs. river mercury concentrations).

Specifically, current data on mercury water concentrations often consisted of just two measurements averaged over time. Total mercury concentrations in lakes generally varied by less than 30% over seasons (Haines 2000 and Burgess 1997). Considerably larger variation was observed across flow conditions for rivers (typically 70%). By averaging low and medium flows or low and high flow conditions, we have effectively assumed that rivers flow 50% of the time at high or medium flow and 50% of the time at low flow. Differences between littoral and open water measurements were minor, but differences with depth for lake open waters (e.g., surface versus bottom) were substantial.

From a comparative perspective, Maine data on mercury water concentration has been consistently reported as unfiltered total mercury concentrations. In contrast, studies conducted in other states have tended to report data as filtered total mercury concentrations. Presumably unfiltered samples will have higher mercury content than filtered samples, suggesting estimates of BAFs should be lower on average than estimates based on filtered water mercury data. The similarity in ${}_{T}BAF_{4}$ for Maine data versus data relying in filtered water mercury data, suggests the difference may not be great.

There appears to be little uncertainty associated with analytical methods in the measurement of total mercury in water at the levels we are seeing an ambient water. Handley (2000) suggested the analytical variation from sample to sample may be less than 30% and maybe as low as 10% for water concentrations above 0.5 ng/L.

There also appears to be little analytical uncertainty in measuring fish methylmercury concentrations. With fish tissue data, uncertainty and/or variability is primarily a consequence of sampling issues: sample size, good variation in age classes of fish, proximity of water and fish measurements, and fish species.

It is important to ensure good variation in age classes within a set of fish tissue data. Younger (or stocked fish, for that matter) have had less time to bioaccumulate mercury than older fish. Hence a data set with younger or stocked fish (e.g., the Piscataqua River) may skew an estimate of a BAF.

The SWAT data have an additional uncertainty arising from use of fish tissue data from different locations than where water mercury samples were obtained. The Androscoggin River BAF, for example, is from river water measurements in Berlin, NH, while fish tissue measurements are from the headwaters of the Androscoggin at Lake Umbagog. While we attempted to choose locations without mercury point sources between our fish and water sampling locations, one can assume some uncertainty is contributed by this situation. It would be very useful to get water mercury and fish mercury concentrations at the same location.

Smallmouth bass was selected as the indicator species for upper level trophic fish, as it is the species for which we have the most Maine specific data. It is also known to be among the highest mercury containing fish species in Maine waters. There are insufficient data to determine whether a BAF for smallmouth bass is substantially different than values for other predator species such as pickerel, or native populations of trout or salmon. Smith and Frohmberg (2000) analyzed a MeDEP SWAT study designed to identify indicator species (by sampling several predatory fish species within individual waterbodies). This study suggests that, generally speaking, while smallmouth bass tend to have higher mercury concentrations compared to other species within the same waterbody, it is not always the highest. For example, the average ratio of mercury tissue concentrations for smallmouth bass over white perch was 1.3 (n=7), with a range of 0.7 to 2.4. Additionally, the ratio of mercury in smallmouth bass to lake trout ranged from 0.9 to 1.5 (average 1.2, n=4).

The inability of a simple linear model to explain variation in the water and fish mercury data (Figure 2) is not surprising given the sources of uncertainty and variability described above, as well as consideration of factors that may cause differences in the conversion of inorganic mercury to methylmercury. It is somewhat surprising however, that most of the estimated ${}_{T}BAF_4$ fall in a 3-fold range. While the average ${}_{T}BAF_4$ for the river only data (4.82×10^5 L/kg) was smaller than that for the combined river and lake data (6.47×10^5 L/kg), the confidence limits on the means were so broad as to preclude any assessment of systematic differences (this was also the case when comparing the lake only data to the river only data). It should be emphasized that the present analysis does not include any data for making inferences about whether the bioaccumulation factors derived from data on lakes and rivers are applicable to marine environments.

The general equation for estimating an ambient water quality criterion for a noncarcinogen such as methylmercury is (EPA 1998):

$$AWQC = \frac{RfD \times BW}{I_w + (BAF \times I_f)}$$

where,
RfD = reference dose (mg/kg/day)
BW = body weight (kg)
I_w = daily intake of water (L/day)
BAF = bioaccumulation factor (L/kg)
I_f = daily intake of fish (kg/day)

In deriving fish tissue action levels for considering the issuance of warnings on eating fish due to chemical contamination, the Bureau of Health is currently using a RfD for methylmercury of 0.0001 mg/kg/day based on neurodevelopmental effects on the fetus,[3] a body weight of 60 kg for a woman of reproductive age, and a daily intake of fish of one 8-ounce meal per week (0.0324 kg/day). BOH has additionally assumed 2 liters per day as the nominal daily intake of water in deriving drinking water guidelines referred to as Maximum Exposure Guidelines (MEGs). Using these values with the above equation, along with BAFs in the range of 2.2×10^5 to 7.3×10^5 L/kg, ambient water quality criteria ranging from 0.3 ng/L to 0.8 ng/L (parts per trillion) can be obtained.

In selecting a point estimate of a BAF for use in deriving a statewide ambient water quality guideline, DEP is encouraged to give careful consideration to the variability in BAFs illustrated in Figure 1. One view might be that the variation is primarily a consequence of uncertainty (e.g., measurement error) about some general tendency that current data does not allow to be estimated with much precision. Under this view, a reasonable point estimate would be the mean (6.5×10^5 L/kg) or perhaps some upper confidence limit on the mean (e.g., 95th percentile UCL of 9.91×10^5 L/kg) to account for uncertainty in estimating this quantity. An alternative view is that the variation reflects heterogeneity in water-body specific BAFs. Under this view, DEP is confronted with a policy issue in selecting a point estimate: what fraction of water bodies does it want to cover with its default statewide BAF. Based on current data, the mean looks to be something less than the 70th percentile of the lognormal distribution.

The Environmental Toxicology Program recommends that a point estimate of a ${}_TBAF_4$ should be no less than 5×10^5 L/kg, and believes an argument can me made for a ${}_TBAF_4$ as high as 1×10^6 L/kg (either as a UCL on mean or as a 90th – 95th percentile waterbody BAF). We also recommend that efforts be made to obtain additional data to improve confidence in estimates of a BAF.

[3] A RfD of 0.0001 mg/kg/day for methylmercury is the current USEPA IRIS value. The value was recently reaffirmed in a National Research Council report: Toxicological Effects of Methylmercury, (NRC, 2000).

5.0 References

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APPENDIX 5.

PROPOSED CHANGES TO 38 MRSA SECTION 420

38 § 420. Certain deposits and discharges prohibited (CONTAINS TEXT WITH VARYING EFFECTIVE DATES)

No person, firm, corporation or other legal entity shall place, deposit, discharge or spill, directly or indirectly, into the ground water, inland surface waters or tidal waters of this State, or on the ice thereof, or on the banks thereof so that the same may flow or be washed into such waters, or in such manner that the drainage therefrom may flow into such waters, any of the following substances:

1. Mercury.

1-A. Mercury. Mercury or any compound containing mercury, whether organic or inorganic, may only be discharged in accordance with the criteria established pursuant to Section, subsection 2 except as provided in this subsection.

A. (Repealed) ~~After October 1, 2001, a person, firm, corporation or other legal entity may not discharge mercury or any compound containing mercury, whether organic or inorganic, in any concentration that increases the natural concentration of mercury in the receiving waters. [1999, c. 500, §2 (new).]~~ It is the goal of the State to eliminate the discharge mercury in any form or concentration that contributes to fish consumption restrictions or other water quality impairments. Any person discharging mercury to the surface waters of the State in concentrations contributing to non-attainment of established water quality criteria for mercury shall, in accordance with this subsection and rules adopted by the department, implement measures to abate such discharges as expeditiously as possible. Such rules are considered routine technical.

B. ~~(TEXT EFFECTIVE UNTIL 10/01/01) Until October 1, 2001, a~~ A person, firm, corporation or other legal entity may not discharge mercury or any compound containing mercury in a concentration greater than the concentration discharged as of the effective date of this paragraph.

The department shall establish and periodically review interim discharge limits, based on procedures specified in rule, for each facility licensed under section 413 and subject to this paragraph. The discharge limits may not be less stringent statistically than the facility's discharge levels as of the effective date of this paragraph, except that the department shall take into account factors such as reduction in flow due to implementation of a wastewater conservation plan, seasonal variations and changes in levels of production. When the department has established an interim discharge limit for a facility, that limit is deemed to be the concentration discharged as of the effective date of this paragraph, and a facility shall comply with that interim discharge limit.

When considering an enforcement action in response to a violation of this paragraph before the department establishes an interim discharge limit for the facility, the commissioner shall consider factors such as reduction in flow due to implementation of a wastewater conservation plan, seasonal variations and changes in levels of production.

