STATEMENT OF NEED AND REASONABLENESS

BOOK III of III

In the Matter of Proposed Revisions
Of Minnesota Rules Chapter 7050,
Relating to the Classification and
Standards for Waters of the State;

The Proposed Addition of a New Rule,
Minnesota Rules Chapter 7053,
Relating to Point and Nonpoint Source Treatment Requirements; and

The Repeal of Minn. R. Chapters 7056 and 7065

BOOK III

1. Addition of fish tissue water quality standard for mercury.
2. Adoption of standards for two herbicides, acetochlor and metolachlor.
3. Update the human health-based water quality standards for benzene and naphthalene.
4. Adopt an *E. coli* standard to replace the current fecal coliform standard for protection of swimming and other forms of water recreation.
5. Change the default industrial use classification from 3B to 3C, which will relax Class 3 standards for chlorides and hardness for most waters.
6. Changes related to use classifications, including update listings for Class 2A and Class 1 waters and correct and clarify the use class listings.
7. Addition of new Class 1 surface waters and update list of trout waters (Class 2A).
8. Propose 12 use classification changes for 12 waterbodies, including new limited resource value water segments (Class 7 waters).

July 2007
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<table>
<thead>
<tr>
<th>ACR</th>
<th>Acute to chronic ratio</th>
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<tbody>
<tr>
<td>Agency</td>
<td>Minnesota Pollution Control Agency</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>AWWDF</td>
<td>Average [monthly] wet weather design flow</td>
</tr>
<tr>
<td>BAF</td>
<td>Bioaccumulation factor</td>
</tr>
<tr>
<td>BAP</td>
<td>Bioavailable phosphorus</td>
</tr>
<tr>
<td>BCF</td>
<td>Bioconcentration factor</td>
</tr>
<tr>
<td>BEACH</td>
<td>Beach Environmental Assessment and Coastal Health (BEACH) Act</td>
</tr>
<tr>
<td>Bio-P</td>
<td>Biological phosphorus removal treatment technologies</td>
</tr>
<tr>
<td>BMP</td>
<td>Best management practice</td>
</tr>
<tr>
<td>BOD₅</td>
<td>Biochemical oxygen demand; BOD₅ is BOD measured over a 5-day period</td>
</tr>
<tr>
<td>BWCAW</td>
<td>Boundary Waters Canoe Area Wilderness</td>
</tr>
<tr>
<td>CAS</td>
<td>Chemical abstract services registry number</td>
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<tr>
<td>CBOD₅</td>
<td>Carbonaceous biochemical oxygen demand; CBOD₅ is CBOD measured over a 5-day period</td>
</tr>
<tr>
<td>CESARS</td>
<td>Chemical Evaluation Search and Retrieval System database</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>cfs</td>
<td>cubic feet per second</td>
</tr>
<tr>
<td>cfu</td>
<td>colony-forming units</td>
</tr>
<tr>
<td>CGMC</td>
<td>Coalition of Greater Minnesota Cities</td>
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<tr>
<td>ch.</td>
<td>Chapter</td>
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<td>Chl-a</td>
<td>Chlorophyll-a</td>
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<td>CLMP</td>
<td>Citizens Lake Monitoring Program</td>
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<td>CS</td>
<td>Chronic standard</td>
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<td>CSF</td>
<td>Cancer slope factor</td>
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<tr>
<td>CSMP</td>
<td>Citizens Stream Monitoring Program</td>
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<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
<tr>
<td>CWP</td>
<td>Clean Water Partnership</td>
</tr>
<tr>
<td>DMR</td>
<td>Discharge monitoring report</td>
</tr>
<tr>
<td>DO</td>
<td>Dissolved oxygen</td>
</tr>
<tr>
<td>DOC</td>
<td>Dissolved organic carbon</td>
</tr>
<tr>
<td>DWS</td>
<td>Drinking Water Standards</td>
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<tr>
<td>EC20, EC50</td>
<td>Effect concentration; concentration of chemical that has a significant effect on 20 percent and 50 percent of the test organisms in a specified time period, respectively</td>
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<tr>
<td>ECOTOX</td>
<td>Ecotoxicology database</td>
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<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
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<tr>
<td>Ex.</td>
<td>Exhibit</td>
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<tr>
<td>EU</td>
<td>Eutrophication</td>
</tr>
<tr>
<td>FAV</td>
<td>Final Acute Value</td>
</tr>
<tr>
<td>FPE</td>
<td>Fullest practicable extent</td>
</tr>
<tr>
<td>FTE</td>
<td>Full time equivalent – measurement of staff resources</td>
</tr>
<tr>
<td>g/d</td>
<td>grams per day</td>
</tr>
<tr>
<td>GLI</td>
<td>Great Lakes Water Quality Initiative</td>
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<tr>
<td>IBI</td>
<td>Index of Biotic Integrity</td>
</tr>
<tr>
<td>IEPA</td>
<td>Illinois Environmental Protection Agency</td>
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<tr>
<td>HBV</td>
<td>Health based value</td>
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<td>HH</td>
<td>Human health-based standard</td>
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<td>HRL</td>
<td>Health risk limit</td>
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<td>IRIS</td>
<td>Integrated Risk Information System</td>
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<tr>
<td>L</td>
<td>Liter</td>
</tr>
<tr>
<td>LAP</td>
<td>Lake Assessment Program</td>
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<td>LC50</td>
<td>Lethal concentration; concentration of chemical that results in death of 50 percent of the test organisms in a specified time period</td>
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<td>LOEC</td>
<td>Lowest observable effect concentration</td>
</tr>
<tr>
<td>m</td>
<td>meter or meters</td>
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<tr>
<td>MATC</td>
<td>Maximum acceptable toxicant concentration</td>
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<td>MCEA</td>
<td>Minnesota Center for Environmental Advocacy</td>
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<td>MCES</td>
<td>Metropolitan Council, Environmental Services</td>
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<td>MCL</td>
<td>Maximum contaminant levels (EPA drinking water standards)</td>
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<td>Minnesota Department of Agriculture</td>
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<td>MDEP</td>
<td>Massachusetts Department of Environmental Protection</td>
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<td>MDH</td>
<td>Minnesota Department of Health</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>------------</td>
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<tr>
<td>MDNR</td>
<td>Minnesota Department of Natural Resources</td>
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<tr>
<td>MeHg</td>
<td>Methylmercury</td>
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<tr>
<td>MESERB</td>
<td>Minnesota Environmental Science and Economic Review Board</td>
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<tr>
<td>MFCA</td>
<td>Minnesota Fish Consumption Advice or Advisory</td>
</tr>
<tr>
<td>μg/L</td>
<td>microgram per liter or parts per billion</td>
</tr>
<tr>
<td>mg/kg</td>
<td>milligram per kilogram or parts per million</td>
</tr>
<tr>
<td>mg/L</td>
<td>milligram per liter or parts per million</td>
</tr>
<tr>
<td>mgd</td>
<td>million gallons per day</td>
</tr>
<tr>
<td>μm</td>
<td>micron, one millionth of a meter</td>
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<td>MPCA</td>
<td>Minnesota Pollution Control Agency</td>
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<tr>
<td>Minn. R. ch.</td>
<td>Minnesota Rules chapter</td>
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<tr>
<td>Minn. Stat. ch.</td>
<td>Minnesota Statutes chapter</td>
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<tr>
<td>MS</td>
<td>Maximum standard</td>
</tr>
<tr>
<td>NA or na</td>
<td>Not applicable or not available</td>
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<tr>
<td>NALMS</td>
<td>North American Lake Management Society</td>
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<tr>
<td>NCHF</td>
<td>North Central Hardwood Forest Ecoregion</td>
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<tr>
<td>NE</td>
<td>No effect concentration</td>
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<tr>
<td>ng/L</td>
<td>nanogram per liter or parts per trillion</td>
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<tr>
<td>NGP</td>
<td>Northern Glaciated Plains Ecoregion</td>
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<tr>
<td>NLF</td>
<td>Northern Lakes and Forest Ecoregion</td>
</tr>
<tr>
<td>NHD</td>
<td>National Hydrography Data</td>
</tr>
<tr>
<td>NOEC</td>
<td>No observable effect concentration</td>
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<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
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<tr>
<td>O&amp;M</td>
<td>operation and maintenance</td>
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<tr>
<td>OPP</td>
<td>Office of Pesticide and Planning, EPA</td>
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<tr>
<td>ORVW</td>
<td>Outstanding Resource Value Water</td>
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<td>P Rule</td>
<td>Existing Minn. R. 7050.0211, subp. 1a; proposed Minn. R. 7053.0255</td>
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<td>PAH</td>
<td>Polynuclear aromatic hydrocarbons</td>
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<td>PCB</td>
<td>Polychlorinated biphenyl</td>
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<td>PMP</td>
<td>Phosphorus management plan</td>
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<tr>
<td>POTW</td>
<td>Publicly owned treatment works</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts per million</td>
</tr>
<tr>
<td>RdD</td>
<td>Reference dose</td>
</tr>
<tr>
<td>RSC</td>
<td>Relative Source Contribution Factor</td>
</tr>
<tr>
<td>SCV</td>
<td>Species chronic value</td>
</tr>
<tr>
<td>SD</td>
<td>Secchi depth or Secchi transparency</td>
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<tr>
<td>SDS</td>
<td>Minnesota State Disposal System permits</td>
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<tr>
<td>SONAR</td>
<td>Statement of Need and Reasonableness</td>
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<tr>
<td>SR</td>
<td>Minnesota State Register</td>
</tr>
<tr>
<td>SSS</td>
<td>Site-specific standard</td>
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<tr>
<td>STORET</td>
<td>EPA water quality data storage and retrieval system</td>
</tr>
<tr>
<td>su</td>
<td>standard units, units for pH measurements</td>
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<tr>
<td>TBEL</td>
<td>Technology-based effluent limit (limit = limitation)</td>
</tr>
<tr>
<td>TMDL</td>
<td>Total Maximum Daily Load</td>
</tr>
<tr>
<td>TSI</td>
<td>Carlson Trophic State Index</td>
</tr>
<tr>
<td>Tox</td>
<td>Toxicity-based standard</td>
</tr>
<tr>
<td>TP</td>
<td>Total phosphorus or phosphorus</td>
</tr>
<tr>
<td>TSS</td>
<td>Total suspended solids</td>
</tr>
<tr>
<td>UAA</td>
<td>Use attainability analysis</td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile organic carbon</td>
</tr>
<tr>
<td>WCBP</td>
<td>Western Corn Belt Plains Ecoregion</td>
</tr>
<tr>
<td>WDNR</td>
<td>Wisconsin Department of Natural Resources</td>
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<tr>
<td>WQBEL</td>
<td>Water quality- [standard] based effluent limit</td>
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<tr>
<td>WQS</td>
<td>Water quality standard</td>
</tr>
<tr>
<td>WWTP</td>
<td>Wastewater treatment plant</td>
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Table III-A. Reader’s Guide to Location of Major Topics in SONAR Book III.

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<tr>
<th>ITEMS</th>
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<td>Section in SONAR:</td>
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<tr>
<td>Major Topics</td>
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<td>What’s in SONAR Books I, II and III*</td>
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<td>Mercury fish tissue standard</td>
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<tr>
<td>- human health</td>
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<tr>
<td>- wildlife</td>
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<tr>
<td>- implementation and economic impact</td>
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<tr>
<td>Acetochlor and Metolachlor standards</td>
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<tr>
<td>- basis for acetochlor standard</td>
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<td>- basis for metolachlor standard</td>
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<td>- implementation and economic impact</td>
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<td>Benzene and Naphthalene standards</td>
<td>70</td>
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<tr>
<td>- human health</td>
<td></td>
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<tr>
<td>- implementation and economic impact</td>
<td></td>
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<tr>
<td>E. coli standard</td>
<td>83</td>
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<tr>
<td>- protection of waters for swimming</td>
<td>83</td>
</tr>
<tr>
<td>- basis for E. coli standard</td>
<td></td>
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<tr>
<td>- transition from fecal coliform, implementation and economic impact</td>
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<tr>
<td>- no change to fecal coliform effluent limit</td>
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<tr>
<td>Change to Class 3, industrial use</td>
<td>128</td>
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<tr>
<td>- chloride and total hardness standards</td>
<td></td>
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<tr>
<td>- implementation and economic impact</td>
<td></td>
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<tr>
<td>Updates, additions and corrections to use classifications</td>
<td>159</td>
</tr>
<tr>
<td>Addition of Class 1 waters and Update of trout waters list</td>
<td>169</td>
</tr>
<tr>
<td>Limited resource values waters (Class 7)</td>
<td>179</td>
</tr>
<tr>
<td>- list of proposed classification changes</td>
<td></td>
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<tr>
<td>- economic impact</td>
<td></td>
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<tr>
<td>Impacts on agriculture and transportation</td>
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*See SONAR Book I, pages 1 and 3.
I. INTRODUCTION

A. SCOPE [I. INTRODUCTION]

The Minnesota Pollution Control Agency (Agency) is proposing to amend Minn. R. ch. 7050, establish a new rule, Minn. R. ch. 7053, and repeal two rules, Minn. R. ch. 7056 and 7065. This book of the Statement of Need and Reasonableness (SONAR) covers the eight proposed changes and additions to Minn. R. ch. 7050 listed below.

1. Addition of fish tissue water quality standard for mercury.
2. Adoption of standards for two herbicides, acetochlor and metolachlor.
3. Update the human health-based water quality standards for benzene and naphthalene.
4. Adopt an E. coli standard to replace the current fecal coliform standard for protection of swimming and other forms of water recreation.
5. Change the default industrial use classification from 3B to 3C, which will relax Class 3 standards for chlorides and hardness for most waters.
6. Changes related to use classifications to update, correct and improve the use class listings.
7. Addition of new Class 1 surface waters and update list of trout waters (Class 2A), and
8. Propose 12 use classification changes for 12 waterbodies, including new limited resource value water segments (Class 7 waters).

B. STATEMENT OF NEED AND REASONABLENESS [I. INTRODUCTION]

The Administrative Procedures Act (Minn. Stat. ch. 14) requires the Agency to address certain questions and issues in rulemaking that are discussed in the SONAR. The SONAR contains the Agency’s affirmative presentation of facts on the need for and reasonableness of the proposed rule amendments. It also addresses all the statutory requirements associated with proposed administrative rules. As stated, Book III of the SONAR covers the proposed changes and additions listed in the previous Section. The need, reasonableness and economic impacts for each of the eight proposed standards or amendments are discussed together in eight major sections of Book III.

All the proposed amendments to Minn. R. ch. 7050 are shown in Exhibit A-15a. The proposed new Minn. R. ch. 7053 is shown in Exhibit A-15b. If there are any discrepancies between the versions in Exhibits A15a and A-15b and the certified versions from the Revisor’s Office, the latter should be assumed to be the correct version.