A person, firm, corporation or other legal entity that discharges mercury shall implement a mercury pollution prevention plan consistent with model plans developed by the department. The facility shall provide information concerning the status of implementation of the mercury pollution prevention plan to the department by December 15, 1999 and December 15, 2000, or as required by the department at a later date. A mercury pollution prevention plan must include monitoring for

mercury as required by the department, and the monitoring information must be provided to the department.

~~This paragraph is repealed October 1, 2001. [1999, c. 500, §2 (new).]~~ Chapter 519 of the department's rules is not repealed on October 1, 2001 and remains in effect until amended or repealed by the department.

B. (TEXT REPEALED 10/01/01) [T. 38, §420, sub-§1-A, paragraph B (rp).]

C. (TEXT EFFECTIVE UNTIL 1/01/04) A person, firm, corporation or other legal entity who, on January 1, 1971, was discharging any of the substances mentioned in this subsection in connection with an industrial process and, on or before December 31, 1971, filed with the board a statement indicating the amount of the substance so discharged on that date may not be considered in violation of this subsection as long as any discharge of mercury by that person, firm, corporation or other legal entity is less than 454 grams, or one pound, per year after January 1, 2000 and less than 45 grams, or 0.1 pound, per year after January 1, 2002. This paragraph is repealed January 1, 2004.

D. Notwithstanding this subsection, whenever the commissioner finds that a ~~concentration of 10 parts per billion of mercury or greater is present in any waters of this State or that~~ danger to public health exists due to mercury concentrations ~~of less than 10 parts per billion~~ in any waters of this State, the commissioner may issue an emergency order to all persons discharging to those waters prohibiting or curtailing the further discharge of mercury and compounds containing mercury into those waters. These findings and the order must be served in a manner similar to that described in section 347-A, subsection 3, and the parties affected by that order have the same rights and duties as are described in section 347-A, subsection 3;

E. No person may directly or indirectly discharge to a publicly owned treatment works concentrations of mercury that contribute to the failure of the treatment facility to comply with effluent limits or applicable water quality criteria for mercury. The owner of a publicly owned treatment works shall have the power to require all users of publicly owned treatment works to institute measures necessary to abate discharges of mercury to the treatment facility. These measures may include but are not limited to testing to determine concentrations of mercury, institution of pollution prevention practices or the evaluation of raw materials, products or practices, and may establish reasonable time schedules for completion of these actions. Any person not complying with the requirements of a publicly owned treatment works to abate mercury discharges may be subject to sanctions pursuant to local ordinances and Section 349, and enforcement action taken by the owner of the treatment works, the State, or through joint action.

2. Toxic or hazardous substances. Any ~~other~~ toxic substance in any amount or concentration greater than that identified or regulated, including complete prohibition of such substance, by the board. In identifying and regulating such toxic substances, the board shall take into account the toxicity of the substance, its persistence and degradability, the usual or potential presence of any organism affected by such substance in any waters of the State, the importance of such organism and the nature and extent of the effect of such substance on such organisms, either alone or in combination with substances already in the receiving waters or the discharge. As used in this subsection, "toxic substance" shall mean those substances or combination of substances, including disease causing agents, which after discharge or upon exposure, ingestion, inhalation or assimilation into any organism, including humans either directly through the environment or indirectly through ingestion through food chains, will, on the basis of information available to the board either alone or in combination with other substances already

in the receiving waters or the discharge, cause death, disease, abnormalities, cancer, genetic mutations, physiological malfunctions, including malfunctions in reproduction, or physical deformations in such organism or their offspring.

A. Except as naturally occurs or as provided in paragraphs B and C, the board shall regulate toxic substances in the surface waters of the State at the levels set forth in federal water quality criteria as established by the United States Environmental Protection Agency pursuant to the Federal Water Pollution Control Act, Public Law 92-500, Section 304(a), as amended.

B. The board may change the statewide criteria established under paragraph A for a particular toxic substance established pursuant to the Federal Water Pollution Control Act, Public Law 92-500, Section 304(a), as amended, as follows:

(1) By adopting site-specific numerical criteria for the toxic substance to reflect site-specific circumstances different from those used in, or any not considered in, the derivation of the statewide criteria. The board shall adopt site-specific numerical criteria only as part of a licensing proceeding pursuant to sections 413, 414 and 414-A; or

(2) By adopting alternative statewide criteria for the toxic substance. The alternative statewide criteria must be adopted by rule.

The board may substitute site-specific criteria or alternative statewide criteria for the criteria established in paragraph A only upon a finding that the site-specific criteria or alternative statewide criteria are based on sound scientific rationale and are protective of the most sensitive designated use of the water body, including, but not limited to, human consumption of fish and drinking water supply after treatment.

C. When surface water quality standards are not being met due to the presence of a toxic substance for which no water quality criteria have been established pursuant to the Federal Water Pollution Control Act, Section 304(a), as amended, the board shall:

(1) Adopt statewide numerical criteria by rule; or

(2) Adopt site-specific numerical criteria as part of a licensing proceeding under sections 413, 414 and 414-A.

Nothing in this section restricts the authority of the board to adopt, by rule, statewide or site-specific numerical criteria for toxic substances that are not presently causing water quality standards to be violated.

D. For any criteria established under this subsection, the board shall establish the acceptable level of additional risk of cancer to be borne by the affected population from exposure to the toxic substance believed to be carcinogenic.

E. In regulating substances that are toxic to humans, including any rulemaking to regulate these substances, the board shall consider any information provided by the Department of Human Services.

F. The Department of Human Services may request that the board adopt or revise the statewide or site-specific criteria for any toxic substance based on the need to protect public health. If the request is filed with the board, the board may propose a rule and initiate a rule-making proceeding. The board shall incorporate in its proposal for rulemaking under this paragraph the statewide or site-specific criteria recommended by the Department of Human Services.

APPENDIX 6.

COMMENTS FROM SWAT TECHNICAL ADVISORY GROUP AND STAKEHOLDERS

From: LAWPCA [lawpca@gwi.net]
Sent: Monday, November 06, 2000 9:21 AM
To: Mower, Barry F
Subject: Re: Ambient Water Quality Criterion for Mercury

Barry-here are some reports for your file on how other States and EPA Regions are regarding implemetnation of GLI standards on mercury. The best
management policy is being prposed in Ohio especially for local limits for indirect dischargers, such as dentists. Vivian

From: LAWPCA [lawpca@gwi.net]
Sent: Monday, November 06, 2000 1:22 PM
To: Mower, Barry F
Subject: draftminutes

Barry, Although i am not a member of the committee I offer a few changes for
your consideration. Vivian

From: LAWPCA [lawpca@gwi.net]
Sent: Monday, November 06, 2000 2:02 PM
To: Mower, Barry F; Bill Zarolinski; Harry Russel; Nick Bennett; Stewart Holm; Terry Haines
Cc: Smith, Andy E.; Winters, Hal; Frohmberg, Eric; Gerry Kamke
Subject: Re: Ambient Water Quality Criterion for Mercury

Barry and other SWAT Team members: I am attaching a copy of Maine's current
interim mercury limits for POTWs and industrial direct dischargers, as a backdrop for discussions so far. I aslo attach my dta file based on Mr. merill's memorandum. These are "where we are now" limits and were generally set based on 3 to 4 data points for each plant. Several plants "excceded" these over the summer at least once. Vivian Matkivich (MWWCA)

From: Nick [nbennett@nrcm.org]
Sent: Monday, December 04, 2000 11:53 AM
To: Mower, Barry F
Subject: RE: mercury AWQC

Hi Barry:

Thanks for this. Just to let you know, the Council takes the position that we need strong, scientifically based criteria that are protective of human health, aquatic life, and wildlife. I don't necessarily agree with Stuart that numbers below background are irrelevant; they are meaningful in the sense that we have to get the concentrations of mercury in our water down to these levels in order for them to be in attainment with "fishable" standards and to protect our wildlife. What I would say is that in addition to keeping dischargers from exacerbating the problem, this also means that Maine has to be working regionally and nationally on deposition sources.

Therefore, we would ask that DEP promulgate a technically sound and protective set of criteria whether by adopting from other states that have good criteria or by developing one for Maine.

For what it's worth, I just want to reiteriate that I was mistaken about the human health criterion in the report to Congress.

Also, I'm attaching a table of Great Lakes criteria from Mike Murray, a scientist with the NWF Great Lakes Office, that I though might be helpful.
[[GLHGWQ~1.DOC : 4156 in GLHGWQ~1.DOC]]
Nick.

-----Original Message-----
From: Mower, Barry F [SMTP:Barry.F.Mower@state.me.us]
Sent: Friday, December 01, 2000 5:44 PM
To: Alan Houston; Bill Zarolinski; Cowger,RepScott; Dan Kusnierz; George Lord; Harry Russel; Nick Bennett; Norm Anderson; Rebecca Van Beneden; Stewart Holm; Terry Haines
Subject: mercury AWQC

If you received a previous email from me a few minutes ago please delete it as it was incomplete.

Thank all of you that were able for attending our meeting Nov 3 to discuss an ambient water quality criterion for mercury. Enclosed is a summary of what

we discussed including the table of various criteria from EPA and other states. We discussed a recommendation to follow EPA's new approach and use Maine's FTAL (fish tissue action level) for mercury (0.2 ppm) with a BAF determined for Maine (400,000-600,000) which results in an AWQC of 0.3-0.5 ng/l (ppt). Nick also made a proposal to adopt the Mercury Study Report to Congress wildlife number, 0.6 ppt, essentially the same as the first method.

In once sense, since these criteria would be less than background, then they may not mean much. In that case, the current law which does not allow a discharge that increases background, would be the controlling factor unless rescinded by the legislature. If the current law is kept, it could be very difficult to meet. Then some other management strategy may need to be developed.

But I never took a final poll of all of you to see if you agree. Please let me know if you do or not, and if not what you propose.

We are having another meeting on Dec 15 from 10-12 here at DEP for municipalities and industry and anyone else who wishes to come. You all are welcome, but this is not a SWAT meeting and we are not requesting your presence. I expect it to focus on policy and compliance issues.

<< File: HGAWQC.xls >> << File: HGAWQCM1sum.doc >>

Water Quality Criteria for Mercury in Great Lakes States

Criteria (ng/l or ppt) [a]			Comments	Source
Aquatic Life	Wildlife	Human Health		
910	1.3	3.1	Lake Michigan Basin	http://www.ipcb.state.il.us/title35/download/C302.pd
1300	-	12	Other waters of state	Same
908	1.3	1.8	Lake Michigan Basin	http://www.ai.org/legislative/iac/title327.html
12	-	150	Other waters of state [b]	Same
	1.3	1.8	Apply statewide	http://www.deq.state.mi.us/pub/swq/rules/part4.pdf
910	1.3	1.5	Class 2 waters of Lake Superior Basin [c]	http://www.revisor.leg.state.mn.us/arule/7052/0100.h
2400 [d]	-	6.9	Other Class 2 waters of state [c]	http://www.revisor.leg.state.mn.us/arule/7050/0222.h
910	1.3	3.1	Lake Erie Basin [e]	http://www.epa.state.oh.us/dsw/rules/3745-1.html
910	-	12	Ohio River Basin	http://www.epa.state.oh.us/dsw/rules/3745-1.html
440 [f]	1.3	1.5	Apply statewide	http://www.legis.state.wi.us/rsb/code/ (Searchable)
	1.3	1.8		http://www.epa.gov/fedrgstr/EPA-WATER/1995/Ma Day-23/pr-82DIR/pr-82.html

a: Chronic standards. In some cases, states have acute standards for mercury as well.
b: Both criteria apply outside of mixing zone; aquatic life criterion for 4-day average.
c: Class 2 waters - based on aquatic life and recreation (including protection of human health through fish consumption).
d: Acute value, (other value of 4900 given as well). Could not find chronic aquatic life value.
e: For all three criteria, outside mixing zone average value, for total reactive mercury.
f: Chronic criterion for cold water fish, warm water sportfish, and other aquatic life.

From: Nick [nbennett@nrcm.org]
Sent: Monday, December 04, 2000 12:05 PM
To: Mower, Barry F
Subject: Hg

One last thought. I don't think I agree with you about low ppt numbers being unworkable. Take a look at the average limits for facilities in Maine. There are a significant number in the single digit ppt range, including Anson-Madison and Lewiston Auburn, which are not typical small-town POTWs by any means. And this is before we have really started to implement pollution prevention fro mercury in Maine.

Nick

From: Terry Haines [haines@maine.edu]
Sent: Monday, December 04, 2000 3:05 PM
To: Mower, Barry F; Alan Houston; Bill Zarolinski; Cowger,RepScott; Dan Kusnierz; George Lord; Harry Russel; Nick Bennett; Norm Anderson; Rebecca Van Beneden; Stewart Holm; Terry Haines
Subject: RE: mercury AWQC

First let me state clearly that I do not condone discharge of mercury to the atmosphere or surface waters by anyone anywhere at any time. Any mercury is too much mercury. However, mercury is a natural component of the earth's crust and will always be present. Therefore, we can never achieve zero discharge of mercury and will never be able to reduce water concentrations of mercury to prehistoric natural background levels while maintaining current standards of living. Because of the complexity of the biogeochemistry of mercury, I do not believe we have sufficient data to demonstrate that discharge of relatively small amounts of mercury (i.e., a maximum of a few tens of ng/L) to rivers and streams will materially damage aquatic resources in the vicinity of these discharges. The spreadsheet Barry has developed of fish mercury concentrations above and below discharges lends support to this view. However, that mercury is going to go somewhere, and may cause damage to resources in areas remote from the discharge. Inspection of the data in the Maine Interim Limits spreadsheet indicates that most of the facilities are discharging modest amounts of mercury and I think it will be very hard to argue that they should be forced to eliminate any discharge, which is essentially what the proposed regulation would do. The top 20 or so facilities, however, are a different kettle of mercury, and I believe these should be capable of greatly reducing their mercury discharge. I think it would damage our credibility to advocate the establishment of a mercury criterion that is unattainable. I would prefer a more measured approach, perhaps something where a standard is phased in over time, or progressively tightened over time, and focused on the most serious dischargers. I think this would have the best chance of garnering public support, and making a real difference in environmental quality in Maine over the near term.

Terry A. Haines
USGS/BRD, University of Maine
5751 Murray Hall, Orono, ME 04469-5751
haines@maine.edu or haines@usgs.gov
phone: 207-581-2578, fax: 207-581-2537
"In the rat race, even if you win, you're still a rat."
<;)====< <;)====< <;)====< <;)====< <;)====<

-----Original Message-----
From: Mower, Barry F [mailto:Barry.F.Mower@state.me.us]
Sent: Friday, December 01, 2000 5:44 PM
To: Alan Houston; Bill Zarolinski; Cowger,RepScott; Dan Kusnierz; George Lord; Harry Russel; Nick Bennett; Norm Anderson; Rebecca Van Beneden; Stewart Holm; Terry Haines

Subject: mercury AWQC

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<<HGAWQCM1sum.doc>> <<HGAWQC.xls>>

From: Lotic [lotic@uninets.net]
Sent: Friday, December 08, 2000 3:15 PM
To: Mower, Barry F; Alan Houston; Cowger,RepScott; Dan Kusnierz; George Lord; Harry Russel; Nick Bennett; Norm Anderson; Rebecca Van Beneden; Stewart Holm; Terry Haines
Subject: Re: mercury AWQC

Sorry for the lateness of my reply, but I have had to mull this over for some time. I have read your email and Terry's reply and I have to tell you I am extremely uncomfortable and cannot support a recommendation for a numerical criteria that is unattainable. A criterion should be the standard or the target value for our ambient waters based upon scientific and toxicological information. As I mentioned during our meeting of November 3, EPA has acknowledged that water quality criteria are developed "based solely on data and scientific judgements on the relationship between pollutant concentrations and environmental and human health effects. Protective assumptions are made regarding the exposure intakes that humans may experience. These criteria do not reflect consideration of economic impacts or the technological feasibility of meeting the chemical concentrations in ambient water".

Given the mercury concentrations identified in Maine's ambient waters and the concentrations reported from wet and dry deposition coming into the state, the adoption of a numerical standard of 0.3 to 0.6 ppt fails "the straight face test". It is both unattainable and it fails to implement a practical approach for the reduction of mercury in the environment. I do not believe with certainty that we either need or want that level of strict standard. One question. What are the socio-economic implications of adopting such a strict standard for the people and businesses of the State of Maine and what are the environmental benefits that will be realized? Use as many blue books as you need.

My suggestion is to adopt a narrative standard that will promote awareness as well as short-term and long-term environmental improvement. This has been done before. Certain Midwestern states are using language like "virtual elimination" of elemental mercury and mercury products as a means to move forward. For example, the City of Boston just announced the future ban on the sale of mercury fever thermometers. As these types of product controls are implemented, the department could move forward by working with those wastewater facilities with mercury sources that are controllable or amenable to removal.

In summary, I do not believe that we should adopt a prohibitive numerical standard given current ambient conditions, its implications for Maine's citizens and our current level of knowledge.