Book I of the Agency's SONAR covers background information on topics relevant to these proposed revisions, which is not repeated in SONAR Books II or III (see list below).

- Beneficial uses and use classification system;
- Water quality standards;
- Triennial review of water quality rules;
• Assessment of impaired waters;
• Total maximum daily loads (TMDL);
• Items originally considered, but postponed for this rulemaking;
• Response to comments outside scope of proposed amendments; and
• Public participation.

References to Minn. R. ch. 7050 or 7053 in this SONAR are to the proposed revised or new rule\(^2\), unless specifically stated otherwise.

Numerous exhibits pertinent to the proposed amendments are cited throughout SONAR Book III. Exhibits have been catalogued in an Access file for ease of tracking, sorting and numbering. The list of exhibits pertinent to the subjects covered in Book III is attached. Due to the large number of exhibits (and large size of some), the exhibits will not be made available on the Agency’s Web pages. Any exhibit can be made available upon request for the cost of reproduction. The prefixes used to identify categories of all exhibits are shown in Table III-1.

Table III-1. Prefixes for Categories of Numbered Exhibits.

<table>
<thead>
<tr>
<th>Prefix to Exhibit Number</th>
<th>Category of Exhibits</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Administrative, legal authority, Board appearances, rule language changes, public comments, etc.</td>
</tr>
<tr>
<td>EU</td>
<td>Eutrophication standards for lakes and reservoirs</td>
</tr>
<tr>
<td>PL</td>
<td>Phosphorus effluent limit</td>
</tr>
<tr>
<td>M</td>
<td>Mercury standard</td>
</tr>
<tr>
<td>HH</td>
<td>Human health-based and drinking water standards</td>
</tr>
<tr>
<td>H</td>
<td>Standards for herbicides acetochlor and Metolachlor</td>
</tr>
<tr>
<td>EC</td>
<td>(E.\ coli) standard</td>
</tr>
<tr>
<td>UC</td>
<td>Use classification changes: Class 1-Domestic Consumption, Class 2-Aquatic Life and Recreation, Class 3-Industrial Consumption, and Class 7-Limited Resource Value Waters.</td>
</tr>
</tbody>
</table>

The SONAR has been assigned the following exhibit numbers:

- SONAR Book I is Exhibit A-1
- SONAR Book II is Exhibit A-2
- SONAR Book III is Exhibit A-3
- A complete list of all exhibits is Exhibit A-5

Throughout the text the reader is referred to relevant sections elsewhere in the SONAR. The references are to sections rather than page numbers. To help locate the cited sections, section and subsection headings are followed [in brackets] by the Roman numeral and capital letter, if needed, that identifies the location of that section or subsection. Also in the same brackets is an

\(^{2}\) Throughout the SONAR, some words or phrases are in bold for emphasis.
abbreviated name of the major section. For example, a heading in the *mercury standard* section is: “Current Mercury Standards [IV.A. mercury standard].”

This SONAR can be made available in other formats, including Braille, large print and audio tape. TTY users may call the Agency teletypewriter at 651-282-5332 or 800-657-3864. The Agency will make the *State Register* notice, the SONAR and the proposed rule available during the public comment period on the Agency’s Public Notices Web site: http://www.pca.state.mn.us/news/data/index.cfm?PN=1
II. AGENCY’S STATUTORY AUTHORITY

The Agency’s authority to adopt water quality standards and to classify waters of the state is found in Minn. Stat. § 115.03 (2005), particularly subdivisions 1(b) and 1(c). Subdivision 1(b) authorizes the Agency to classify waters, while subdivision 1(c) authorizes the Agency:

To establish and alter such reasonable pollution standards for any waters of the state in relation to the public use to which they are or may be put as it shall deem necessary for the purposes of this chapter and, with respect to the pollution of waters of the state, chapter 116;

Additional authority for adopting standards is established under Minn. Stat. § 115.44, subd. 2 and 4. Subdivision 2 authorizes the Agency to:

group the designated waters of the state into classes, and adopt classifications and standards of purity and quality therefor. …

Subdivision 4 authorizes the Agency to:

adopt and design standards of quality and purity for each classification necessary for the public use or benefit contemplated by the classification. The standards shall prescribe what qualities and properties of water indicate a polluted condition of the waters of the state which is actually or potentially deleterious, harmful, detrimental, or injurious to the public health, safety, or welfare; to terrestrial or aquatic life or to its growth and propagation; or to the use of the waters for domestic, commercial and industrial, agricultural, recreational, or other reasonable purposes, with respect to the various classes established…

Finally, the Agency is authorized under Minn. Stat. § 115.03, subd. 5 to perform any and all acts minimally necessary, including the establishment and application of standards and rules, for the Agency’s ongoing participation in the NPDES\(^3\) permitting program.

Under these statutory provisions, the Agency has the necessary authority to adopt the proposed rules.

The adoption of administrative rules is regulated under Minn. Stat. ch. 14. This statute and Minn. R. ch. 1400 lay out the rulemaking process, and obligations of the Agency to, for example, involve the public, consider the impact of the rules amendments on certain subsets of Minnesotans, and assess the economic impact of the proposed amendments. They also serve to assure fairness and openness in the process.

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\(^3\) NPDES means National Pollutant Discharge Elimination System.
The proposed rule will be enforced in accordance with the authority provided to the Agency by Minn. Stat. ch. 116 and 115. The Agency has general authority to enforce its rules under these statutes. If approved, the changes to the existing rule will be enforceable by the Agency.
III. OVERALL NEED

Minnesota Stat. ch. 14 requires the Agency to explain the facts establishing the need for and the reasonableness of the rules as proposed. In general terms, “need” means that the Agency must present the reasons for making the proposed changes to Minn. R. ch. 7050. Also, need has come to mean that a problem exists which requires administrative attention.

The Agency has the authority to develop and promulgate water quality standards under the Clean Water Act (CWA)\(^4\) and Minnesota Statutes.

The need for the six proposed changes included in Book III of the SONAR will discussed separately in Sections IV.B, V.B, VI.B, VII.B, VIII.D, IX.B, X.B, X.C and XI.B.

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IV. FISH TISSUE STANDARD FOR MERCURY

A. INTRODUCTION [IV. mercury standard]


Minnesota currently has numeric water quality standards for mercury in both Minn. R. ch. 7050 and 7052 that apply to total mercury concentrations in water (Table III-2).

Table III-2. Existing Class 1 and Class 2 Numeric Chronic Water Quality Standards for Mercury. Minn. R. ch. 7050 and 7052.

<table>
<thead>
<tr>
<th>Rule</th>
<th>Chronic Standard</th>
<th>Mercury Form</th>
<th>Basis</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class 1</td>
<td>Class 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drinking water</td>
<td>Aquatic life</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch. 7050 Statewide</td>
<td>2.0 µg/L (2000 ng/L)</td>
<td>0.0069 µg/L (6.9 ng/L)</td>
<td>Total mercury*</td>
<td>Human Health</td>
</tr>
<tr>
<td>Ch. 7052** Lake Superior basin</td>
<td>na</td>
<td>0.0013 µg/L (1.3 ng/L)</td>
<td>Total mercury*</td>
<td>Wildlife that eat Fish</td>
</tr>
</tbody>
</table>

* Chemical Abstract Service (CAS) number for total mercury: 7439-97-6.
** Ch. 7052 also lists a human health-based criterion of 1.8 ng/L.

Minnesota also has a narrative standard in Minn. R. 7050.0150, subp. 7 that limits fish tissue contaminants to levels that allow safe consumption of fish as often as one meal per week. The original narrative standard (“…nor shall there be any significant increase in harmful pesticide or other residues in the waters, sediments, and aquatic flora and fauna…”) dates to the first statewide water quality rule in 1967. In a 2003 rulemaking, the Agency linked the level of contaminants that are acceptable and unacceptable in fish to Minnesota Department of Health (MDH) fish consumption advice by expanding on the original narrative standard in Minn. R. 7050.0150, subp. 7 (quoted below).

[Minn. R. 7050.0150] Subp. 7. Impairments of waters relating to fish for human consumption. In evaluating whether the narrative standards in subpart 3, which prevent harmful pesticide or other residues in aquatic flora and fauna, are being met, the commissioner will use the residue levels in fish muscle tissue established by the Minnesota Department of Health to identify surface waters supporting fish for which the Minnesota Department of Health recommends a reduced frequency of fish consumption for the protection of public health. A water body will be considered impaired when the recommended consumption frequency is less than one meal per week, such as one meal per month, for any member of the population. That is, a
The Agency is now proposing to add a numeric fish tissue water quality standard to Minn. R. ch. 7050 that is a quantification of the narrative standard. The proposed standard is based on the U.S. Environmental Protection Agency (EPA) *Water Quality Criterion for Protections of Human Health: Methylmercury* (2001; Exhibit M-1). The proposed mercury standard is 0.2 milligram of total mercury per kilogram of fish (or parts per million, ppm). It will apply to total mercury concentrations in edible fish tissue of any species of fish from Minnesota’s waters. The promulgation of a 0.2 ppm mercury standard will augment the current numeric chronic standards by providing a more precise level of protection to fish consumers. The proposed standard applies directly to the fish medium rather than the water medium. The fish tissue standard will not affect or change the application of the current mercury acute or chronic water column standards.

2. **Mercury in the Environment** [IV.A. mercury standard]

Mercury is unique among most pollutants that the Agency deals with and a word about its sources, movement and fate in the global environment is warranted. Mercury has a complex environmental cycle that results in significant bioaccumulation in fish and consequent significant route of exposure to fish consumers (human and wildlife). As depicted in Figure III-1, the primary source of mercury in the environment is air emissions from both anthropogenic and natural sources. In Minnesota, sources of mercury deposition are attributed 70 percent to anthropogenic (burning coal, mining operations, etc.) and 30 percent to natural sources (volcano eruptions, rock weathering, etc.) (Exhibit M-2). Mercury emitted to the atmosphere can travel short and extremely long distances before being deposited on land and water by wet and dry processes. Ninety percent of mercury deposited in Minnesota comes from outside the state (Exhibit M-3).

Once introduced into surface water, certain bacteria can transform mercury to methylmercury by adding a carbon group. This organic form of mercury is efficiently taken up by aquatic organisms, but is only slowly eliminated. Thus, with each step up the aquatic food chain, methylmercury accumulates in tissues at ever greater concentrations. This process, called biomagnification, can result in methylmercury concentrations in top predator fish like walleye and northern pike reaching concentrations more than 2.5 million times the methylmercury concentrations in water (Exhibit M-1).
Mercury is a water quality problem that stems from excessive atmospheric releases from human activities, therefore a multimedia strategy is needed to address the problems caused by too much mercury in the environment. The Agency’s proposed fish tissue standard will help limit mercury exposure to fish consumers, while mercury regulations and reduction strategies at the Federal and State level strive to reduce the sources. Minnesota enacted legislation in 1999 leading to programs at the Agency that have removed mercury from products, manufacturing, incinerator emissions, and schools. Voluntary reduction agreements have also resulted in mercury reductions from coal burning power plants and taconite processors. Prompted by stakeholder concern and considerable feedback on mercury regulations Governor Pawlenty in early 2006 called for legislative mandates to reduce mercury emissions; the Minnesota Mercury Emissions Reduction Act of 2006 passed in May 2006, requiring more stringent mercury controls on the state’s three largest coal-fired power plants.

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B. NEED FOR FISH TISSUE MERCURY STANDARD [IV. mercury standard]

1. Adoption of EPA 304(a) Mercury Criterion [IV.B. need, mercury standard]

The Clean Water Act (CWA) mandates that the EPA develop water quality criteria for toxic pollutants listed in the CWA. The criteria are designed to protect aquatic life and the human use of aquatic life (e.g., fish consumption). The EPA criteria have only guidance status. States and tribes use the EPA criteria as the basis for the adoption of legally enforceable water quality standards into rules. States are required to adopt standards equal to, or “as protective as,” the criteria to protect the beneficial uses of state surface waters. The CWA and EPA authorize states to make scientifically defensible changes to EPA criteria, including proposing a standard more stringent than the EPA criterion if the more stringent value is supported by local information. This is what the Agency has done in the case of mercury. In 2001, EPA’s Office of Water and Office of Science and Technology released a final fish tissue residue criterion of 0.3 ppm or mg/kg (Exhibit M-1). This criterion is meant to ensure that the methylmercury levels in freshwater fish are below levels considered harmful to people that eat fish.

2. Fish Tissue Is the Medium of Concern [IV. B. need, mercury standard]

Traditionally, water quality criteria (from EPA) and Agency standards are water concentrations, and the current numeric standards for mercury are no exception (Table III-1). The ultimate goal of the water-medium standards is to keep mercury concentrations below health benchmarks in fish tissue. Determining protective water concentrations requires estimating how much the concentration of mercury in fish exceeds concentrations in the water the fish live in. This ratio, mercury in fish to mercury in water, is called the bioaccumulation factor (BAF). BAFs for mercury are influenced by numerous factors that can differ from waterbody to waterbody, leading to difficulty in assigning a single BAF. Use of a fish tissue standard eliminates the need to apply a BAF because it applies directly to the medium of exposure, offering a more reliable approach for protecting fish consumers.

Another important aspect to having a fish tissue standard for mercury involves the available monitoring data. Mercury is present in the surface water column at very low or trace concentrations. Specialized sampling and analysis techniques are required to accurately measure mercury at these levels. The cost of sampling and analysis substantially exceeds that of conventional pollutants. In contrast, techniques used to analyze mercury in fish tissue are less specialized and more cost effective. The Agency partners with the Minnesota Departments of Health, Natural Resources, and Agriculture to annually obtain edible fish tissue data on mercury and PCBs (polychlorinated biphenyl ethers) in Minnesota’s lakes and streams (Section IV.D.8). This more comprehensive monitoring data provides the primary foundation for determining if surface waters meet water quality standards and beneficial uses.

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7 Clean Water Act Section 303(c)(2)(B).
3. **0.2 ppm Is Being Implemented Currently, Promulgation is Appropriate** [IV.B. need, mercury standard]

The Agency has been using 0.2 ppm of mercury in fish, the same as the proposed standard, to assess surface waters for impairment beginning in 2002 (section 303(d) of the CWA). As noted, the 0.2 ppm value used to date is a numeric interpretation of the existing narrative standard. Average fish tissue concentrations in each waterbody tested are compared to the 0.2 ppm threshold. Exceedances of 0.2 ppm in fish was responsible for 67 and 58 percent of all impaired water listings on the 2004 and 2006 303(d) lists, respectively (Exhibit A-6). The listing of surface waters on the 303(d) list is mandated by the CWA and has regulatory and legal implications. Adopting this numeric value in rule provides more visibility and clarity for the 303(d) listing process for mercury.