Bill Zarolinski
Lotic, Inc.
phone: 207-948-3062
Fax: 207-948-3087

-----Original Message-----
From: Mower, Barry F <Barry.F.Mower@state.me.us>
To: Alan Houston <phoward@gwi.net>; Bill Zarolinski <lotic@uninets.net>; Cowger,RepScott <SCOWGER@state.me.us>; Dan Kusnierz <pinwater@penobscotnation.org>; George Lord <Ecocycle@mint.net>; Harry Russel <HHRUSSELL-ME@worldnet.att.net>; Nick Bennett <nbennett@nrcm.org>; Norm Anderson <Nanderson@MaineLung.org>; Rebecca Van Beneden <rebeccav@MAINE.maine.edu>; Stewart Holm <seholm@gapac.com>; Terry Haines <Haines@maine.maine.edu>
Date: Friday, December 01, 2000 5:47 PM
Subject: mercury AWQC

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From: Norman Anderson [NAnderson@mainelung.org]
Sent: Monday, December 11, 2000 11:10 AM
To: Mower, Barry F; Alan Houston; Bill Zarolinski; Cowger,RepScott; Dan Kusnierz; George Lord; Harry Russel; Nick Bennett; Norman Anderson; Rebecca Van Beneden; Stewart Holm; Terry Haines
Cc: Smith, Andy E
Subject: RE: mercury AWQC

The concerns expressed regarding a standard that is lower than background have parallels to the standard setting process for hazardous air pollutants (HAPS). Indeed, even criteria air pollutants such as ozone, particulates, and lead may have background levels above those that are cause for health concern. Needless to say, there has been very little progress over the past 20-30 years in setting ambient air criteria for HAPS. As I recall, mercury was one of the original HAPS, and an emission standard was set back in the 1970s, although I'm not sure how relevant it is now.

At the risk of appearing overly simplistic, it would seem to me that any criterion or standard should prevent mercury emissions from increasing, and motivate some sort of continuous improvement goal. It should also motivate the collection and analysis of data necessary to develop a priority list of sources warranting attention from a pollution control/prevention standpoint.
Also, focusing on my particular sphere of interest, it should somehow be coordinated with other similar pollution prevention strategies (such as limiting nitrogen oxide or particulate emissions from utility boilers).

Whatever the final outcome is, it seems like there's some opportunity here to stimulate creative thinking towards realistic environmental improvement objectives.

-Norm

Norman Anderson, MSPH
American Lung Association of Maine
122 State St.
Augusta, Maine 04330
Phone: 622-6394 or 1-800-499-5864
Fax: (207) 626-2919
Email: Nanderson@mainelung.org

> -----Original Message-----
> From: Mower, Barry F [mailto:Barry.F.Mower@state.me.us]
> Sent: Friday, December 01, 2000 5:44 PM
> To: Alan Houston; Bill Zarolinski; Cowger,RepScott; Dan Kusnierz; George
> Lord; Harry Russel; Nick Bennett; Norm Anderson; Rebecca Van Beneden;
> Stewart Holm; Terry Haines
> Subject: mercury AWQC

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> << File: HGAWQCM1sum.doc >> << File: HGAWQC.xls >>

From: Nick [nbennett@nrcm.org]
Sent: Thursday, December 14, 2000 4:34 PM
To: Lotic; Mower, Barry F; Alan Houston; Cowger,RepScott; Dan Kusnierz; George Lord; Harry Russel; Norm Anderson; Rebecca Van Beneden; Stewart Holm; Terry Haines
Cc: Smith, Andy E.; Frohmberg, Eric
Subject: RE: mercury AWQC

[[SWATHG~1.DOC : 5403 in SWATHG~1.DOC]]

December 14, 2000

To the SWAT Committee:

This e-mail concerns the development of ambient water quality criteria for mercury. First, as background, it is important to remember that DEP is required by law to develop criteria that are protective of human health, aquatic life, and wildlife. To quote the statute:

"The Department of Environmental Protection shall develop proposed statewide criteria for mercury that are protective of human health, aquatic life and wildlife. In developing the criteria, the department shall consider all available information, including standards developed by other states, the Great Lakes region and the United States Environmental Protection Agency and any information provided by the Department of Human Services, Bureau of Health" (Reference 1).

In addition, another relevant piece of background information comes from the Code of Federal Regulations:

"131.11 Criteria

(a) *Inclusion of Pollutants*: (1) States must adopt those water quality criteria that protect the designated use. Such criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive use.

(2) Toxic pollutants. States must review water quality data and information on discharges to identify specific water bodies where toxic pollutants may be adversely affecting water quality or the attainment of the designated water use or where the levels of toxic pollutants are at a level to warrant concern and must adopt criteria for such toxic pollutants applicable to the water body sufficient to protect the designated use." (Reference 2)

Currently all of Maine's waters violate their designated use of fishing due to mercury contamination.

Therefore, it is the position of the Natural Resources Council of Maine (NRCM) -- and it is a legal obligation -- that DEP must recommend to the legislature water quality criteria that are truly protective of human health, wildlife, and aquatic life. Clearly, there is too much mercury in our water now. We have fish advisories in all of our inland waters that strictly limit -- and in some cases for some species, completely recommend against -- fish consumption. It is also clear that our wildlife is threatened by mercury. "Based on risk categories developed from the literature and *in situ* studies by BioDiversity Research Institute and their collaborators, 28% of the breeding loon population in Maine is estimated to be at risk, while 40% of the eggs laid are potentially impacted... Recaptured adult loons exhibit a significant annual increase of Hg (9% in males, 5.6% in females) that we predict will significantly reduce lifetime individual performance (Reference 3). Maine's eagles have comparable levels of mercury contamination to Maine's loons and the lowest reproductive rate of any major population in the US (Reference 4).

Again, this information tells us that mercury levels in our waters are already too high now.

Levels of mercury that are "safe" must be lower than what we currently have, or we would not have all of the problems associated with mercury that we do -- both wildlife and human-health related. Our new criteria must reflect this reality.

A truly protective set of criteria is also not only important in terms of licensed discharges to our waters, but it is also important in terms of enforcing limits on air deposition as well. In Wisconsin and Florida, EPA has already begun work on air TMDLs that model the relationship between air pollution sources of mercury and concentrations in waters to which the mercury is deposited (Reference 5). Maine must, with the help of EPA and other states, eventually perform the same or similar exercises to ratchet down on air sources that are contributing to mercury contamination of our waters. We need accurate criteria in order to have target values for these sorts of exercises.

In addition, concerning direct discharges to surface water, Maine statute is very clear that the DEP "may issue a discharge license or approve water quality certification for a project affecting a water body in which the standards of classification are not met if the project does not cause or contribute to the failure of the water body to meet the standards of classification" (Reference 6). Because Maine waters are not in attainment with the standards of their classification (i.e., they do not meet the designated use of fishing), DEP cannot license discharges that increase the amount of mercury in our waters.

Although NRCM will maintain this position strongly, we are very willing to be flexible in terms of a compliance time table and to commit our own resources to help reduce sources of mercury that end up in discharges to our waters. We do not believe that drastically reducing or eliminating mercury from discharges to our surface waters should be a treatment-based effort. It is clearly important to reduce mercury sources. To this end, NRCM is already in a partnership with DEP and Maine hospitals to virtually eliminate the use of mercury in hospitals over the course of the next several years. We also believe that getting mercury out of dentistry will be important, because so much of the mercury in domestic wastewater comes from dental amalgam (the mercury leaches out fillings and is excreted in human waste). We are also working in the legislature to get mercury out of consumer products and would welcome help from industry and municipal treatment plant operators in all of these endeavors.

Finally, it should also be noted that many POTWs and industrial facilities are very near to where they need to be in terms of compliance according recent DEP data (i.e., they have discharge concentrations under 10 ppt). Out of 149 facilities, more than 50 (I counted 57) facilities had average discharge concentrations under 10 ppt (Reference 7). This is true even without significant pollution prevention efforts aimed at source reduction of mercury for many or most of these facilities. This means that reducing mercury to low single digit ppt levels for all of Maine's facilities should be feasible through source reduction.

I would like to make two final points. The first is in response to the discussion of the relationship between inorganic and methylmercury in water that took place both at our meeting and through e-mail exchanges. I do believe it is reasonable to develop bioaccumulation factors (BAFs) for inorganic mercury in water to methyl mercury in fish. While there is variability in the values of these BAFs, variability is something that is frequent in environmental contaminant data, and the variability of these BAFs is well within the range of variability we see for other environmental data. Indeed, we see that that bioaccumulation

factors are mostly within a factor of two or three across the state (Reference 8). Certainly, it is reasonable to use statistics and conservative assumptions to account for this degree of variability. In addition, while NRCM acknowledges that methylation rates may differ in different environments and that the ratio of MeHg to inorganic Hg in water may also vary, we believe that the bioaccumulation process offers many opportunities for "smoothing" of this variability. In addition, we are not convinced that the ratio of MeHg to inorganic Hg in the water column is necessarily the critical relationship in the bioaccumulation process. The concentration of MeHg in sediment versus that of inorganic mercury in the water column or in sediment may in fact be a more critical relationship. In any event, environmental variability is something that is dealt with in every ambient water quality criterion; mercury is not different.

Lastly, as SWAT members consider the issue of the mercury water quality criteria, please keep in mind that Maine is committed to an international agreement signed by the Governor with the northeastern Canadian provinces and the New England states. This document states as its goal: "The virtual elimination of the discharge of anthropogenic mercury into the environment, which is required to ensure that serious or irreversible damage attributable to these sources is not inflicted upon human health and the environment" (Reference 9). The criteria should be developed with this commitment in mind.

Please let me know if you have questions.

Sincerely,

Nick Bennett
Staff Scientist
Natural Resources Council of Maine

References

1. Maine Session Laws. 1999. Chapter 500 S.P. 716 - L.D. 2038
2. 40 CFR CH 1. 131.11.
3. David Evers, Chris De Sorbo, and Lucas Savoy. 2000. Assessing the impacts of methylmercury on piscivorous wildlife as indicated by the Common Loon, 1998-99. 1999 Final Report. Submitted to: Maine Department of Environmental Protection. Surface Water Ambient Toxic Monitoring Program. March 31.
4. Linda Welch. 1994. Contaminant Burdens and Reproductive Rates of Bald Eagles Breeding in Maine. US Fish and Wildlife Service.
5. See, for example, http://www.epa.gov/OWOW/tmdl/madppfs.html, for a brief description of this work.
6. 38 MRSA 464 (F)(1-a)(3)
7. Maine DEP. 2000. List of interim limits for Maine dischargers. August 24.
8. Andy Smith and Eric Frohmberg. Handout to SWAT Committee.
9. New England Governors/Eastern Canadian Premiers. 1998. Mercury Action Plan.

From: lawpca@gwi.net
Sent: Wednesday, December 27, 2000 2:40 PM
To: Mercury Policy, Legislation, and Regulations
Cc: Mower, Barry F
Subject: [mercury_policy] phenyl mecuric acetate

>As a wastewater operator, I am interested in discharges of outdated lab reagents and medicines that contain mercury preservatives. Wal-Mart's Equate nasal spray contains 0.02 mg/mL of Phenylmercuric Acetate as a preservative. Commercial pH buffers 4 and 7 also contain phenyl mecuric acetate (62-38-4) as a preservative. How much mercury is is phenyl mecuric
acetate mg/G? I have seen MWRA's extensive list of mercury preserved hospital lab reagents, but have not seen such a list of "brand name" products sold at retail. Has anyone?

Vivian Matkivich
Lewiston-Auburn Water Pollution Control Authority
207-782-0917

You are currently subscribed to mercury_policy as:
Barry.F.Mower@state.me.us
To unsubscribe send a blank email to
leave-mercury_policy-228S@lyris.newmoa.org

From: Terry Haines [haines@maine.edu]
Sent: Tuesday, January 02, 2001 3:12 PM
To: Mower, Barry F
Subject: RE: mercury report to Legislature

Hi Barry:

I have reviewed the report and generally agree with it. Two things you might consider are:

1. The large variation in fish mercury content among lakes suggests that there are major factors affecting the bioaccumulation of mercury from the environment that we don't yet understand. The BAF is a major oversimplification of a very complex process, and should be recognized as such.

2. The pollock and mackerel data lend support to the hypothesis that human activity affects fish mercury content over and above atmospheric deposition, and supports the need to reduce discharge of mercury into surface waters.

Terry A. Haines
USGS/BRD, University of Maine
5751 Murray Hall, Orono, ME 04469-5751
haines@maine.edu or haines@usgs.gov
phone: 207-581-2578, fax: 207-581-2537
"In the rat race, even if you win, you're still a rat."
<;)====< <;)====< <;)====< <;)====< <;)====<

-----Original Message-----
From: Mower, Barry F [mailto:Barry.F.Mower@state.me.us]
Sent: Friday, December 29, 2000 3:47 PM
To: Courtemanch, Dave L; Merrill, Dennis L; Pierce, Sterling; Lennett, David; Brooks, James P; 'David VanWie'; Smith, Andy E.; Frohmberg, Eric; Winters, Hal; Bourque, Peter; Analeis Hafford; Bill Taylor; Bob Nadeau; Brad Moore; BRI; Bruce Nicholson; Carl Akeley; Charles Applebee; Chris Hall; Douglas Barton; Gerry Kamke; Heather Swan; Ken Gallant; Patricia Ianni; Peter Clark; Sandy Perry; Scott Cowger; Scott Reed; Smith, Andy E.; Vivian Matkivich; Alan Houston; Bill Zarolinski; Cowger,RepScott; Dan Kusnierz; George Lord; Harry Russel; Nick Bennett; Norm Anderson; Rebecca Van Beneden; Stewart Holm; Terry Haines
Subject: mercury report to Legislature

Here is a draft of the mercury Ambient Water Quality Criteria report due the Legislature Jan 15, 2001 for your review and comment. Since we need to make any necessary changes and get the report printed by Jan 12, we need comments ASAP and no later than Jan 5, earlier if they are substantial, or we will not be able to consider them.

As you will see we are recommending elimination of 38 MRSA section 420(1)(A)

the 'no discharge that increases the natural concentration' section and some
other changes to clean up the statute. We are proposing that we use our upcoming AWQC rule-making to adopt new EPA criteria including mercury. EPA
will publish a new mercury criterion in the FR within the next week or so, which allows states to adopt site-specific criteria. We will propose to adopt statewide site-specific criteria for mercury by rule. Ala the new EPA
AWQC, we will propose a Fish Tissue Criterion (FTC). We will propose 0.2 ppm, the Bureau of Health's current Fish Tissue Action Level for women of childbearing age and children under 8. And we will propose to use a BAF of
1-1.3 million which results in an AWQC of ~0.2 ppt.

Knowing that most facilities will have difficulty meeting the new FTC, at least initially, we will also propose in rule a waste minimization approach,
with license limits based on the existing interim mercury limits, and P2 plans that require more effort to reduce by tiers. Facilties might be placed into tiers by the calculated increase in mercury levels in their receiving waters; the higher the projected increase in the receiving water,
the more work needs to be done. Remember this is a draft and ideas are welcome, especially for the P2 portion.

Enclosed are the main document HGAWQC.doc, and table 1 HGAWQC1t1.xls in MS
Word 97 and Excel 97

<<HGAWQC.doc>> <<HGAWQC1t1.xls>>

From: LAWPCA [lawpca@gwi.net]
Sent: Tuesday, January 02, 2001 3:35 PM
To: Mower, Barry F
Cc: William E. Taylor; Michael Barden; Geoff Pellechia; Annaleis Hafford; Gerald Kamke; Charles McDowell; Bentzel, Dick; Brad Moore; David Keith; Janet Abrahamson; Joan Kiszely; John Hart; Mike Bolduc; Paul Wintle; Phyllis Rand; Thomas Wiley; Steve Harris; Scott Clukey; Ron Letarte; Jay Pimpare; Howard Carter; Dave Anderson; Andrew Rudzinski; Rogers, James R; Steven Lane; Russ Mathers; Nicholson, Bruce; John Barlow; Deb McGrath; Brent Dickey; Bill Zarolinski; Waring, Mary
Subject: Draft Report to Legislature: mercury limit

Barry: Because time is really important, I have quickly jotted down some comments for you. If you need more substantive material, like a summary of requirements for TMDL allocations when the river does not have attainment, and the requirments development of local limits, I can get these to you. However, you probably could get it quicker and better from DEP permit writers like Greg Wood, DEP's pretreatment program coordinator, Jim Rogers, and TMDL experienced staff, like Paul Mitnik. Thanks for the opportunity to comment. Vivian Matkivich, MWWCA, 207-782-0917

To: Barry Mower
From: Vivian Matkivich, MWWCA
January 2, 2001

Here are some comments on the draft report to the Legislature. Thanks for getting this out to the stakeholders so soon.

1. Stakeholders concern: An instream water quality limit lower than the actual instream concentration requires that the State and EPA refuse to write new permits, or allow growth (increased discharge) for existing permittees, until a Total Maximum Daily Loading (TMDL) has been established, and allocations made. The TMDL requirements, and resulting adverse economic impacts, should be explained in the report to the Legislature.
2. Stakeholders concern: Local limits for indirect dischargers to all publicly owned wastewater treatment plants will be necessary. Only 14 or 15 municipalities currently have legal authority to write permits for indirect dischargers. Who will write the rest of the local limits? In any case, if the treatment plant has to meet 0.2 ng/L at end of pipe, this virtually makes the local mercury limit for industry less than 0.2 ng/L, and probably zero discharge. If the municipal permit writer can use 0.2 ng/L as an instream limit, allowing for mixing zones (dilution), its still a problem because of the TMDL allocation requirement. If the waterbody is above 0.2 ng/L, its still probably a zero limit for industry until an allocation is made to increase the POTW's limit. Otherwise the industrial users/indirect dischargers are contributing to "pass-through." As a POTW exceeding our interim end-of-pipe limit of 4.5 ng/L, we are already concerned about "pass-through." The effects of the proposed water quality standard on municipalities and indirect dischargers needs to be expressed in the report.
3. Stakeholders meeting: Nothing is noted about atmospheric deposition of mercury as being the primary cause of fish advisories in Maine. David Van Wie said the State would be able to address atmospheric deposition by giving a TMDL allocation (I assumed to be expressed as specific air emissions limits to Midwest utilities, etc.). If the DEP has genuine plans to address atmospheric deposition by TMDL, this needs to be expressed in this report.