4. **Conclusions** [IV.B. need, mercury standard]

The need to augment the current chronic standards for mercury with the proposed 0.2 mg/kg or ppm fish tissue standard include:

- The CWA requires that states adopt EPA criteria—in this case the 2001 EPA fish tissue residue criterion (or modification thereof)—when applicable for protecting designated beneficial uses.
- Fish consumption is the primary source of mercury exposure to humans; the standard applies in fish tissue.
- Fish tissue is the medium of interest and concern; therefore having a fish tissue standard more reliably protects fish consumers by eliminating the need to extrapolate safe mercury levels in fish from water column standards by removing the uncertainty in bioaccumulation factors (BAFs).
- The Agency has far more fish tissue data than water column data for mercury.
- The proposed standard is the same as the Agency’s numeric interpretation of the narrative standard and MDH fish consumption advise,
- The proposed standard serves as the primary basis to assess mercury contamination in surface waters. Promulgation is the appropriate step, and adding this numeric standard in the rule enhances visibility of the 303(d) listing process. It was used to list mercury impairments for the 2002, 2004, and 2006 303(d) lists of impaired waters. Mercury listings account for 58 percent (1309/2274) of all surface water impairment listings in 2006, with 97 percent listed because of mercury in excess of 0.2 mg/kg in fish and only 3 percent for water column violations.

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9 MPCA. 2006. Clean Water Act Section 303(d) TMDL List [Draft], MPCA, St. Paul, MN, April 2006
C. REASONABLENESS OF PROPOSED MERCURY FISH TISSUE STANDARD, REQUIRED INFORMATION [IV. mercury standard]

1. Introduction [IV.C. reasonableness, mercury standard]

Minnesota Stat. ch. 14 requires the Agency to explain the facts establishing the reasonableness of the proposed rules. “Reasonableness” means: 1) that there is a rational basis for the Agency’s proposed actions, 2) that the Agency’s proposed amendments are appropriate and consistent with its mandate to protect Minnesota’s water resources, and 3) due consideration has been given to the potential economic impacts of the proposals. The reasonableness of the proposed mercury standard is explained in this and the next Section, but this introduction to “reasonableness” applies to all the proposed amendments.

The Agency is obligated to review and revise as necessary Minnesota’s water quality standards every three years (Clean Water Act § 303(c)(1)). The Agency is about three years behind the three-year schedule. Typically there are more standards or provisions in Minnesota’s water quality rules that the Agency feels need to be revised or updated than the Agency has staff resources to pursue. Thus, the items that are included in the scope of this revision represent items considered to have a relatively high priority. It is reasonable and appropriate for the Agency to make these priority decisions, to balance the number of water quality rule provisions that can be addressed against statutory requirements, water quality programmatic considerations, available staff resources, and other factors that together define overall priorities for rulemaking. This introductory statement on reasonableness will not be repeated for each of the proposed changes covered in this Book of the SONAR.

Minnesota Stat. § 14.131 requires that this SONAR, as part of demonstrating the reasonableness of the proposed amendments, include information about affected parties, costs and other topics that are covered in the following 11 sections. The discussion in these sections pertains only to the proposed mercury standard.

2. Classes of Persons Affected by the Proposed Rule Amendments, Including those Classes that Will Bear the Costs and Those that Will Benefit [IV.C. reasonableness, mercury standard]

Because the Agency already has a narrative fish tissue standard for protecting human health and a fish tissue assessment process in place, the adoption of the numeric fish tissue standard essentially does not affect any parties (see discussion in Section IV.E). The Agency sees benefits, however in adopting the standard, because the numeric standard offers transparency to outside parties on the value used to assess fish tissue data for 303(d) impairment listing, corresponds to the fish tissue concentration used by MDH for limiting fish consumption in sensitive subpopulations, and meets the CWA requirements of promulgating EPA ambient water quality criteria, enhancing consistency in the state and federal approaches to mercury contamination in fish tissue.
3. **Estimate of the Probable Costs to the Agency and Other Agencies of Implementing and Enforcing the Rule Amendments, and Any Anticipated Effect on State Revenues** [IV.C. reasonableness, mercury standard]

The Agency does not expect there to be any additional costs to any party initially as a result of promulgation of the mercury fish tissue standard. The Agency in cooperation with the Minnesota Departments of Health, Natural Resources, and Agriculture already have a fish tissue monitoring program in place to assess human health impacts. The addition of this standard does not affect the monitoring program. The Agency programs utilizing mercury standards will also not have costs at the outset of this rule promulgation; as fully discussed in Section IV.D.9, the fish tissue standard augments the water column standards and effluent limits and narrative fish consumption standard and does not change impairment assessments or National Pollutant Discharge Elimination System (NPDES) or State Disposal System (SDS) permit activities at the Agency. However, the Agency cannot rule out the possibility that in the future the EPA will require states to apply an alternative approach to setting effluent limits and mercury control that could result in costs to NPDES/SDS permitted facilities.

The addition of water quality standard for mercury in fish tissue will not affect State revenues.

4. **Determination of Whether There Are Less Costly or Less Intrusive Methods of Achieving the Rule Amendments’ Purpose** [IV.C. reasonableness, mercury standard]

Addition of the fish tissue mercury standards does not have any costs associated with it, and because the 0.2 ppm value is being used now, adoption will be no more intrusive.

5. **Describe Any Alternative Methods for Achieving the Purpose of the Proposed Rule Amendments that the Agency Seriously Considered and the Reasons Why They Were Rejected in Favor of the Proposed Amendments** [IV.C. reasonableness, mercury standard]

The Agency has not seriously considered alternatives to the proposed fish tissue standard for mercury. Because the Agency already has a narrative fish tissue standard that addresses human health using the same numeric value of 0.2 ppm for impaired water assessments, the Agency initially considered not adding the numeric standard in rule, however, as described in Section IV.B., Need, the standard has unique advantages and meets CWA requirements not specifically satisfied by the narrative standard.

6. **Estimate of the Probable Costs of Complying with the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [IV.C. reasonableness, mercury standard]

The Agency does not expect any costs to affected parties that are not already being incurred under the existing fish-contaminant narrative standard or the mercury numeric standards. Economic impacts are described in Section IV. E.
7. **Estimate of the Probable Costs of Not Adopting the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [IV.C. reasonableness, mercury standard]

No party will incur costs if the Agency does not adopt the fish tissue standard, because, as stated we are already using 0.2 ppm.

8. **Differences Between the Proposed Rule and Existing Federal Regulations and the Need for and Reasonableness of Each Difference** [IV.C. reasonableness, mercury standard]

Federal regulations in the CWA and laid out in EPA guidance and water quality criteria documents provide the requirements and guidelines to develop water quality standards; the proposed mercury fish tissue standard developed by the Agency is consistent with relevant federal regulations. There is no Federal mercury fish tissue standard. The CWA gives states the authority to promulgate water quality standards based on EPA criteria. EPA has published Ambient Water Quality Criteria for a mercury fish tissue residue criterion of 0.3 ppm. The CWA and EPA guidance encourage states to modify criteria based on local data. The Agency modified the standard based on the higher fish consumption rate used in Minnesota over the default general population rate used by EPA, resulting in a proposed standard of 0.2 ppm (Section IV.C.4).


Minnesota statutes require state agencies, whenever feasible, to develop rules that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency’s regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals. The proposed fish tissue standard for mercury is “prescriptive” as are all numeric standards as described in more detail in Section III.C.9, *Implementation*. Numeric water quality standards are important benchmarks for the protection of Minnesota’s water resources and the Agency believes their prescriptiveness is not inconsistent with the intent of this statute.

The general concepts of how prescriptive or flexible a rule should be are discussed more in SONAR Book I, Section VIII.I.


Minnesota Stat. §§ 14.131 and 14.23 require the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made.

The Agency described its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I. The Agency has gone well beyond the statutory requirements in its efforts to involve the public in this rulemaking. The Agency has
made significant changes to the scope and content of the proposed amendments in response to public comments.

The Agency intends to send a copy of the Notice of Hearing to the following people and organizations.

- All parties who have registered with the Agency for the purpose of receiving notice of rule proceedings, as required by Minn. Stat. § 14.14, subd. 1a;
- All individuals and representatives of associations the Agency has on file as interested and affected parties; and
- The chairs and ranking minority party members of the legislative policy and budget committees, with jurisdiction over the subject matter of the proposed rule amendments, will receive a copy of the proposed rule amendments, SONAR and notice, as required by Minn. Stat. § 14.116.

Minnesota Stat. § 115.44, subd. 7 states that notices required under sections 14.14, subd. 1a, and 14.22 must also be mailed to the governing body of each municipality bordering or through which the waters for which standards are sought to be adopted flow. The Agency intends to hold public hearings, therefore, section 14.22 does not apply. To comply with Minn. Stat. § 115.44, subd. 7, the Agency shall provide a copy of the notice to the following:

- Mayors of cities in Minnesota
- Minnesota County Commissioners Chairs
- Minnesota Township Chairs
- Soil and Water Conservation Districts
- County Water Planners
- Watershed Districts
- Water Management Organizations
- NPDES/SDS industrial permittees
- POTW permittees

Additionally, the Agency will provide notice to:

- Environmental Justice Advocates of Minnesota
- Council of Asian-Pacific Minnesotans
- Chicano-Latino Affairs Council
- Council of Black Minnesotans
- Minnesota Indian Affairs Council
- EPA Tribal Liaison, and the Indian Tribes in Minnesota:
  - Boise Fort Band of Chippewa
  - Fond du Lac Reservation
  - Grand Portage Reservation
  - Leech Lake Reservation
  - Lower Sioux Indian Community
  - Mille Lacs Band of Chippewa
The Agency will issue a press release at the time the notice of proposed rule adoption is published in the *State Register*. The press release will include the dates, times and locations of the public hearings, and information on how the public can submit comments. In addition, a copy of the notice, proposed rule amendments and SONAR will be posted on the Agency’s public notice Web site at: [http://www.pca.state.mn.us/news/index.html](http://www.pca.state.mn.us/news/index.html). Due to the large number (and large size of some), the exhibits will not be made available via the Agency’s Web pages. Any exhibit can be made available upon request.

Pursuant to Minn. Stat. § 14.14, subd. 1a, the Agency believes its regular means of notice, including publication in the *State Register* and on the Agency’s public notice Web page will adequately provide notice of this rulemaking to persons interested in or potentially affected by these rules.

This section of the *reasonableness, required information* will not be repeated for the other eight proposed amendments in this SONAR but it applies equally to all.

11. **Consultation with the Commissioner of Finance Regarding Fiscal Impacts on Local Governments** [IV.C. reasonableness, mercury standard]

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency will provide the Department of Finance with a copy of the proposed rule and SONAR Form at the same time as these items are sent to the Governor’s Office. This timing allows the fiscal impacts and fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with the Governor’s Office review.

12. **Agency Determination Regarding Whether Cost of Complying with Proposed Rule in the First Year After the Rule Takes Effect Will Exceed $25,000** [IV.C. reasonableness, mercury standard]

The Administrative Procedures Act was amended in 2005 to include a section on potential first-year costs attributable to the proposed amendments (Minn. Stat. § 14.127, subd. 1 and 2). This amendment requires the Agency to determine if the cost of complying with a proposed rule in the first year after the rule takes effect will exceed $25,000 for:

- Any one business that has less than 50 full-time employees, or
- Any one statutory or home rule charter city that has less than ten full-time employees.
The Agency has determined that the cost of complying with the proposed mercury standard in the first year after it takes effect will not exceed $25,000 for the two categories listed above. This is because the proposed mercury standard is already being implemented and adoption will not change the way the Agency assesses waterbodies for potential impairment.

D. REASONABLENESS OF PROPOSED MERCURY FISH TISSUE STANDARD [IV. mercury standard]

1. Introduction [IV.D. reasonableness, mercury standard]

As stated, mercury is one of the most prevalent and troublesome pollutants the Agency deals with, and the consumption of fish is the primary source of mercury to people. The Agency is proposing to augment the current mercury standards that define safe levels in water with a standard that defines a safe level in fish tissue. “Safe” in this context means safe for sensitive populations that eat freshwater fish up to, but not exceeding, a frequency of one meal per week for a lifetime (Table III-4). The Agency plans to retain both chronic standards currently in Minn. R. ch. 7050 and 7052: the statewide 6.9 ng/L and the Lake Superior Basin 1.3 ng/L standards (Table III-2).

Addition of a fish tissue standard for mercury in Minn. R. ch. 7050 is reasonable, because it provides consistency in the goals and approaches used by Agency, MDH, and EPA for protecting humans from mercury’s health effects.

- Follows the comprehensive and thoroughly reviewed risk assessment by EPA for the sole purpose of having states promulgate a fish tissue standard—the EPA concluded a fish tissue standard is the most scientifically defensible and practical approach for addressing mercury contamination in surface waters (the 2001 EPA criterion; Exhibit M-1);
- Addresses protection for sensitive populations, in this case, life-stages: developing fetuses, infants, and children.
- Reflects the threshold used by Minnesota Department of Health (MDH) to recommend fish consumption of less than one meal per week for some women and children and the Agency for determining impairment based on the narrative fish consumption standard adopted into Minn. R. 7050.0150, subp. 7 in 2003.
- Supports the multi-agency fish tissue mercury monitoring program. The fish tissue data supports multiple programs and provides the most comprehensive data on mercury contamination in surface waters for use in 303(d) impaired waters assessments.

2. EPA Fish Tissue Residue Criterion (2001) [IV.D. reasonableness, mercury standard]

The EPA criterion for mercury (Exhibit M-1) is unique among all the aquatic life criteria that EPA has published over the years in that it is the only one that sets a safe concentration in fish tissue rather than water. EPA felt that a fish tissue criterion was the most scientifically sound and rationale approach to address mercury contamination in surface waters and fish. Having a criterion apply in fish tissue instead of water best fits the environmental characteristics and
human health-exposure and -toxicological data for mercury. An important factor, according to EPA, is that fish consumption is the primary route of exposure of mercury to humans.

The EPA, in consideration of the National Research Council’s 2000 extensive report on the health effects of methylmercury\textsuperscript{10} and the 1997 EPA Eight-Volume Mercury Report to Congress on mercury emissions, impacts, and controls\textsuperscript{11}, conducted a comprehensive and thorough risk assessment of mercury and all its common forms to propose the fish tissue criterion (Exhibit M-1). The guidance document was also bolstered by critical and extensive comments from peer reviewers, including experts from the Agency and MDH. The assessment covered exposure, health effects, sensitive life-stages, and bioaccumulation in fish.