MEMO

To: Barry Mower
From: Bruce Nicholson
Date: 1/3/01

Re: Comments on the Draft Mercury Report to the Legislature

A couple of comments for your consideration on the draft report. These comments are mine and should not be attributed to MWWCA. Thank you for providing the draft to the interested parties for comment.

1. The table to the November 3, 2000 SWAT meeting notes in Appendix 1 is not included, perhaps by design, but I think it should be included.

2. The DEP's position up through 11/3/00 was that mercury was subject to EPA's AWQC in effect on 8/13/97, and I don't understand why there is now a sudden change in this position as evidenced in the report on page v, "Mercury was not subject to the AWCQ but rather had its own narrative criterion (38 MRSA section 420(1) (A) since 1971, ...". This sentence does not square with the 11/3/00 DEP SWAT meeting notes. See page xvii of the report (November 3, 2000 SWAT meeting notes in Appendix 1, 1st page last sentence in 1st paragraph)-- "It is the DEP's position that US EPA AWQC that were recommended on August 17, 1997, the last time DEP made changes to Chapter 530.5, are Maine's current criteria." The AWQC in effect on 8/13/97 included criteria for mercury, and this criteria was provided on the referenced attached table (now absent from report, see comment above). This mercury criteria has also been historically posted on the DEP's web page at www.state.me.us/dep/blwq/docmonitoring/dmlist.htm as Maine's "adopted criteria". I believe you also confirmed this on 12/15/00 in response to my inquiry at the stakeholders meeting, although acknowledging that the Department's position was in dispute. The argument being that mercury is addressed separately in 38 MRSA section 420(1) with a narrative criteria and "any other toxic substance" is dealt with in section 420(2) by adopting the EPA AWQC by reference. The fact remains, however, that: 1) Maine's AWCQ appear in both statute and regulations (DEP Chapter 530.5 promulgated by the BEP); 2) there is no carve out for mercury in Chapter 530.5 which on its face regulates all toxics with national water criteria in accordance with EPA AWQC or alternative criteria established in the rule; and 3) the statutory authority for the BEP's rulemaking in Chapter 530.5 is 38 MRSA sections 420 and 464, therefore, the argument that section 420 trumps the mercury AWQC established by the BEP in Chapter 530.5 is not entirely valid. The legislature has given the BEP specific rulemaking authority with respect to water quality criteria in 38 MRSA section 464(5):

> "Rules shall be promulgated by January 1, 1987, and as necessary thereafter, and shall include, but are not limited to, sampling and analytical methods, protocols and procedures for satisfying the water quality criteria, including evaluation of the impact of any discharge on the resident biological community."

Finally, I don't believe it is valid to say that just because mercury has a narrative criterion in 38 MRSA section 420(1), it can not also be subject to numeric criterion. It is not necessarily an either or scenario, as evidenced by provisions for both narrative and numerical water quality criteria in DEP Chapter 530.5(A)(1) and (2). Has there been an official change in the Department's position on this issue?

3. I have to take issue with the statement attributed to me in Appendix 2, "Bruce Nicholson said that maybe the existing law of no discharge would be preferred over the proposed AWQC." I have always believed that any "risk-based criteria" which is the legislative directive in developing a statewide criteria that is protective of human health, aquatic life and wildlife after consideration of all available information would be better than the existing narrative standard in 38 MRSA section 420(1), because the 1971 standard can never be enforced in practice; and any statements that we should not "backslide" from it are silly, because for good reason the DEP has never enforced the standard. The reasons being: 1) how would a NPDES permit writer ever translate, "... in any concentration which increases the natural concentration of mercury in the receiving waters" into an enforceable numeric permit condition; and 2) a straight reading of the statute indicates it is supposed to apply to

all indirect as well as direct dischargers of mercury. This would pick up nonpoint discharges of mercury including stormwater discharges, as well as all non-domestic indirect dischargers of mercury discharging into POTWs. What was being discussed at the 12/15/00 meeting was this new concept of facilities to take additional mandatory pollution prevention measures or BMPs if they exceeded the new standard. What I spoke to was, that to the extent that the trigger to take these prescribed measures was linked to exceedances of the standard in the old law (any concentration above the "natural concentration" in the receiving waters), it should be noted that the DEP has only determined the so called natural concentration mercury in Maine's fresh waters not marine waters.

4. I am not sure that it is accurate to state that a general consensus was reached on the concept of compliance schedules and mandatory additional pollution prevention/BMPs for facilities that can not meet a 0.2 ppt AWQC. I do not think enough details were provided for a consensus and the stakeholders were hearing the concept floated for the first time. One potential issue that I see as unfair, is that the burden of this new pollution prevention work appears to fall only on the shoulders of existing 38 MRSA section 413 facilities that have interim limits established under DEP chapter 519. There is no discussion sharing this burden with: 1) other section 413 dischargers that the DEP has exempted under Chapter 519 (land application facilities, overboard dischargers, CSOs, snow dumps, pesticides applications, and all the various Group III facilities; 2) nonpoint source dischargers of mercury; 3) indirect dischargers of mercury into POTWs and 4) sources of atmospheric deposition of mercury which is the major source of mercury contamination in Maine.

Mr. Barry Mower
Bureau of Land and Water Quality
Department of Environmental Protection
17 State House Station
Augusta, ME 04333-0017

Dear Barry:

This letter represents the comments of the Natural Resources Council of Maine (the Council) on your draft report "Development of Ambient Water Quality Criteria for Mercury". On the whole, the Council is very supportive of this document. In particular, we support DEP's use of the BAF of one million, the Fish Tissue Action Level of 0.2 ppm, and the AWQC of 0.2 ng/l. We also commend DEP for doing this very substantial piece of work in such a short time and making it available to the public quickly.

In addition, we support DEP's development of a pollution-prevention based policy for dealing with mercury discharges and the recognition of the importance of source reduction in this process. We also agree that the details of this policy should be developed through rulemaking and look forward to participating in that process.

However, we are concerned about the use of the current set of interim license limits as permanent future limits in discharge licenses, an action this report implies DEP may take. The Legislature clearly asked DEP to develop these limits only as an interim measure to prevent increases in mercury pollution while DEP developed criteria. As we stated clearly at the meeting on December 15th, these interim limits will not drive pollution prevention measures. Although we recognize that there needs to be flexibility in terms of the timing of compliance with the new criteria and that this process will be a long term effort, the Council believes there must also be continuous progress towards the goal of compliance with the criteria. The Council also believes that license limits are the most important tool in terms of driving pollution prevention efforts and that DEP should not rely on best management practices alone -- although these too are important -- to work towards compliance with the new mercury criteria. We are willing to think flexibly about compliance schedules, and as David Van Wie discussed at the stakeholders' meeting, tiered approaches requiring more rapid improvements and more substantial efforts by facilities discharging more mercury. However, we believe use of the current interim limits as long-term license limits will hinder improvements to effluent quality. We look forward to working with DEP on the details of a compliance program during the rulemaking process.

In addition, we are concerned about DEP's proposal to base tiers on a given "facility's impact on the receiving water concentration of mercury". The Council believes DEP must remember that mercury is a bioaccumulative toxicant with the potential for far-field and sediment impacts. Therefore, mass load is just as important, if not more so, than receiving water concentration, and should also be considered when developing tiers.

The Council also believes that DEP's apparent decision not to promulgate a wildlife criterion for mercury is unacceptable. DEP notes in its report that "PL 1999 Chapter 500 section 6 required that 'the Department of

Environmental Protection shall develop proposed statewide criteria for mercury that are protective of human health, aquatic life, and wildlife'." DEP also notes that "that 28% of Maine's loons are considered at risk based on levels of mercury reported to cause reproductive effects in laboratory studies." Therefore, it is both a clear legal obligation and an ecological necessity to develop a wildlife criterion. However, the Council understands DEP's concern about using an unpromulgated wildlife criterion from EPA's report to Congress. Therefore, we recommend that DEP work with Dave Evers to develop a wildlife criterion based on his work with loons. From a review of his report prepared for Maine DEP, we believe that he should be very capable of assisting DEP in developing a wildlife criterion quickly.

Thank you again for your effort on this report. Please let me know if you have questions.

Sincerely,

Nick Bennett
Staff Scientist

From: Carlton E. Akeley [akeleyce@GNPaper.com]
Sent: Friday, January 05, 2001 10:49 AM
To: Mower, Barry F
Cc: Brian R. Stetson
Subject: RE: mercury report to Legislature

It still came through garbled. I would like the material mailed even though it may be to late to comment on it. I understand Pierce, Atwood and/or MPPA will be commenting. My comments from your cover letter explanation would be that the recommended AWQC seems to be based on the most conservative assumptions possible. Considering this fact, it becomes even more important to the regulated community that the criteria for setting discharge limits be very clearly spelled out. (I suspect that very few facilities have any chance of coming close to 0.2ppt in their discharge in the foreseeable future because of background levels.) Your cover letter indicates discharge limits will be "based on" interim limits. Does this mean the existing interim limits would be continued for some time? If they were subject to change I would be interested to know how the magnitude of the change would be determined. I would also like to understand better what is meant by "more effort" in reference to P2 plans.
What P2 requirements would you envision for vaious levels of Hg effluent concentration?