The EPA’s exposure assessment focused on characterizing sources of exposure to all the common forms of mercury. Again, exposure to methylmercury from fish consumption stands out as the principal form and route of exposure. The amount of fish consumed and whether the fish are freshwater or marine, factors into the criterion. In 2000, EPA established 17.5 grams of fish per day (g/d) as the default freshwater fish consumption rate for the general population (Exhibit HH-4). This rate is based on routine, comprehensive surveys on food and water consumption by the U. S. Department of Agriculture (USDA). EPA used data from the USDA 1994-1996 Continuing Survey of Food Intake by Individuals on fish consumption by both fish consumers and non-consumers to set the 17.5 g/day consumption rate, which is the 90\textsuperscript{th} percentile rate (represents daily freshwater fish consumption rate for the upper 10 percent of the surveyed population). EPA also concluded that 17.5 g/day is an adequate estimate of the average fish consumption rate for sport fishers. EPA subtracts out methylmercury exposure from marine fish, because the criterion applies only to exposure from freshwater sources (fish). The estimated exposure to methylmercury from marine fish consumption for the general population is accounted for in the determination of the mercury standard by the Relative Source Contribution Factor (RSC).

3. EPA Criterion and Proposed Standard Reflect Latest Analysis of Health Effects [IV.D. reasonableness, mercury standard]

The most well studied and understood health effect from excess mercury exposure is toxicity to the nervous system (Exhibit M-1). Mercury in a variety of forms can affect neurological functioning of infants, children, and adults. But the subpopulations with the greatest sensitivity to neurological effects are developing fetuses and infants. Extensive studies are available that have followed neurodevelopment in babies and children in populations that rely heavily on fish and seafood as a source of food. These epidemiological studies have shown that prenatal methylmercury exposure through fish and seafood consumption by pregnant women correlates with deficits in neurological tests in their babies and children. Exposure to methylmercury during these early life-stages is shown to affect the “processes involved with a child’s ability to learn and process information” (Exhibit M-1).


The EPA develops a health toxicity value for noncarcinogens, termed a reference dose (RfD), to establish a limit of daily exposure for a lifetime below which adverse health effects are unlikely. The EPA uses the most sensitive and well understood health endpoint to set this value and for methylmercury determined that was neurodevelopmental deficits arising from prenatal exposure. The final EPA RfD of 0.0001 mg/kg-d (milligram of methylmercury per kilogram of adult body weigh-day) sets a sound health protective value by being based on strong human evidence, additional uncertainty factors, and comprehensive peer review by numerous experts at EPA and other organizations (Exhibit M-1). Recent studies have also linked methylmercury exposure to impaired cardiovascular function. Given the current health data, EPA concluded the RfD to also be protective of other health effects to other populations, so applies the RfD to the general population. Both the MDH in their fish consumption advice and the Agency, by basing the proposed standard on the EPA criterion, are using the same RfD.

The EPA also reviewed the bioaccumulation of methylmercury in fish to propose a nationwide BAF (Exhibit M-1). The review encompassed data on the concentrations of mercury in different forms in surface waters and accompanying fish data from across the U.S. The EPA compilation of the data confirmed what experts already knew: BAFs for mercury are influenced by many physical and biological factors in a surface water system and that the ranges of BAFs found across the country were not suitable to developing single values that would be reliable in all waterbodies. The highly variable BAFs for methylmercury contributed to the decision to develop a fish tissue criterion.

4. Basis for Modification of EPA Criterion - 30 Grams Per Day Fish Consumption [IV.D. reasonableness, mercury standard]

The Agency is proposing to adopt a fish tissue mercury standard that is more stringent than the EPA criterion, 0.2 ppm rather than 0.3 ppm. The adjustment is based on the assumption in Minnesota that people eat 30 grams of fish per day (g/d), compared to EPA’s assumption that people nation-wide eat 17.5 g/d (Exhibit HH-4).

The Agency has used a fish consumption rate of 30 g/d since first promulgating human health-based numeric water quality standards for toxic pollutants in 1990. The higher Minnesota rate is based on regional fish consumption data, and recognizes the importance and popularity of fishing to Minnesotans. The CWA authorizes and encourages states to modify EPA criterion based on statewide data that differs from national default values. In this case, the Agency is modifying the fish consumption rate used in EPA fish tissue criterion. In addition, if reliable data are available to show that localized populations in Minnesota consistently eat more (or less) fish than 30 g/d, existing Minn. R. 7050.0220, subp. 7 allows the Agency to recalculate an existing standard using the local fish consumption data for a site-specific application.

The fish consumption value of 30 g/d is based on a recommendation of a technical advisory committee to the Agency that met for almost a year in 1988-1989. This committee reviewed data from two surveys of the fish eating habits of the fishing population in Wisconsin and
Ontario. These data are shown in Table III-3, along with data from a nation-wide survey for comparison. It is apparent from these data that the general population eats relatively little freshwater fish even in states that have large fishing populations. In contrast, a survey of people that regularly fish Lake Michigan showed a high fish consumption rate (mean of 45.5 g/d). The Agency felt in 1989 that the Wisconsin and Ontario data were more representative of consumption patterns in Minnesota where the majority of fish caught are from inland lakes rather than from the Great Lakes. The technical advisory committee, which made a number of significant recommendations to the Agency on water quality standard issues, recommended using the 80th percentile fish consumption rate for the angling population. The mean of the 80th percentile values from the Wisconsin and Ontario surveys was 29 g/d, which was rounded to 30 g/d. This value was accepted by the Agency and it became the basis for the successful promulgation of about 30 human health-based chronic water quality standards in 1990 (existing Minn. R. 7050.0222).

Table III-3. Summary of Fish Consumption Data from Several Sources; Basis for 30 g/day Fish Consumption Rate.

<table>
<thead>
<tr>
<th>Surveyed Population</th>
<th>N</th>
<th>median</th>
<th>Mean</th>
<th>75%</th>
<th>80%</th>
<th>95%</th>
<th>99%</th>
<th>source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Michigan anglers</td>
<td>182</td>
<td>27.4</td>
<td>45.5</td>
<td>50.1</td>
<td>56.6</td>
<td>103</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>General, NW Centrala</td>
<td>1503</td>
<td>0.0</td>
<td>2.3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>25.3</td>
<td>1</td>
</tr>
<tr>
<td>General, NE Centralb</td>
<td>2924</td>
<td>0.0</td>
<td>2.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>25.8</td>
<td>1</td>
</tr>
<tr>
<td>Wisconsin anglers (sport-caught fish)</td>
<td>790</td>
<td>6.2</td>
<td>11.3</td>
<td>15.5</td>
<td>21.0</td>
<td>37.3</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>Wisconsin anglers (all fish)</td>
<td>797</td>
<td>21.1</td>
<td>25.4</td>
<td>33.6</td>
<td>--</td>
<td>63.4</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>Ontario anglers (sport-caught fish)c</td>
<td>3020</td>
<td>12.5</td>
<td>20.8</td>
<td>30.7</td>
<td>37.5</td>
<td>105</td>
<td>--</td>
<td>2</td>
</tr>
</tbody>
</table>

Footnotes:
a NW central, includes Minnesota, Iowa, Missouri, N & S Dakota, Nebraska, Kansas
b NE central, includes Ohio, Indiana, Illinois, Michigan, Wisconsin.
c Consumption values equal meals/day times median meal size of 227 grams.

Soon after the adoption of 30 g/d fish consumption rate several additional fish consumption surveys became available. In particular, two studies in Michigan were used to support the selection of a fish consumption amount for the Great Lakes Initiative (GLI) rule, promulgated by

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12 Wisconsin Division of Health and State Laboratory of Hygiene. 1987. Study of sport fishing and fish consumption habits and body burden levels of PCBs, DDE, and mercury of Wisconsin anglers. Final report to study participants. 14 pp.
EPA in 1995 and adopted by the Agency in 1998 (Minn. R. ch. 7052). EPA and the Great Lakes States selected a consumption rate of 15 g/d for the calculation of GLI criteria, which is the mean consumption rate for anglers in the Michigan studies. The 80th percentile consumption rate from the same Michigan studies was 30 g/d. Thus, the Michigan survey results agree very well with the two earlier studies used by the Agency.

To further put 30 g/d fish consumption rate in perspective it is useful to note the following points:

- The amount of fish people eat in one meal varies with the size of the person. MDH assumed that a person weighing 154 pounds (70 kilograms) would eat a half pound of fish in one meal. Thirty g/d equals 210 grams per week or just under one half pound (0.463 pounds). Thus, 30 g/d is essentially equal to one, ½ pound meal per week for the “standard” 70 kg person.

- Use of the 80th percentile consumption rate for anglers may protect many anglers in the upper 20th percentile consumption bracket as well, because these people, while eating a lot of fish, may not eat all their fish from the same source over an entire lifetime.

- A recent survey of fish consumption habits of people with fishing licenses living in Minnesota and North Dakota suggests that a value of about 30 g/d of sport-caught fish was closer to the 95th percentile consumption rate, rather than the 80th percentile. The Agency is reluctant to draw too many conclusions from this one survey because the authors were not able to characterize non-response bias and the response rate for survey recipients was only 20 percent. Nevertheless, it may indicate that the 30 g/d rate is more protective than previously thought.

- An 80th percentile consumption value for the angling population should protect better than 95 percent of the general population (Table III-3, values for General NW and NE Central).

- Prior to 2000 and for many years, EPA used a fish consumption rate of 6.5 g/d to calculate criteria. They increased that amount in 2000 to 17.5 grams per day for the calculation of their human health-based criteria (Exhibit HH-4).

In conclusion the Agency has used 30 g/d to calculate human health criteria since 1990, and feels that it is appropriate and reasonable to continue to use that consumption amount to adjust the EPA mercury fish tissue criterion. The result is a proposed standard somewhat more stringent than the EPA national criterion, but this is reasonable because of the importance of sport fishing and the high percentage of Minnesotans (about half) that have fishing licenses.

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15 The Agency recalculated the EPA Great Lakes Initiative human health-based standards using 30 g/d rather than 15 g/d so Minn. R. ch. 7052 standards would agree with Minn. R. ch. 7050 standards.
5. Consistent with Existing Narrative Standard and Fish Consumption Advice [IV.D. reasonableness, mercury standard]

The proposed numeric fish tissue mercury standard offers consistency in the goals and approaches for protecting fish consumers from mercury contamination among the Agency, MDH and EPA. The shared goal of all three agencies is to limit mercury exposure to fish consumers, so they can enjoy the numerous health benefits of eating fish.

In the “assessment factor” rulemaking completed in 2003 the Agency added details about how waterbodies are assessed for impairment due to mercury in fish (existing Minn. R. 7050.0150, subp. 7, quoted in Section III.A.1). The addition linked the narrative standard to fish consumption thresholds established by MDH, and to a fresh water fish consumption level of one meal per week. The proposed mercury standard of 0.2 ppm is also linked to a consumption level of one meal per week. The proposed standard is completely compatible with the rule changes made in 2003.

To encourage good health for the people that eat fish in Minnesota, the MDH issues guidelines for how often certain fish can be eaten safely. This is called the Minnesota Fish Consumption Advisory (MFCA). Beginning in 2001 the MFCA has provided general advice applicable to all fishing lakes and rivers in Minnesota, regardless of whether the fish from a given waterbody have been tested, with the exception of a subset of lakes and rivers listed individually that have more restrictive consumption advice (Exhibit M-4).

The MDH establishes the concentrations of mercury in fish that trigger the various levels of advice – from “unlimited consumption” to “do not eat”. These concentrations are derived using health-based estimates of exposure to mercury through fish consumption that are likely to be without appreciable risk of harmful effects on humans. The advice is derived using the best peer-reviewed science available. The fish tissue mercury concentrations and corresponding MDH advice categories are shown in Table III-4. Mercury concentrations in Table III-4 are for consumption by the more sensitive sub-populations.

Mercury concentrations in edible fish tissue of 0.2 ppm is the upper end of the range of mercury in fish that corresponds to MDH advice for limiting fish consumption to one meal per week for sensitive members of the population (pregnant women, women who may become pregnant, and children under age 15). At mercury levels between 0.2 and 1.0 ppm, the advice changes to no more than one meal per month for the sensitive groups (Table III-4). Because methylmercury affects neurodevelopment, developing fetuses, infants, and children are more sensitive to health effects than older children and adults. The 0.2 ppm value is based on keeping exposure below the health toxicity value or reference dose (RfD) designed to protect humans (including susceptible subgroups or life-stages) from an appreciable risk of adverse health effects over a lifetime. The 0.2 ppm threshold is lower than the threshold applicable to the less sensitive members of the population, women not planning on getting pregnant and men.

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Table III-4. Mercury Fish Tissue Concentrations (in ppm) that Correspond to MDH Fish Consumption Advice, and Levels that Indicate an Impaired Condition (shaded cells).

<table>
<thead>
<tr>
<th>Mercury Consumption Advice</th>
<th>Minnesota Department of Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish consumption advice for pregnant women, women who may become pregnant, and children under age 15</td>
<td></td>
</tr>
<tr>
<td>Fish Concentration in mg/kg (ppm)</td>
<td>&lt;= 0.05</td>
</tr>
<tr>
<td>Mercury Consumption Advice</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Fish Concentration in mg/kg (ppm)</td>
<td>&lt;=0.16</td>
</tr>
</tbody>
</table>

Shaded cells indicate consumption advice that corresponds to an impaired condition or non-support for the human health narrative fish consumption standard.

The MDH consumption advice is, as the name implies, a guide to help people make good choices about the fish they eat; there is nothing mandatory or regulatory about the MFCA. In contrast, waters determined to be impaired due to mercury (the 303(d) list) are deemed to be in violation of a legally enforceable water quality standard. While mindful of the differences between “advice” and the regulatory implications of impaired waters listings, the Agency also feels it is very important to maintain as much consistency as possible between the thresholds MDH uses to assess data for the MFCA and the thresholds the Agency uses to assess data for determination of impairment. Consistency is important to facilitate public understanding and acceptance of both assessment processes as well as for scientific reasons.

6. Standard in Form of Total Mercury [IV.D. reasonableness, mercury standard]

The proposed mercury fish tissue standard is specified as total mercury, rather than as methylmercury (MeHg) or an inorganic form. There are several reasons why the Agency believes a total mercury fish tissue standard is appropriate and reasonable, even though MeHg is the form that is harmful to people and the human health risk analyses (EPA’s RfD) are based on MeHg.

Probably the primary reason “total” mercury makes the most sense is that the analysis of mercury in fish tissue are reported as total mercury. Also, the vast majority of all mercury concentrations measured in water are, historically as well as currently, total mercury. In the last 10 years or so the analysis of water samples for MeHg has increased, but MeHg is measured usually as part of a more specialized monitoring program or as part of a research project. In water the concentration of total mercury is normally much greater than the concentration of MeHg, and therefore total mercury is easier to detect and measure analytically.
Second, a total mercury standard is reasonable because while the concentration of MeHg is relatively low in water, it is very high in fish tissue. The Agency must be concerned about all forms of mercury in water (i.e., total mercury); because we don’t know how much of the total will end up in fish as MeHg. The amount of MeHg relative to total in most surface waters is low. The EPA reviewed the percentages of dissolved MeHg to total mercury in a variety of surface waters at the time the new fish tissue criterion was being prepared. The data EPA assembled for nine lakes in the northern hemisphere had an average percent of dissolved MeHg of about three percent (range: 0.2 to 14 percent). The data for 13 rivers in the U.S. (including separate averages reported for 39 and 7 rivers in Wisconsin) showed an average percent of dissolved MeHg of 1.4 percent (range: 0.2 to 5.1 percent).