Thank you.

Carl Akeley

-----Original Message-----
From: Mower, Barry F
Sent: Thursday, January 04, 2001 5:29 PM
To: 'Carlton E. Akeley'
Subject: Re: mercury report to Legislature

Sorry. Here it is again. If you don't get it this time I will put it in the mail, but you probably won't get it before we have to go to print.

-----Original Message-----
From: Carlton E. Akeley [mailto:akeleyce@GNPaper.com]
Sent: Wednesday, January 03, 2001 8:14 AM
To: Mower, Barry F
Subject: RE: mercury report to Legislature

This document, as well as the updated appendix 4 from Eric Frohmberg, came

through in a form I could not recover. Could you resend them or send them snail-mail. My address is Carl Akeley, Great Northern Paper, 1 Katahdin Avenue,
Millinocket, ME 04462. Thanks.

Carl

-----Original Message-----
From: Mower, Barry F
Sent: Friday, December 29, 2000 4:02 PM
To: Courtemanch, Dave L; Merrill, Dennis L; Pierce, Sterling; Lennett, David; Brooks, James P; 'David VanWie'; Smith, Andy E.; Frohmberg, Eric...
Subject: mercury report to Legislature

Here is a draft of the mercury Ambient Water Quality Criteria report due the
Legislature Jan 15, 2001 for your review and comment. Since we need to make
any necessary changes and get the report printed by Jan 12, we need comments ASAP and no later than Jan 5, earlier if they are substantial, or
we will not be able to consider them.

As you will see we are recommending elimination of 38 MRSA section 420(1)(A)
the 'no discharge that increases the natural concentration' section and some
other changes to clean up the statute. We are proposing that we use our upcoming AWQC rule-making to adopt new EPA criteria including mercury. EPA
will publish a new mercury criterion in the FR within the next week or so, which allows states to adopt site-specific criteria. We will propose to adopt statewide site-specific criteria for mercury by rule. Ala the new EPA
AWQC, we will propose a Fish Tissue Criterion (FTC). We will propose 0.2 ppm, the Bureau of Health's current Fish Tissue Action Level for women of childbearing age and children under 8. And we will propose to use a BAF of
1-1.3 million which results in an AWQC of ~0.2 ppt.

Knowing that most facilities will have difficulty meeting the new FTC, at least initially, we will also propose in rule a waste minimization approach,
with license limits based on the existing interim mercury limits, and P2 plans that require more effort to reduce by tiers. Facilties might be placed into tiers by the calculated increase in mercury levels in their receiving waters; the higher the projected increase in the receiving water,
the more work needs to be done. Remember this is a draft and ideas are welcome, especially for the P2 portion.

Enclosed are the main document HGAWQC.doc, and table 1 HGAWQC1t1.xls in MS
Word 97 and Excel 97

From: bnicholson@woodardcurran.com
Sent: Friday, January 05, 2001 11:10 AM
To: Mower, Barry F
Cc: lotic@uninets.net; bmoore@midmaine.com; brentd@skowhegan.org; dskeith@somtel.com; dmcgrath@katahdinlab.com; jabrahamson@kstd.com; parisud@megalink.net; john.leslie@bfi.com; pcloutier@spsd.org; wintle@saturn.caps.maine.edu; waterrat@megalink.net; sclukey@brewerme.org; slane@agate.net; wiley@pwd.org; lawpca@gwi.net
Subject: RE: RE: mercury report to Legislature

CC: "'lotic@uninets.net'" <lotic@uninets.net>, "'bmoore@midmaine.com'" <bmoore@midmaine.com>, "'brentd@skowhegan.org'" <brentd@skowhegan.org>, "'dskeith@somtel.com'" <dskeith@somtel.com>, "'dmcgrath@katahdinlab.com'" <dmcgrath@katahdinlab.com>, "'jabrahamson@kstd.com'" <jabrahamson@kstd.com>, "'parisud@megalink.net'" <parisud@megalink.net>, "'john.leslie@bfi.com'" <john.leslie@bfi.com>, "'pcloutier@spsd.org'" <pcloutier@spsd.org>, "'wintle@saturn.caps.maine.edu'" <wintle@saturn.caps.maine.edu>, "'waterrat@megalink.net'" <waterrat@megalink.net>, "'sclukey@brewerme.org'" <sclukey@brewerme.org>, "'slane@agate.net'" <slane@agate.net>, "'wiley@pwd.org'" <wiley@pwd.org>, "'lawpca@gwi.net'" <lawpca@gwi.net>

Barry,
My responses for your consideration.

1. Yes, but obviously it is the DEP's call. I am just surprised that the Department's official position now is that it does not have a numeric AWQC for mercury per Chapter 530.5.

2. I thought it would matter for the DEP because by taking the position that Maine never had a numeric AWQC for mercury, the Department is admitting that the State is in violation of the the Clean Water Act - - CWA section 303(c)(2)(B) which requires that that "Whenever a State reviews water quality standards pursuant to paragraph (1) of this subsection, or revises or adopts new standards pursuant to this paragraph, such State shall adopt criteria for all toxic pollutants listed pursuant to section 307(a)(1) of this Act for which criteria have been published under section 304(a).... Such criteria shall be specific numerical criteria for such toxic pollutants." The Department's prior position up through 12/15/00 was that 'we did this through rulemeking per Ch 530.5 for all toxics including mercury.' Now the position reflected in the draft report is Maine never had a numeric mercury AWQC.Under this new position the State will remain in violation of the CWA section 303 for mercury until the BEP adopts through rulemaking the new 0.2ppm/ 0.2 ppt AWQC to be proposed by the DEP sometime in 2001 assuming the legislature passes the DEP's proposed bill. You might want to check with someone as to whether this new positon effects NPDES delegation.

3. I tried to clarify what I thought was discuused in my comments.

4. I think P2 is the way to go and that the POTWs are more than willing to do their fair share which they are under Chapter 519. It still would be nice to put the scope of the problem into perspective for the

legislature-- this is primarily an air deposition problem. The 1998 laws you mention permit Maine solid waste incinerators to emit up to 100 lbs of mercury each. The biggest 75POTWs in Maine studied by the DEP in 1998 discharged 2.6 pounds of mercury total according to the 1999 Mercury in Wastewater Report.

From: Barry.F.Mower
Sent: Thursday, January 04, 2001 5:55 PM
To: "'bnicholson@woodardcurran.com'" <bnicholson@woodardcurran.com>
Cc: "'lotic@uninets.net'" <lotic@uninets.net>; "'bmoore@midmaine.com'" <bmoore@midmaine.com>; "'brentd@skowhegan.org'" <brentd@skowhegan.org>; "'dskeith@somtel.com'" <dskeith@somtel.com>; "'dmcgrath@katahdinlab.com'" <dmcgrath@katahdinlab.com>; "'jabrahamson@kstd.com'" <jabrahamson@kstd.com>; "'parisud@megalink.net'" <parisud@megalink.net>; "'john.leslie@bfi.com'" <john.leslie@bfi.com>; "'pcloutier@spsd.org'" <pcloutier@spsd.org>; "'wintle@saturn.caps.maine.edu'" <wintle@saturn.caps.maine.edu>; "'waterrat@megalink.net'" <waterrat@megalink.net>; "'sclukey@brewerme.org'" <sclukey@brewerme.org>; "'slane@agate.net'" <slane@agate.net>; "'wiley@pwd.org'" <wiley@pwd.org>; "'lawpca@gwi.net'" <lawpca@gwi.net>
Subject: RE: mercury report to Legislature

This message is in MIME format. Since your mail reader does not understand
this format, some or all of this message may not be legible.
Thanks for the comments.

1. Yes the table was omitted from Appendix 1, but not by design, rather by omission. Yet I am not sure it matters, because I gave you an updated one with the draft report. Do you still think I should have both in the report?

2. With respect to whether we did or did not have an AWQC for mercury, I was convinced by Bill Taylor at the December 15 meeting that we did not. I don't think it matters anyway, because the legislature's intent in suspending 420(1)(A), establishing interim limits, and directing DEP to develop an AWQC seems pretty clear that they think they have suspended the only mercury criterion we had.

3. I have it recorded that you said that. Am I wrong or did you say that and I just misunderstand what you meant?

4. The burden will not fall only on the point source dischargers. We already passed a statute in 1998 that reduces air emissions and have other programs in the works to reduce solid waste contributions. And nationally al lot has and will be done to curb air emissions. But since we have a statewide mercury advisory, we need to cut back where we can; hence our proposal. The legislature has the final say.