In fish tissue the situation is reversed. That is, almost all the mercury in fish is in the methyl form. Aquatic organisms are exposed to different forms of mercury from the surrounding water and food uptake, but because of the efficient absorption of MeHg in the gastrointestinal tract and its very low elimination rate, mercury in fish tissue is almost 100 percent MeHg (Exhibit M-1). The standard analytical method does not distinguish the form of mercury actually measured in fish tissue (EPA Method 7473)\(^\text{17}\). Analytical results are reported as total mercury, but it can be safely assumed that essentially all the mercury in fish is MeHg.

Third, the current water standards are expressed as total mercury, therefore there is consistency in having a total mercury fish tissue standard.

Finally, the laboratory method for analysis of mercury in fish tissue measures total mercury concentrations.\(^\text{17}\) Again, it is well established that the total mercury measured in fish is equal to the MeHg concentration. The analytical technique does not have to specifically measure MeHg, which lowers the cost and increases reliability of results. It is reasonable for the Agency to promulgate the fish tissue standard as a total mercury concentration.

7. Protection of Wildlife [IV.D. reasonableness, mercury standard]

Fish consumption is also the principal source of mercury-exposure for fish-eating wildlife. EPA has extensively reviewed wildlife data on exposure and health effects for the water quality standard proposed in the Great Lakes Initiative (GLI) in 1995,\(^\text{18}\) promulgated into Minn. R. ch. 7052 in 1998. The Great Lakes basin standard of 1.3 ng/L is based on protecting fish-consuming avian and mammalian wildlife in the Great Lakes area. EPA also conducted a thorough review of fish-eating wildlife and impacts of mercury exposure in the Mercury Report to Congress in 1997.\(^\text{11}\) This review encompassed a broader national view of fish-eating wildlife. To date EPA has not developed a national fish tissue mercury criterion for protecting fish-eating wildlife, nor have they developed national guidance or protocols for proposing a fish tissue standard for the protection of wildlife. The Agency is not currently proposing a fish tissue standard exclusively based on protecting fish-eating wildlife, but is retaining the GLI standard in Minn. R. ch. 7052


and feels the current and proposed standards in Minn. R. ch. 7050 also provide benefits for wildlife.

However, ongoing work by EPA and collaborators has potential for providing a sound foundation for future criteria.\textsuperscript{19,20} Common loons are considered a sentinel species for setting limits on mercury exposure for northern waters.\textsuperscript{20,21} Extensive laboratory and field research on common loons and mercury exposure and health effects in Wisconsin and northeastern United States is providing important data for protecting this and other fish-eating species of wildlife.\textsuperscript{22,23} The Agency has collaborated with one of the nation’s top experts on common loons, Dr. David Evers, to examine mercury exposure in Minnesota’s common loons.\textsuperscript{24} Because recent work by Dr. Evers and colleagues linked adverse effects in loons with fish tissue concentration in prey fish greater than 0.15 ppm (mg/kg),\textsuperscript{23} the Agency will continue examining new data and guidance by EPA for future fish tissue standards for wildlife.

The current lack of a statewide wildlife-based mercury criterion or standard is offset by the fact that numerous lakes and river segments are already listed as impaired for mercury. These waterbodies will be addressed by the proposed mercury TMDL (Exhibit M-2). Because mercury is an air problem, identification of impaired waters serves as a route to achieve reductions in mercury emissions that will benefit both human and wildlife fish consumers in all waterbodies, not just those actually listed as impaired. The TMDL impairment threshold is also based on 0.2 ppm in large predator fish (walleyes and northern pike); therefore, achieving the human health standard in these fish results in even lower concentrations in smaller fish, lower on the food chain – fish typically consumed by many wildlife species, including common loons.

8. Monitoring Mercury Contamination in Surface Waters and Fish [IV.D. reasonableness, mercury standard]

The Agency has programs to monitor mercury in surface waters and edible fish tissue and receives data from outside sources. Beginning in 1996, the Agency began monitoring river basins across the state for mercury and other metals using improved methods. Other agencies have also provided mercury monitoring data from surface waters, including the Metropolitan Council Environmental Services and the U. S. Geological Survey. These programs employ ultra-clean sampling and analytical methods to ensure the highest quality of data. But the longest standing and most comprehensive mercury monitoring data comes from the multi-state agency Fish Contaminant Monitoring Program, which started testing fish for contaminants in 1967.\textsuperscript{8}

\textsuperscript{22} Meyer. 2005. The Wisconsin Loon Project: Insuring Loons will be Here for the Grand Kids. Wisconsin Department of Natural Resources, Rhinelander, Wisconsin.
The Fish Contaminant Monitoring Program involves the Minnesota Departments of Health, Natural Resources and Agriculture as well as the Agency. The program collects fish from lakes and rivers throughout Minnesota, primarily for assessment of human exposure to mercury (and fish tissue contaminants). A variety of fish species and sizes that represent the resident community are collected annually from an average of 95 locations (lakes and streams). The complete fish tissue data base has over 23,000 records. MDNR fisheries staff captures the fish, the fish are processed in the Agency’s water lab, and the analyses are done at the MDA analytical lab. The MDH issues an annual fish consumption advisory, updated with the fish tissue results from the previous year for waters with more restrictive advice than the general advice.

The identification of waters impaired due to the indigenous fish being a potential health hazard is an important part of protecting surface waters for full aquatic life uses. The direct analysis of fish tissue for contaminants is the best means to do this. The shared fish contaminants database ensures the most cost-effective, complete, and consistent data for fish consumption advice and comparison to standards for impairment listing.

9. Mercury Total Maximum Daily Load Study [IV.D. reasonableness, mercury standard]

In June 2006, the Agency published the final draft of a regional TMDL for mercury impaired waters. (Minnesota’s Total Maximum Daily Load Study of Mercury [Draft], Exhibit M-2). The mercury TMDL was submitted to EPA Region 5 for review in August 2006 and EPA approved the TMDL on March 27, 2007.

The TMDL study stems from over 1,300 listings of waterbodies impaired due to too much mercury as measured in fish tissue or in the water. The CWA requires the state to examine pollutant sources and allocate reductions in all sources needed to meet water quality standards (the TMDL). The principal source of the mercury in Minnesota, as elsewhere, is fallout from the atmosphere. Because the primary source is consistent state-wide, it is very appropriate for the TMDL to address the problem regionally.

The TMDL determined that point sources (water discharges from wastewater treatment plants) contribute less than one percent of total mercury loading state-wide. Nevertheless, the TMDL study may affect the requirements of NPDES/SDS permitted facilities in the future. The Agency plans to form a stakeholder advisory committee in 2007 to discuss implementation options for point sources under the approved TMDL. The committee should be able to make recommendations to the Agency in about a year. Meanwhile the Agency will continue to rely on requiring mercury minimization plans in NPDES permits and the current 6.9 ng/L standard to set effluent limits for mercury where needed. Minimization plans identify and seek to reduce the direct sources of mercury to the municipal wastewater treatment system. The less mercury coming into the plant the less that goes out in the effluent. The TMDL also proposes to include fish tissue monitoring along with water monitoring for some facilities, which will enhance data on BAF calculations if need for site-specific TMDLs.
The adoption of the 0.2 ppm mercury standard will not impact the TMDL itself at all because the impairments leading to the TMDL were based on the same threshold, 0.2 ppm in fish.

10. Implementation and Water-Medium Standards [IV.D. reasonableness, mercury standard]

As previously discussed, the mercury fish tissue criterion is the first ambient water quality criterion published by EPA that applies in fish tissue and not water. A “fish-tissue” standard is implemented very much like any other water quality standard (SONAR Book I, Section II.A.6), including the assessment of waterbodies for potential impairment and as the foundation for setting effluent limits in NPDES and State Disposal System (SDS) permits. The Agency has used fish tissue mercury data for impaired waters assessments since 2002. However, it poses unique challenges in practical application in programs built on standards applied as water concentrations, such as the NPDES/SDS program.

The EPA fish tissue criterion does not address the application of the criterion or provide guidance on using fish monitoring data to determine compliance to the criterion for impaired waters assessments (the Federal Register notice provides some guidance, see below). The Agency already has established protocols, updated with each 303(d) impaired waters list that describes the use of fish tissue data in relationship to the narrative standard. In Minn. R. ch. 7050, there will be no restrictions set on the application of the fish tissue criterion based on fish species or fish characteristics, however in response to extensive comments received from stakeholders on the mercury TMDL and recent legal interpretations of the CWA, the Agency is reviewing protocol for 303(d) listing and TMDL applications. At the January 24, 2006 update of the Agency Citizen Board, staff mentioned that several refinements on the interpretation of a fish tissues standard were under discussion (Exhibits A-64a and A-64b). Considered were the possibility of, 1) not applying the standard to top predator fish that exceed a certain size, 2) requiring more than one fish in a sample to list a waterbody, and 3) using regression analysis to infer mercury concentrations for fish of a size not represented in the sample. The Agency received over 500 e-mails in response to this presentation; the concern was that these actions would weaken the mercury standard (example of the most common e-mail is Exhibit A-67a). An e-mail response was sent to all those that e-mailed comments (Exhibit A-67b). The Agency will be obtaining additional stakeholder input and making final decisions on these changes through the 303(d) listing, assessment guidance, and TMDL process. The Agency is not considering changes in how water column data is used in impairment listings.

Currently, effluent limits for mercury in NPDES/SDS permits are based on either the statewide water column chronic standard of 6.9 ng/L, adopted in 1990 (Minn. R. ch. 7050), or in the Lake Superior Basin, 1.3 ng/L adopted in 1998 (Minn. R. ch. 7052). With the promulgation of the mercury fish tissue standard, the Agency is retaining these water column standards and plans to continue their use in setting effluent limits until alternative approaches are deemed practicable and feasible based on the recommendation of the mercury TMDL implementation stakeholder committee and any final guidance from EPA on the implementation of the 2001 EPA fish tissue residue criterion.

The EPA Federal Register notice on the publication of the fish tissue criterion in 2001 provides a short discussion on possible alternatives for implementing the fish tissue standard as a basis for
NPDES effluent limits, including conversion to water concentrations (Exhibit M-5). The exception would be for waters covered by the Great Lakes Initiative (GLI) where the EPA supports retention of the mercury water column standards and their use in setting effluent limits (1.3 ng/L in Minn. R. ch. 7052). In the notice, EPA presents problems inherent with applying any of the approaches for setting effluent limits and announces by the end of 2001 EPA would publish detailed guidance for States and Tribes on implementation. On August 9, 2006 a draft guidance was finally published by EPA (Exhibit M-8). The Agency has reviewed the Draft Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion, but is not planning at this time to alter our approach to implementation for these reasons:

- Any new approach for implementing mercury controls at water point sources needs to be consistent with the recommendations of the mercury TMDL stakeholder advisory committee, EPA final guidance, and other NPDES/SDS and CWA rules;
- Simple use of bioaccumulation factor (BAF) for mercury to translate the fish tissue standard to a water concentration for effluent limits is problematic as described below.

The “BAF” approach to translating a fish tissue to a water concentration is simple:

\[ C_w \text{ in ng/L (ppt)} = (0.2 \text{ ppm / BAF}) (1,000,000) \]

Where:

- \( C_w \text{ = concentration of mercury in water in ng/L} \)
- 0.2 mg/kg or ppm = fish tissue standard
- BAF in l/kg
- 1,000,000 = adjustment of units from parts per million to parts per trillion

There is a substantial amount of information on mercury bioaccumulation rates. But one fact that always emerges from any analysis of mercury bioaccumulation is how variable it is, and how site-specific it can be. This was the conclusion of EPA in their review of bioaccumulation for the revised mercury criterion (Exhibit M-1). The EPA avoided having to settle on one BAF, or a range of BAFs, by proposing a fish tissue mercury criterion – one of its major advantages.

The Agency has examined monitoring data from Minnesota’s lakes and streams from which mercury BAFs can be derived. Using total mercury concentrations measured in water and fish in the same watersheds, the Agency evaluated BAFs for river basins and lakes (Exhibits M-6 and M-7). The best set of BAF data for lakes is from 14 lakes covering the three distinct geographical and land-use zones across the state: agriculture, Twin Cities metropolitan area, and forest (Exhibit M-2 and M-7). BAFs for total mercury in lakes using standard size walleye and northern pike ranged from 32,587 L/kg to 1,426,490 L/kg, with a geometric mean of 388,424 L/kg.

Similarly the Agency reviewed bioaccumulation data for major river systems in Minnesota (Exhibit M-6). Basin-wide average BAFs ranged from a low of 28,000 L/kg for the lower Mississippi River to a high of 148,000 L/kg for the upper Mississippi River basin. The variability of mercury BAFs within Minnesota means that one needs to be cautious about using a
particular BAF in the translation process, and final guidance on how to translate a fish tissue number to a water column concentration is pending.

At this time the Agency plans to retain the current water quality standards for mercury that apply to water column concentrations (Table III-2), primarily to maintain consistency in how the Agency addresses mercury from water point sources. The Agency always planned to retain the 1.3 ng/L standard in Minn. R. ch. 7052 because it is wildlife-based, and until the Agency (or EPA) develops a wildlife-based fish tissue standard (criterion), the Agency will retain this standard. The Agency changed its position regarding retaining the human health-based 6.9 ng/L standard over the course of preparing for this rulemaking. The Agency originally planned to replace it with the proposed fish tissue standard of 0.2 ppm. The decision was made to retain it because EPA had not issued a final implementation guidance (Exhibit M-5), and because, at the time, the Agency’s mercury TMDL was still in draft from (Exhibit M-2). In addition, the lack of EPA final guidance means the Agency does not have the benefit of EPA’s expertise on the issues, or their strategies and policies on how to make the transition from fish to water concentrations. EPA also has easy access to nation-wide monitoring data and modeling tools that the Agency may not. The Agency decided to retain the 6.9 ng/L standard for the purpose of setting mercury effluent limits, at least as an interim measure.

In conclusion, the Agency will continue to urge point sources to reduce mercury emissions wherever they can through development and implementation of mercury reduction plans. And the Agency will continue to set effluent limits for the larger facilities. The Agency plans to delay using the 0.2 ppm fish tissue standard as the basis for setting point source effluent limits until the mercury stakeholder committee issues recommendations. Final implementation guidance from EPA would be helpful as well. Meanwhile, the Agency plans to retain the 6.9 ng/L standard and continue to use it as the basis for setting effluent limits. The addition of the fish tissue standard will not affect NPDES or SDS effluent limits for some time and the outcome of the stakeholder committee process is uncertain.