-----Original Message-----
From: bnicholson@woodardcurran.com [mailto:bnicholson@woodardcurran.com]
Sent: Wednesday, January 03, 2001 6:23 PM
To: Mower, Barry F; lotic@uninets.net; bmoore@midmaine.com; brentd@skowhegan.org; dskeith@somtel.com; dmcgrath@katahdinlab.com; jabrahamson@kstd.com; parisud@megalink.net; john.leslie@bfi.com;

pcloutier@spsd.org; wintle@saturn.caps.maine.edu; waterrat@megalink.net;
sclukey@brewerme.org; slane@agate.net; wiley@pwd.org; lawpca@gwi.net
Subject: RE: mercury report to Legislature

TO: Barry Mower, ME DEP

FROM: Jeff Toorish, MPPA

DATE: January 5, 2001

RE: Draft ambient water quality criteria report to the legislature

---

Barry, the Maine Pulp and Paper Association and its member companies appreciate the opportunity to provide the Department with comments on the January 2 draft mercury ambient water quality report.

Conceptually, we agree with the Department's recommended approach to continue with the interim limits and ongoing implementation of the mercury P2 plans, while a methodology and numeric ambient water quality criteria for mercury is developed. However, we believe the draft report needs significant changes before it is submitted to the Legislature. Most notably,

- There is no discussion in the introduction on total loading of mercury to Maine's surface waters. While the draft report correctly points out that an ambient water quality criteria that is less than "natural" background levels will be impossible for dischargers to meet, there should be some discussion on the relative contribution of mercury from point source discharges vrs. loadings from air deposition. As drafted, the report leaves the reader with the impression that by simply reducing mercury levels in wastewater effluent, fish consumption advisories in Maine could be lifted. NESCAUM has estimated that the air pathway is the predominant transport medium for both naturally occurring and anthropogenic mercury emissions.[4] Moreover, studies comparing fish mercury concentrations with rates of atmospheric deposition have found that airborne sources of mercury account for much of the aquatic system loading.[5]

  The report should clearly state that the fish consumption advisories apply to <u>all</u> inland surface waters, including great ponds that do not have any point source discharges. Clearly, reducing mercury levels in effluent discharges will have no measurable effect on water quality in those water bodies.

- <u>BAF calculations</u>. Two days notice is not sufficient time for us to fully review the Bureau of Health's proposed BAF methodology, and we will likely have significant comments on the appendix. Briefly, we question the use of the St. Croix and Sebago Lake water column data to derive BAFs. The St. Croix River total mercury level in the report is significantly less than levels measured by one of our member companies, and the Sebago Lake BAF is based upon a single data point. When adjusting the BAFs in Table 3 of the BOH report for dissolved mercury, the BAF value is reduced to approximately 250,000. The BAF in the GLI is 139,000. The 10^6 BAF

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[4] NESCAUM, 1998. *Northeast States and Eastern Canadian Provinces Mercury Study. A Framework for Action.* Northeast States for Coordinated Air Use Management. February 1998.

[5] Rada et al. 1989. "Recent Increases in atmospheric deposition of mercury to north-central Wisconsin lakes inferred from sediment analysis". *Arch. Environ. Contam. Toxicol.* 18:175-181. Fitzgerald, W.F. 1995. "Is mercury increasing in the atmosphere? The need for an atmospheric mercury network (AMNET). *Water, Air, and Soil Pollution* 80:245-254. Rudd, J.W.M. 1995. "Sources of methylmercury to freshwater ecosystems: a review". *Water, Air, and Soil Pollution* 80:697-713.

is not consistent with those reported by EPA and would be the highest in the country. Accordingly, the report should simply refer the reader to the BOH appendix on the draft derivation of BAF's, rather than stating a 10^6 number that is extremely suspect. Lastly, given the difficulty in establishing a single BAF for all receiving waters, the report should also state that site-specific BAFs will be allowed to calculate site specific AWQC where appropriate.

- Fish consumption levels. Appendix 3 discusses the BOH's fish tissue action levels. We question the use of a 0.0324 kg/day fish consumption rate. EPA guidance recommends that local consumption rate data be used where available. Since Maine appears to have a local consumption rate study, why wasn't the 0.026 kg/day value used? There is no explanation in the report why Maine studies were dismissed in favor of EPA's fish consumption rate of 0.0324 kg/day. EPA has recently issued a FTAL of 0.3 ppm. Therefore, the BOH needs to provide a clear rationale why Maine's action level should be 0.2 ppm

- Stakeholder participation. DEP hosted two meetings with interested parties to solicit input on an ambient water quality criteria for mercury, and the executive summary leaves the impression that there was consensus among the SWAT Technical Advisory Group that a single AWQC would be appropriate. This was not the case, and SWAT members submitted comments in response to DEP's November 3 minutes. Appendix 1 should include copies of all comments submitted by SWAT members, and the report should clearly state that no consensus was reached on either an approach or a criterion.

- Compliance schedules. The DEP recommends that facilities that could not comply with the new FTC would be placed on a compliance schedule. There may be less resource intensive means to accomplish this. For example, there could be some type of rebuttable presumption specified in rule that facilities with an approved P2 plan would automatically be considered in compliance with the standard. The tiered approach to BMPs and P2 plans will need to be fully explored through a stakeholder process that would facilitate the sharing of P2 efforts and the development of reasonable BMPs for different tiers and facilities. The mere fact that a particular facility is above a new criterion does not necessarily mean it is not performing well. Other factors such as source category, background concentration, raw material supplies, prior efforts at P2 implementation, etc. need to be considered.

- Comparison of state AWQC for mercury. If DEP intends to include the table comparing water quality criteria in different states, there should be a citation on the source of the information. Is this based on verbal discussions with state regulatory officials, taken from state statute or regulation, etc. Please explain. Additionally, the report mentions that some states have adopted the Great Lakes criteria. It's our understanding that the Great Lakes states do not have permit limits based upon the 1.3ppt wildlife criteria, and/or variances are being granted. Some discussion on how mercury control strategies are being implemented in these states may be helpful.

From: Michael Barden [mbarden@pulpandpaper.org]
Sent: Wednesday, January 10, 2001 5:20 PM
To: Mower, Barry F
Cc: Hafford, Annaleis; Bob Nadeau; Jeff Toorish; Courtemanch, Dave L; VanWie, David
Subject: Re: MPPA comments on draft mercury AWQC report

Barry,
It's obvious we'll continue to have some points of disagreement, and we can
have that debate with the legislature. As a minimum, we'd like to see an appendix in the report that would include all comments DEP received on the draft. At least the legislature would have the benefit of reading all points of view if they so desired. Again, thanks for giving us the opportunity to comment.

-----Original Message-----
From: Mower, Barry F <Barry.F.Mower@state.me.us>
To: 'Michael Barden' <mbarden@pulpandpaper.org>
Cc: VanWie, David <David.Vanwie@state.me.us>; Courtemanch, Dave L <Dave.L.Courtemanch@state.me.us>
Date: Friday, January 05, 2001 7:33 PM
Subject: RE: MPPA comments on draft mercury AWQC report

>Thanks for the comments. We agree with some and question others as
>discussed below.
>
>1. I agree that there should be some language to discuss atmospheric
>depositon and will add some. I do not intend to write that no controls on
>point sources are warranted therefore.
>
>2. The report already says in the executive summary and in the main text
>that the fish consumption advisories apply to all fresh waters.
>
>3. For the report including the BAFs I gave everyone a week, not 2 days,
>to comment. Clearly not much, but we are proposing to adopt the criterion
>via rule-making which will give everyone more time to think about this. I
>have changed the language to make this clearer.
>
>4. Regarding fish consumption levels, we have used 32g/d since the early
>90's for all fish consumption advisories, including dioxin and mercury. The
>ChemRisk study that proposed 26g/d was heavily criticized by 3 national
>experts we had review the study at that time. Anyway we will have a chance
>to discuss this as well during rule-making.
>
>5. Stakeholder participation. Appendix 1, the summary of the SWAT meeting,
>doesn't say there was consensus, it just indentifies the options discussed.
>The executive summary identifies the two options and says the DEP favors

>one. It also says that general consensus was reached at the Dec 15 meeting
>about using a pollutiton minimization approach. I don't find an email from
>Stewart after the Nov meeting. Was there one or some other form of
>communication? If so could I get a copy. We switched email systems around
>then and may have lost it. I thought that the meeting summaries would
>suffice to capture the meetings. I will discuss adding all the comments
>with people here.
>
>6. I agree that there may be other ways besides a compliance schedule, and
>have made changes to say so. We will discuss this as well during
>rule-making.
>
>7. I don't see the need for references on the states criteria table, I
>believe they are all reasonably accurate. And for the wildlife criteria,
>this is not a discussion of who did what with license limits, and what their
>implementation strategies are. I think those need to be discussed in
>rule-making but not in this table.
>
>
>
>
>
>> -----Original Message-----
>> From: Michael Barden [mailto:mbarden@pulpandpaper.org]
>> Sent: Friday, January 05, 2001 4:10 PM
>> To: Mower, Barry F
>> Subject: MPPA comments on draft mercury AWQC report
>>
>> << File: ATTACH01.TXT >> << File: mercuryA.doc >>
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