E. ECONOMIC IMPACT [IV. mercury standard]

The addition of new water quality standards can have the potential for economic impact primarily to programs involved with surface water monitoring, 303(d) impairment listings, TMDL studies and NPDES/SDS permits. Initially, the addition of the fish tissue mercury standard will have no economic impacts on any of these programs, because:

- The numeric fish tissue standard is already applied under the narrative fish consumption standard in existing Minn. R. 7050.0150, subp. 7;
- Monitoring and 303(d) listing programs are already based on assessing mercury contamination in fish tissue;
- Water quality standards and effluent limits for mercury underlying NPDES/SDS permits will not change until stakeholders have an opportunity to weigh in on the process.

The Agency has been using 0.2 ppm of mercury in fish, the same as the proposed standard, to assess surface waters for 303 (d) impairment beginning in 2002 (section 303(d) of the CWA).
As noted previously, the 0.2 ppm value used to date is the numeric interpretation of the existing narrative standard for protecting human consumers of fish. The promulgation of this value in rule as the fish tissue mercury standard does not change the Agency’s assessment of mercury in fish tissue.

The principle monitoring program for mercury in surface waters has been based on fish tissue measurements. The Agency already has cooperated with the Minnesota Departments of Health, Natural Resources, and Agriculture to set up a cost-effective and comprehensive fish tissue monitoring program focused primarily on mercury contamination. The promulgation of the mercury fish tissue standard does not affect the monitoring design or scope of the already ongoing FCMP.

As noted, dischargers covered under NPDES/SDS permits will not have any changes in their permits due to the addition of the mercury fish tissue standard, at least for the foreseeable future. The Agency is retaining the two water column mercury standards, which are unaffected by the mercury fish tissue standard. However, the Agency recognizes that the retention of the current chronic water column standard may prove to be an interim solution for setting effluent limits and the mercury TMDL stakeholder process or a final implementation guidance from the EPA may ultimately lead to an alternative approach for setting effluent limits or controlling mercury from water point sources.

Because of the high uncertainty in identifying the timeframe for when changes to effluent limits could occur and what those changes would mean, if any, the Agency cannot provide a definitive answer on if costs would be incurred by NPDES/SDS permitted facilities in the future.

F. CONCLUSIONS [IV. mercury standard]

Mercury is an air pollutant that because of its complex environmental cycle ends up being a significant problem in aquatic systems. Bioaccumulation in fish and other aquatic organisms mean that humans receive most of their mercury exposure from fish consumption. The Agency is proposing to add a numeric fish tissue water quality standard to Minn. R. ch. 7050. The proposed standard is based on the EPA Water Quality Criterion for Protections of Human Health: Methylmercury (2001; Exhibit M-1). The proposed mercury standard is 0.2 milligram of total mercury per kilogram of fish (or parts per million, ppm) will apply to total mercury concentrations in edible fish tissue of any species of fish from Minnesota’s waters. The promulgation of a 0.2 ppm mercury standard is important for augmenting the current numeric chronic standards for water column concentrations by providing a more precise level of protection to fish consumers, where mercury exposure is a concern. The fish tissue standard would not, however, affect or change the application of the current mercury chronic standards.
V. PROPOSED STANDARDS FOR ACETOCHLOR AND METOLACHLOR

A. INTRODUCTION [V. acetochlor and metolachlor]

In February 2002, the Minnesota Department of Agriculture (MDA) asked the Agency to develop surface water standards for several pesticides (Exhibit H-1). In subsequent meetings, the Agency indicated it had resources to develop and promulgate water quality standards for two herbicides. MDA responded by saying that standards for acetochlor and metolachlor would be their first priority.

B. NEED FOR ACETOCHLOR AND METOLACHLOR STANDARDS [V. acetochlor and metolachlor]

1. Introduction [V.B. need, acetochlor and metolachlor]

The Agency develops and revises water quality standards to protect aquatic life, and human and ecological health under mandates in the Clean Water Act, Minnesota Statutes, and Minnesota Rules chapters 7050 and 7052. Most numeric standards promulgated and adopted by the Agency are based on aquatic life criteria published by EPA under Section 304(a) of the Clean Water Act. It is EPA’s responsibility to research the literature, conduct toxicity tests as needed, solicit public input, develop and publish nation-wide aquatic life criteria. EPA criteria are guidance, and they must be adopted as standards by states to become legal entities. EPA’s role as developer of national criteria is extremely important to state (and Tribal) water quality standard programs. It facilitates the adoption of consistent and well researched numeric standards by states and Tribes. Unfortunately, EPA criteria are not available for many modern-day pesticides, including acetochlor and metolachlor. Therefore, the Agency undertook the development of the proposed standards “from scratch” using methods that follow EPA and Agency guidance (described fully in Reasonableness, with reference to Exhibits H-11 and HH-3). The Agency has done this before; in the absence of EPA criteria; for example, we developed and successfully promulgated standards for two herbicides, atrazine and alachlor, in 1994.

Before committing to develop standards, the Agency had developed “advisory values” for both acetochlor and metolachlor in 1996 and 1998, respectively. Advisory values are based on a limited search of relevant toxicity data, and they have not, nor would they, be promulgated into Minnesota Rules. The Agency advisory values for both herbicides are based on aquatic life toxicity. Advisory values are often developed in response to spill incidents and for use as clean-up thresholds at pesticide remediation sites (Exhibits H-2a, H-2b and H-3, Table III-5). The Class 2A (trout waters) advisory value for acetochlor was lowered slightly in 1998.
In 1986 EPA developed advisory values for metolachlor based on both human health and aquatic life toxicity. The EPA aquatic life “advisory program” seemed to be an effort by EPA in the mid-1980s to satisfy the strong demand for toxicity-based values, in lieu of the more rigorous and time consuming process of developing 304(a) criteria. EPA advisory values, like the Agency’s counterpart, are based on a limited investigation of toxicity data. EPA urges caution in the application of advisory values. It appears that by about 1990, EPA abandoned the advisory value program. These values are shown in Table III-5 compared to the proposed chronic standards (in shaded rows).

Table III-5. Agency and EPA Chronic Advisory Values for Acetochlor and Metolachlor, Compared to Proposed Chronic Standards, in μg/L.

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Source</th>
<th>Basis</th>
<th>Class 2A</th>
<th>Class 2Bd</th>
<th>Class 2B,2C,2D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetochlor</td>
<td></td>
<td>μg/L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1996 advisory</td>
<td>MPCA</td>
<td>Toxicity</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1998, revised advisory</td>
<td>MPCA</td>
<td>Toxicity</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed chronic standard</td>
<td>MPCA</td>
<td>Toxicity</td>
<td>1.7</td>
</tr>
<tr>
<td>Metolachlor</td>
<td></td>
<td>μg/L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1998 advisory</td>
<td>MPCA</td>
<td>Toxicity</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1986 advisory</td>
<td>EPA</td>
<td>Human health</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1986 advisory</td>
<td>EPA</td>
<td>Toxicity</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed chronic standard</td>
<td>MPCA</td>
<td>Toxicity</td>
<td>23</td>
</tr>
</tbody>
</table>

MPCA means Minnesota Pollution Control Agency

2. Request for Standards from Minnesota Department of Agriculture [V.B. need, acetochlor and metolachlor]

The Minnesota Department of Agriculture (MDA) is Minnesota’s lead agency for pesticide regulations and management. And the Pollution Control Agency has a broad mandate to protect Minnesota’s waters from toxic pollutants. Both agencies have an excellent record of coordination in carrying out these roles. In conjunction with records of pesticide sales and monitoring data that shows potential exceedances, and sales of pesticides, MDA asked the Agency to develop water quality standards, or at a minimum, advisory values, to evaluate the significance of pesticides detected in surface waters, or to anticipate the aquatic toxicity of new

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products. The MDA in turn uses standards and advisory values to make pesticide management decisions (Acetochlor and Metolachlor Supplements, Exhibit H-4 and H-5).

In February 2002, MDA’s Agricultural Chemical Environmental Section sent a formal request to Agency Water Standards Unit explaining the need for additional pesticide standards (Exhibit H-1). The MDA updated their request in April 2003 to encompass new information on pesticide-use and detections. Their request also recommended an extensive review for promulgation of water quality standards for eight pesticides and/or their environmental breakdown products (degradates), as preferred to a less comprehensive aquatic toxicity review used to set advisory values (Exhibit H-6). Further discussion between the Agency and MDA in May 2004 (as recorded in a letter on June 23, 2004; Exhibit H-7) led to the Agency’s commitment to develop standards for acetochlor and metolachlor, and to review degradate information when available. The Agency also agreed to follow up on the development of additional advisory values on the other priority pesticides and degradates in the future, as staff availability permits.

3. Acetochlor and Metolachlor Used Extensively in Minnesota [V.B. need, acetochlor and metolachlor]

Acetochlor and metolachlor (including s-metolachlor) are both preemergence herbicides used to control grasses and some broadleaf weeds. About three to five million pounds of acetochlor and about one to two million pounds of metolachlor were sold in Minnesota each year from 2002 to 2004, mainly for use on corn (see Exhibits H-4 and H-5).

4. Herbicides Detected in Ground and Surface Waters [V.B. need, acetochlor and metolachlor]

Requests from MDA for acetochlor and metolachlor water quality standards were prompted by detection of these herbicides in Minnesota’s surface waters, and contamination at remediation sites. As explained fully in the Acetochlor and Metolachlor Supplements (Exhibits H-4 and H-5), under the guidance of MDA’s Pesticide Management Plan, MDA identified acetochlor as a surface water pesticide of concern, and both acetochlor and metolachlor as frequently detected in ground water in 2003. Previously, a multi-stakeholder committee representing state agencies, farmers, agricultural industries, environmental groups, and academia recommended MDA take additional actions in response to the frequency of detection and measured concentrations of acetochlor in surface water, and for acetochlor and metolachlor in ground water. MDA surface water monitoring data has shown concentrations of acetochlor at or above the Agency advisory value developed in 1998 (Exhibit H-2b). These “exceedances” met MDA’s Pesticide Management Plan criteria for a “surface water pesticide of concern”, which calls for pesticide-

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30 Pesticide is a general term that encompasses a range of agents used to control and kill pests and commonly refers to herbicides (controls plants), fungicides (controls fungi), and insecticides (controls insects).
31 MDA Web site on pesticide use at http://www.mda.state.mn.us/appd/pesticides/pesticideuse.htm
specific voluntary best management practices (Exhibit H-8). Pesticide-specific voluntary BMPs were also developed for acetochlor and metolachlor for ground water protection.

Frequent occurrence of acetochlor and metolachlor in surface runoff flows, prompted MDA to request the development of standards for these two pesticides, in part as a prevention strategy to keep various watersheds in Minnesota from being put on a total maximum daily load (TMDL) impaired waters list. Metolachlor detections in surface water samples have been found in as much as 100 percent of samples taken during storm-events, and in 92 percent of samples taken during base flow periods. Concentrations have been below the Agency’s advisory value at most sampling locations. The properties of metolachlor result in a high potential for movement into surface waters following land application. Acetochlor’s registration in 1994 for use on crops by EPA was contingent on a reduction in use of other corn herbicides, such as alachlor. As early as 1995, MDA monitoring showed detections in surface water; acetochlor is now detected at all automated river stations during the growing season and in almost half of the statewide survey sites. Monitoring has shown single samples with acetochlor concentrations above the advisory value (Acetochlor Supplement, Exhibit H-4).

The Agency believes it is important to respond positively to MDA’s request and monitoring results, and to promulgate water quality standards for acetochlor and metolachlor in Minn. R. ch. 7050. The development and promulgation of standards assures that there will be a complete, current and comprehensive scientific review of aquatic life and human health toxicity information, and an opportunity for a full public review. Adopted pesticide standards will help provided the basis for appropriate responses by MDA, Agency, and the agricultural community to surface water detections. The significance to human and ecological health from pesticides in surface waters cannot be determined without water quality criteria.

In summary, standards for acetochlor and metolachlor are needed to honor MDA’s request for additional pesticide standards, because of the extensive use of these herbicides on corn, and because they are being detected in both ground and surface waters in Minnesota. Detected concentrations of these chemicals in waters of the state, particularly acetochlor, pose a potential threat to aquatic communities. Water quality standards will help assess the magnitude of these potential problems in the future.

C. REASONABLENESS OF PROPOSED ACETOCHLOR AND METOLACHLOR STANDARDS, REQUIRED INFORMATION [V. acetochlor and metolachlor]

1. Introduction [V.C. reasonableness, acetochlor and metolachlor]

Minnesota Stat. § 14.131 requires that this SONAR, as part of demonstrating the reasonableness of the proposed amendments, include information about affected parties, costs and other topics that are covered in the following 11 sections. The discussion in these sections pertains only to the proposed acetochlor and metolachlor standards.

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2. Classes of Persons Affected by the Proposed Rule Amendments, Including those Classes that Will Bear the Costs and Those that Will Benefit [V.C. reasonableness, acetochlor and metolachlor]

As with all statewide water quality standards, essentially all the citizens of Minnesota could be affected by, and benefit from, the proposed water quality standards for the corn herbicides, acetochlor and metolachlor. Some of the benefits to people in general are intangible, such as the assurance that Minnesota’s Agencies are taking steps to protect aquatic communities and human health by continuing to address detections of pesticides in surface waters. Concerns about another corn herbicide, atrazine, have made pesticides a popular news item. The MDA has taken critical steps with the development and promotion of pesticide-specific voluntary best management practices (BMPs) to manage and reduce the occurrence of corn herbicides in surface and ground waters. Water quality standards provide benchmarks to show that Minnesota’s waters are healthy and support their designated beneficial uses or are in need of additional intervention. Agency promulgation of water quality standards for the most frequently used and detected corn herbicides is a necessary step to ensure protection of Minnesota’s valuable water resources and fulfill the protection level goals under the Clean Water Act.

In the corn-growing areas of the state where acetochlor and metolachlor are used, water quality standards provide local and state agencies the tools for ensuring aquatic communities and human health are not being impacted by pesticides in surface waters. Surface waters with measurable concentrations of acetochlor and metolachlor include rivers protected for trout fishing, swimming, drinking water, and fish consumption. The standards for acetochlor and metolachlor are designed to protect all these designated beneficial uses. Direct users (human and aquatic organisms) of surface waters will benefit by having the protection provided by the standards.

Promulgated water quality standards for pesticides benefit the Agency and MDA when setting priorities for monitoring and management activities. Numerous pesticides are registered for agricultural use, all with different toxicity and properties; information on their relative toxicities and potential for leaching and runoff assists in setting monitoring priorities by MDA. Analytical costs and available resources dictate which pesticides should be included in their monitoring program. Monitoring can target the most toxic, highly used, and mobile pesticides in the environment. The MDA uses advisory values and standards from the Agency to trigger voluntary statewide and chemical-specific BMP development and outreach activities to reduce impacts before impairment may occur. Comprehensive reviews of pesticides for standards ensure that the best data is being used by state agencies to direct activities by the agricultural community.

Section IV.L., Economic Impact, provides a complete discussion of the affected parties and costs. Stakeholders possibly affected are summarized below.

The Agency and MDA have shared responsibilities for ensuring waters meet their designated beneficial uses relative to pesticides. Water quality standards give the Agency a basis for assessing waters for impairment by acetochlor and metolachlor for 303(d) listing. The Agency already assesses MDA pesticide monitoring data for possible impairment of other herbicides with standards: alachlor and atrazine. The Agency has staff with expertise on pesticide
assessments put time into the Impaired Waters assessment process; the time commitment is expected to increase with the new acetochlor and metolachlor standards, but the extent is uncertain. The MDA will be affected primarily in their technical support role to the Agency in pesticide assessments.

More parties will be affected if waters are listed as impaired on the 303(d) list. The Agency would need to direct resources into developing a TMDL and implementation plan for listed watersheds. The MDA would also likely assist in TMDL development and implementation. Corn growers in the listed watershed would be affected by a herbicide impairment by responding to BMPs. Registrants may participate in monitoring or management activities.

3. Estimate of the Probable Costs to the Agency and Other Agencies of Implementing and Enforcing the Rule Amendments, and Any Anticipated Effect on State Revenues [V.C. reasonableness, acetochlor and metolachlor]

The Agency and MDA are the principal state agencies that deal with pesticides in surface waters. The Agency doesn’t expect any substantial new costs to either agency as an immediate result of the promulgation of acetochlor and metolachlor standards. Where agency costs are anticipated would be as a result of a 303(d) listing; current monitoring data points to at least one future listing for acetochlor. A complete discussion of probable costs to the Agency is found in Section IV.L.

The Agency anticipates no impact to minimal impacts to State revenues from the addition of water quality standard for acetochlor and metolachlor.

4. Determination of Whether There Are Less Costly or Less Intrusive Methods of Achieving the Rule Amendments’ Purpose [V.C. reasonableness, acetochlor and metolachlor]

Promulgation of water quality standards for acetochlor and metolachlor offers options to the Agency not available without the standards. Assessment of herbicide concentrations in surface waters could be enacted under the current narrative standard in Minn. R. 7050.0150, subp. 3, but numeric standards provide clear, sound, and legally defensible protective water concentrations for determining if waters are meeting their designated beneficial uses. No other option exists for offering the same level of confidence and visibility of important health benchmarks for assessing the potential impacts of herbicides in surface waters.

As popular corn herbicides, acetochlor and metolachlor are widely applied annually to corn crops in Minnesota. Sales of acetochlor and metolachlor in 2004 were 3.8 and 2.7 million pounds, respectively, and ranked number two and four in pounds of active ingredients sold for all corn herbicides. Both herbicides are detected in surface waters draining corn growing sections of the state. The MDA has requested the Agency develop water quality standards for over 15 pesticides and some degradates, but identified these two herbicides as their top priority (Exhibits H-1, H-6, and H-7). The Agency feels it is important to act on MDA’s requests, so not
developing any water quality standards for pesticides (includes herbicides) is not a defensible option.

Previous advisory values developed by the Agency do not receive the level of scrutiny and exposure as promulgated water quality standards. The MDA can use the advisory values and have for developing and promoting voluntary BMPs (Exhibit H-8), but water quality standards provide greater reliability for such resource-intensive efforts. Promulgation of water quality standards requires and provides a forum for extensive review and opportunities for comments from any interested party; development of advisory values don’t go through the same rigorous review process. The Agency also has not used advisory values for 303(d) listing, an important assessment of surface waters required by the Clean Water Act.

5. Describe Any Alternative Methods for Achieving the Purpose of the Proposed Rule Amendments that the Agency Seriously Considered and the Reasons Why They Were Rejected in Favor of the Proposed Amendments [V.C. reasonableness, acetochlor and metolachlor]

The Agency has not seriously considered alternatives to the proposed water quality standards for acetochlor and metolachlor. The Agency would like to have developed additional water quality standards for pesticides as requested by MDA, but because of the significant amount of staff time and need to adhere to the rules timeline, the Agency could only feasibly commit to the two top pesticides, acetochlor and metolachlor. The publication of final ambient water quality criteria for modern pesticides by EPA in the future would greatly reduce the time and staff commitment to develop these standards and would facilitate addressing more pesticides.

6. Estimate of the Probable Costs of Complying with the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties [V.C. reasonableness, acetochlor and metolachlor]

Potential costs to any party attributed to the herbicide standards would primarily be contingent on impairment listings on the 303(d) list and subsequent TMDLs; estimates of possible costs are discussed in Section IV.L, Economic Impacts.

7. Estimate of the Probable Costs of Not Adopting the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties [V.C. reasonableness, acetochlor and metolachlor]

The Agency believes there could be “costs” to Minnesotans if the herbicide standards are not adopted. Minnesotans place a high value on our water resources for drinking water and fish consumption, recreation, and healthy ecosystems (see example discussion for benefits of eutrophication standards in Book II, Section V.B). The Agency has a mandate to protect these designated beneficial uses and when chemicals are detected in surface waters the Agency has a responsibility to take a closer look at possible impacts to humans and aquatic systems. At certain levels of exposure, acetochlor and metolachlor can affect human health; acetochlor is classified as a likely human carcinogen (see Section V.I). Both show toxicity to aquatic plants at concentrations that have been measured in surface waters (see Section V.G). Development of
acute and chronic water quality standards aim to protect humans and aquatic systems from detrimental effects. If water quality standards are exceeded there can be a direct and indirect “cost” to human health and quality of life, resulting in monetary losses.35

8. **Differences Between the Proposed Rule and Existing Federal Regulations and the Need for and Reasonableness of Each Difference** [V.C. reasonableness, acetochlor and metolachlor]

Federal regulations in the CWA, EPA guidance and water quality criteria documents provide the requirements and guidelines to develop water quality standards. The EPA has not published ambient water quality criteria or Maximum Contaminant Levels (federal drinking water standards) for acetochlor or metolachlor. The proposed herbicide standards developed by the Agency followed, and are consistent with, relevant federal regulations and guidance.


Minnesota Stat. § 14.002 requires state agencies, whenever feasible, to develop rules that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency’s regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals.

The proposed numeric water quality standards for acetochlor and metolachlor are “prescriptive” as are all numeric standards as described in more detail in Section V. J. on Implementation.

The general concepts of how prescriptive or flexible a rule should be are discussed more in SONAR Book I, Section VIII.I.


Minnesota Stat. § 14.131 and 14.23 require the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made. These specific notification requirements are discussed in Section IV.C.10 and will not be repeated here. The Agency outlined its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I.

11. **Consultation with the Commissioner of Finance Regarding Fiscal Impacts on Local governments** [V.C. reasonableness, acetochlor and metolachlor]

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency

provided the Department of Finance with a copy of the proposed rule and SONAR at the same
time as these items were sent to the Governor’s Office. This timing allows the fiscal impacts and
fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with
the Governor’s Office review.

D. REASONABLENESS OF PROPOSED ACETOCHLOR AND METOLACHLOR
STANDARDS, GENERAL [V. acetochlor and metolachlor]

1. Introduction [V.D. reasonableness, acetochlor and metolachlor]

The Agency is responsible for protecting surface and ground waters from degradation and effects
of pollutants. Due to the wide use of acetochlor and metolachlor in Minnesota and their
detection in waters of the state it is reasonable to develop and promulgate standards for these two
herbicides.

In developing the proposed water quality standards for acetochlor and metolachlor, Agency staff
determined criteria that protect, 1) aquatic life (toxicity-based criteria), and 2) human health
(human health-based criteria). For some, usually highly bioaccumulative, chemicals the Agency
will also determine a criterion to protect wildlife (wildlife-based criteria). There is not enough
information available to develop a wildlife-based criterion for either acetochlor or metolachlor.
As such, the research for these two pesticides was limited to aquatic toxicity and potential
impacts on human-health. The Agency is proposing to adopt as standards the lower or more
stringent of the toxicity- or human health-based criteria; which in this case for both herbicides,
are the toxicity-based criteria. Promulgation of the lower of the two criteria as the proposed
standard is standard Agency practice and ensures protection of all Class 2 uses. The Agency is
not aware of any information that would suggest that the proposed standards will not be
protective of wildlife also.

The methodologies to develop toxicity-based, human health-based and wildlife-based standards,
and bioaccumulation factors and are described in Minn. R. ch. 7050.0218, subparts 4-9 and in
Exhibit HH-3, MPCA’s Guidelines for the Development of Surface Water Quality Standards
(2000).

2. Acquisition of Data [V.D. reasonableness, acetochlor and metolachlor]

The Agency has worked closely and cooperatively with MDA’s Agronomy and Plant Protection
Division (now the Pesticide and Fertilizer Management Division) to assemble background
information on acetochlor and metolachlor (Acetochlor and Metolachlor Supplements, Exhibits
H-4 and H-5). In addition, the Agency consulted with MDA to ensure comprehensive
retrieval of all data relevant to standards development, including acquisition of aquatic toxicity
and fish tissue measurements from the EPA Office of Pesticide Programs and from the pesticide
registrants. MDA’s knowledge of data sources has supported the Agency’s data needs, including
the data Minnesota Department of Health needs for the human health toxicological review.

36 J. Zachmann, Ph.D., Pesticide Management Plan Coordinator and D. Stoddard, Assistant Division Director.
Most of the ‘raw’ toxicity data (EC50s and LC50s) the Agency needs to develop standards is obtained from the ECOTOXicology database (ECOTOX) and the Chemical Evaluation Search and Retrieval System (CESARS) database. ECOTOX was built and is maintained by EPA’s Office of Research and Development and the National Health and Environmental Effects Research Laboratory’s Mid-Continent Ecology Division (Duluth, MN). CESARS was developed by the Ontario Ministry of the Environment and the Michigan Department of Natural Resources. Agency staff utilized EPA’s Office of Pesticide and Planning’s (OPP) pesticide database and pesticide registration documents. For instance, staff reviewed the final EPA document, *Ecological Risk Assessment for the use of S-Metolachlor (PC 108800) on Pumpkins and Winter Squash* (DP324973, DP327861), May 2006 (Exhibit H-68C). The principal registrants for acetochlor, Monsanto, and s-metolachlor, Syngenta, also provided the Agency with aquatic toxicity study results. Agency staff also does a literature search through the State’s library system for additional relevant research in scientific journals, in International Joint Commission reports, as well as publications by EPA and the U.S. Fish and Wildlife Service. Acute and chronic toxicity data for the particular chemical of interests is assembled from these searches. This same process and databases are used to search for bioaccumulation factor (BAF) and bioconcentration factor (BCF) data to develop human health-based standards and wildlife-based standards (if needed) for the chemical of interest. The toxicity data assembled by the Agency in summary sheets and tables for acetochlor and metolachlor are in (Exhibits H-9, H-10a and H-10b).

3. **Standards for Parent Chemical Only** [V.D. reasonableness, acetochlor and metolachlor]

The Agency is currently proposing water quality standards only for the parent chemicals, acetochlor and metolachlor, and not the environmental degradates or metabolic break-down products. The MDA’s monitoring program measures only the parent chemicals in surface waters, but measures both parent chemicals and degradates in ground water. Because of the large amount of staff time it takes to develop standards, and the general lack of data on degradates, the Agency is focusing on standards for the acetochlor and metolachlor parent chemicals. Limited information suggests that the degradeate chemicals are no more toxic than the parent chemicals. Information on degradeate toxicity is available in EPA Office of Pesticide Program risk assessments published August 30, 2006 (Exhibits H-68a-d).

E. **ACETOCHLOR, PROPOSED ACUTE TOXICITY-BASED STANDARDS, REASONABLENESS** [V. reasonableness, acetochlor]

Aquatic life (Class 2) numeric standards have three parts:

1. Final Acute Value (FAV) – protects for acute toxicity (most often used as an “end-of-pipe” effluent limit)
2. Maximum (MS) – protects for acute toxicity, applied to surface waters
3. Chronic (CS) – protects for chronic toxicity, applied to surface waters
The three proposed standards for acetochlor are toxicity-based, for all class 2 waters. The proposed acute toxicity standards (FAV and MS) are based on toxicity data for aquatic animals; and the proposed chronic standard is based on chronic data for aquatic plants. This Section discusses the former.

There is not enough acceptable acute toxicity data for aquatic animals to use the preferred EPA criteria development method (called the Tier I method). This method requires toxicity test results for a minimum of eight species distributed in several taxonomic groups of aquatic organisms (e.g., fish, aquatic insects, crustaceans, zooplankton, mussels, etc.; Exhibit HH-3). The Agency has acceptable toxicity data for acetochlor for just four species of aquatic animals. In this situation the Agency uses a “Tier II” method to calculate the standard (Minn. R. 7050.0218, subp. 5, item G). The Tier II method requires data for at least one fish species and one zooplankton (a water flea or daphnid). In brief, the Tier II method selects the lowest acute value in the limited data set and divides it by an “adjustment factor” to arrive at the final acute value. The less data available, the larger the adjustment factor; factors range from a maximum of 13 (2 toxicity values) to a minimum of 4.3 (7 toxicity values). The lowest acute value in the data set divided by the appropriate adjustment factor is the Tier II final acute value. The FAV is then divided by an acute to chronic ratio (ACR) to arrive at the Tier II chronic criterion (based on aquatic animals). Since there are no data from which a chemical-specific ACR can be developed, the default ACR of 18 is used (Minn. R. 7050.0218, subp. 5, item G, subitem (10).

The acceptable acute aquatic organism studies used to develop the acetochlor FAV are listed in Table 3a of Exhibit H-9. The lowest of the four acute values is 1,210 µg/L for rainbow trout (for complete EPA Data Evaluation Records and registrant (Monsanto) studies, see Exhibits H-12a and H-12b). Complete EPA reviews and registrant studies for the other acceptable aquatic organism (animal) studies pertinent to the FAV are in Exhibits H-13a through H-16b.

The proposed acute-based standards (FAV and MS) and the values used to calculate them are shown below in Table III-6. The plant-based chronic standard is shown as well (see Section V.G). Table III-6 also shows human health-based criteria for acetochlor, calculated from both a reference dose and a cancer potency factor (see Section V.I).
Table III-6. Summary of Proposed Acetochlor Water Quality Standards, Showing Calculation Steps for FAV and MS.

<table>
<thead>
<tr>
<th>Information for Acetochlor</th>
<th>Value or Proposed Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toxicity-based (Tox)</strong></td>
<td></td>
</tr>
<tr>
<td>Number of species</td>
<td>4</td>
</tr>
<tr>
<td>with acceptable test results</td>
<td></td>
</tr>
<tr>
<td>Lowest acute value, µg/L</td>
<td>1,210</td>
</tr>
<tr>
<td>Tier II Adjustment Factor</td>
<td>7.0</td>
</tr>
<tr>
<td>Final Acute Value, µg/L</td>
<td>173</td>
</tr>
<tr>
<td>Acute to chronic ratio</td>
<td>18</td>
</tr>
<tr>
<td>Chronic, based on animal data, µg/L</td>
<td>9.6</td>
</tr>
<tr>
<td><strong>Human Health-Based (HH)</strong></td>
<td></td>
</tr>
<tr>
<td>Reference dose, mg/kg-day*</td>
<td>0.02 Na</td>
</tr>
<tr>
<td>Cancer Potency Slope Factor, mg/kg-d⁻¹*</td>
<td>na 0.0327</td>
</tr>
<tr>
<td>BAF, L/kg (all Class 2 waters)</td>
<td>43.4 43.4</td>
</tr>
<tr>
<td>Chronic, µg/L (Class 2A, 2Bd)</td>
<td>85 6.5</td>
</tr>
<tr>
<td>Chronic, µg/L (Class 2B, 2C, 2D)</td>
<td>213 16</td>
</tr>
<tr>
<td><strong>Proposed Standards</strong></td>
<td></td>
</tr>
<tr>
<td>Final Acute Value, µg/L</td>
<td>173</td>
</tr>
<tr>
<td>Maximum (FAV divided by 2), µg/L</td>
<td>86 1.7</td>
</tr>
</tbody>
</table>

* In a recent memo, EPA indicates that the RfD is protective of potential cancer effects on humans. The Cancer Assessment Review Committee (CARC) classified acetochlor as, “Suggestive Evidence of Carcinogenic Potential,” and they concluded that: "Quantification of cancer risk is not required since the chronic RfD (cRfD) of 0.02 mg/kg/day will be protective of both non-cancer and cancer effects, including rat nasal tumors, thyroid tumors, and mouse tumors." This suggests that the Agency's RfD-based values of 85 and 213 µg/L would be the applicable human health-based criteria. (Memo from the U.S. EPA Office of Prevention, Pesticides, and Toxic Substances' Cancer Assessment Review Committee (CARC; Acetochlor: Fifth Report), January 3, 2007.)

F. METOLACHLOR, PROPOSED ACUTE TOXICITY-BASED STANDARDS, REASONABLENESS [V. reasonableness, metolachlor]

Background information on the Tier II method and development of the three-part water quality standard (FAV, MS and CS) are provided in the previous Section.

Currently there are two forms of metolachlor being used by the agricultural community (Exhibit H-5). One form, racemic metolachlor, is a 50:50 mixture of r- and s- isomers of 2-Chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide. It has a chemical abstract services (CAS) registry number of 51218-45-2. This form is simply called metolachlor and referred to as 50:50 metolachlor in discussions of aquatic toxicity data. The second form, a newer product, contains mostly the s- isomer of metolachlor; it contains 88 percent s- and 12
percent r-metolachlor, and is called s-metolachlor and referred to as 88:12 metolachlor for the aquatic toxicity data discussions. The chemical name for s-metolachlor is (S)-2-Chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)-acetamide, with a CAS registry number of 87392-12-9.

The Agency developed acute toxicity-based criteria (FAV and MS) for both the 50:50 and 88:12 forms of metolachlor using the Tier II method. The Agency is proposing the more stringent of the two as the metolachlor standard, because the two forms cannot be differentiated analytically in water samples (Exhibit H-5). Based on acute tests with both forms on the same species (rainbow trout), 50:50 metolachlor seems to be the more toxic of the two (Exhibits H-10a, H-19a, H-19b and H-20). The toxicity data for the apparently less toxic 88:12 form is shown in Exhibits H-10b, H-17, H-18a and H-18b. Thus, the proposed metolachlor acute toxicity-based standards are based on the 50:50 metolachlor data but apply to both forms as total metolachlor concentrations.

As for acetochlor, the Tier II method must be used to determine the FAV and MS for metolachlor because of the small amount of adequate animal toxicity data. The proposed metolachlor FAV is based on four acute values; the lowest is 3,800 μg/L for a species of aquatic fly (midge, Chironomus, Exhibit H-20). The other acute study pertinent to the FAV, including EPA Validation Sheets and registrant (Syngenta) studies, are found in Exhibits H-19a, H-19b, and H-69. The proposed FAV and MS, and the values used to calculate them are shown in Table III-7; the plant-based chronic standard is shown also. Table III-7 includes the metolachlor human health-based criteria for comparison, calculated from a reference dose (see Section V.I).

In summary, as for acetochlor, the proposed metolachlor standards are toxicity-based for all class 2 waters; and the:

- Tier II method is used to determine the proposed acute toxicity-based FAV and MS standards (Exhibit H-10a),
- FAV and MS are based on toxicity data for aquatic animals, and
- Chronic standard is based on aquatic plant data (next Section).
Table III-7. Summary of Proposed Metolachlor Water Quality Standards, Showing Calculation Steps for FAV and MS.

<table>
<thead>
<tr>
<th>Information for Metolachlor</th>
<th>Value or Proposed Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toxicity-based (Tox)</strong></td>
<td></td>
</tr>
<tr>
<td>Number of species with acceptable test results</td>
<td>4</td>
</tr>
<tr>
<td>Lowest acute value, µg/L</td>
<td>3,800</td>
</tr>
<tr>
<td>Tier II Adjustment Factor</td>
<td>7.0</td>
</tr>
<tr>
<td>Final Acute Value, µg/L</td>
<td>543</td>
</tr>
<tr>
<td>Acute to chronic ratio</td>
<td>18</td>
</tr>
<tr>
<td>Chronic, based on animal data, µg/L</td>
<td>30</td>
</tr>
<tr>
<td><strong>Human Health-Based (HH)</strong></td>
<td></td>
</tr>
<tr>
<td>Reference dose, mg/kg-day</td>
<td>0.1</td>
</tr>
<tr>
<td>BAF, L/kg (all Class 2 waters)</td>
<td>16.5</td>
</tr>
<tr>
<td>Chronic, µg/L (Class 2A/2Bd)</td>
<td>561</td>
</tr>
<tr>
<td>Chronic, µg/L (Class 2B,2C,2D)</td>
<td>2,777</td>
</tr>
<tr>
<td><strong>Proposed Standards</strong></td>
<td></td>
</tr>
<tr>
<td>Final Acute Value, µg/L</td>
<td>543</td>
</tr>
<tr>
<td>Maximum (FAV divided by 2), µg/L</td>
<td>271</td>
</tr>
<tr>
<td>Chronic (plant toxicity), µg/L</td>
<td>23</td>
</tr>
</tbody>
</table>

G. ANALYSIS OF AQUATIC PLANT TOXICITY DATA AND PROPOSED CHRONIC STANDARDS FOR ACETOCHLOR AND METOLACHLOR, REASONABLENESS [V. reasonableness, acetochlor and metolachlor]

1. Analysis of Aquatic Plant Toxicity Data\(^{37}\) [V.G. reasonableness, acetochlor and metolachlor]

Not surprisingly, toxicity data for the two herbicides acetochlor and metolachlor show that aquatic plants tend to be more sensitive to harmful effects than fish and aquatic invertebrates (Exhibits H-68b and H68c).\(^{38,39}\) Acute toxicity tests with aquatic animals use mortality as the endpoint. Effect endpoints used in plant toxicity tests measure non-lethal impacts such as growth, loss of biomass or population changes. Thus, essentially all plant toxicity data is chronic, rather than acute. The proposed chronic standards are based on plant data. Plant data are generally not amenable for developing the acute-toxicity-based FAVs and MSs because of the difficulty in determining a lethal endpoint with plant data.

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\(^{37}\) Since January 17, 2006, the Agency has included a detailed description on the methods used to develop the aquatic plant-based chronic standards on the Minn. R. ch. 7050 revision webpage (Exhibit A-49d).

\(^{38}\) Exhibits H-21a through H-23b cover the acceptable chronic aquatic animal data for acetochlor.

\(^{39}\) Exhibits H-24a and H-24b cover the acceptable chronic aquatic animal data for metolachlor (only 88:12 form or s-metolachlor).
Plant toxicity data is more difficult to interpret than animal data. The EPA 1985 guidance says that procedures for conducting and interpreting the results of plant toxicity tests are not well established (Exhibit H-11). The 1985 guidance, which is still EPA’s current guidance\(^{40}\), provides only the following suggestions on how to interpret plant data when developing standards.

- Compare relative sensitivities of plants and animals.
- Select lowest result from a test with an important aquatic species.

In fact, however, the EPA has gone well beyond this very simplistic approach to interpreting plant data in their draft atrazine criterion (Exhibit H-59). The EPA’s assessment of plant data in this criterion document offers a good deal of guidance, by example, which will be discussed below. Of note, Agency staff reviewed the final EPA document, *Ecological Risk Assessment for the use of S-Metolachlor (PC 108800) on Pumpkins and Winter Squash* (DP324973, DP327861), May 2006, which became available August 30, 2006 (Exhibit H-68C). The recent ecological risk assessment on s-metolachlor published by the EPA Office of Pesticide Programs also identifies potential concerns for ecological effects to aquatic plant communities, including shifts in algal species composition, and indirect effects to the larger aquatic community from non-target exposures from s-metolachlor field application, providing more support for the protection-level goals described below (Exhibits H-68b and H-68c). The information in this document does not provide any information which would change the proposed metolachlor water quality standards.

Due to the lack of more definitive “official” guidance, but using the atrazine criterion as a guide, the Agency felt it was important to spell out our protection-level goals for chronic standards based on aquatic plant data. These goals reflect a policy to provide a community level of protection to aquatic plants, and they are consistent with ecological risk assessment guidance to help determine relative sensitivities of individually tested species to implement protection at the community or population level.\(^{41}\)

- Protect the overall integrity of the plant community from significant impacts. For example, avoid discernable or projected negative shifts in species composition, such as green algae species replaced by blue-green algae, or a sensitive "desirable" macrophyte replaced by a "less desirable" macrophyte.
- Protect the most sensitive species tested if it is clear that the species is (are) ecologically important in Minnesota; otherwise it is not necessary to totally protect the most sensitive species from any impact to provide a community level of protection.
- Target approximately a 20\(^{th}\) percentile level of protection based on the body of chronic toxicity data for plants. We feel this can be achieved by selecting a 5\(^{th}\) percentile median effect concentration (EC50), or 20\(^{th}\) percentile maximum acceptable toxicant concentration (MATC) from the distributions (EC50, EC20 and MATC are defined below).

\(^{40}\) EPA is working on an update of the aquatic life criteria guidance.

The Agency reviewed the draft EPA atrazine criterion to obtain ideas for deriving standards for acetochlor and metolachlor. The atrazine criterion is helpful in framing an overall approach to assessing plant data, and in framing the protection level goals stated above, but the exact criteria determination methods used by EPA for atrazine cannot be used for acetochlor and metolachlor, because:

- There is far more plant data for atrazine, including an extensive set of laboratory and field aquatic plant community data (termed microcosm and mesocosm studies), which
- Allowed EPA to predict 5\textsuperscript{th} percentile plant community effect levels versus time from the micro- and mesocosm data set, using a mathematical model (Figure III-2). Consistent with the community level protection goal, EPA’s use of the 5\textsuperscript{th} percentile effect level from the mesocosm studies does not provide complete protection at all times to the most sensitive organisms.

Figure III-2. Results of Micro- and Mesocosm Studies with Atrazine Plotted Against the Study-specific Test Duration. Black Line Is the Five Percent Effect Level Over Time Interpolated By the CASM Model. From the EPA Atrazine Criterion (Exhibit H-59).

![Figure III-2](image)

Figure E. Micro- and mesocosm study effect concentrations scored according to Brock et al 2000 and plotted against the study specific exposure duration. Interpolated 5\% CASM Similarity Index points plotted.
Faced with less plant data to work with, the Agency decided to use the EPA method for calculating final acute values, described in Stephan et al. (1985, Exhibit H-11), as the basic approach to calculating the chronic standards. The FAV calculation is associated with the Tier I criterion calculation methods mentioned in Section V.E. The FAV method has been used by EPA since the late-1970s to calculate aquatic life criteria, and it was adopted into Minn. R. ch. 7050.0218, subp. 4, item B, subitem (4) in 1990. The FAV is a probability calculation of the 5th percentile value (or other percentile of choice) from the distribution of acceptable toxicity data. It is typically used with acute data to calculate the final acute value, hence the name. The FAV calculation uses the four values from the distribution of all values that most closely bracket the 5th percentile. These are almost always the lowest four values (i.e., the acute toxicity results for the four most sensitive organisms tested) because of the limited amount of data.

The FAV method can be used with chronic as well as acute data, which is what we are doing with the herbicide plant data. The resulting value is then called a “species chronic value” (SCV). As noted, percentile values other than the 5th percentile can be calculated as well, which is what we do with the MATC data, as explained below. The aquatic plant toxicity data are shown in Exhibits H-25a through H-36 for acetochlor, H-37 through H-53 for metolachlor 50:50 and H-54 through H-56b for metolachlor 88:12 and summarized in Table 4 of Exhibits H-9 and H-10a and b. Plant data are also shown with the FAV calculations in Exhibits H-57 and H-58).

For our analysis, aquatic plant data were divided into:

- EC50 values – median effect concentration; the concentration that demonstrates nonlethal effects or impacts on half the test population.
- MATC values – maximum acceptable toxicant concentration; the mean of the lowest concentration showing a measurable effect (LOEC) and the highest test concentration showing no significant effect (NOEC). The MATC is roughly comparable to an EC20.
- NE (No effect) values – highest concentration tested had no significant effect.
- In a few cases, where no EC50 was available for a species, EC50s were estimated from LOEC or NOEC concentrations based on the average of the species-specific EC50 to MATC ratios.

In general, the plant data for acetochlor and metolachlor show:

- The lowest to highest test results span a very large range, about five orders of magnitude (e.g. toxicity values for acetochlor range from 0.088 to 35,000 µg/L).
- The relative results of toxicity tests (EC50s, MATCs and NEs) across species often did not fall in the expected order of high to low; i.e., EC50 > MATC > NE.
- The ratio between associated EC50s and MATCs is generally small, in the range of 1-4.
- The lowest values for both chemicals are dominated by two species commonly used in plant toxicity tests, _Selenastrum capricornutum_ (green algae) and _Lemna gibba_ (inflated duckweed).

Aquatic plant data were assessed and combined as follows for both acetochlor and metolachlor:
1. Acceptable species-specific EC50 and MATC values were assembled. If two or more EC50s or MATCs are available for the same species, species geometric means are determined.
2. We could not discern any consistent relationship between test results and the toxic endpoint used in the test (i.e., growth, growth rate, change in biomass, frond development, etc.).
3. We could not discern any consistent relationship between test results and the duration of the test, which ranged from less than one day to 90 days (most tests last 3 to 14 days).
4. Therefore, results for the same species were averaged together regardless of the chronic endpoint, or duration of the test.
5. 5th percentile SCVs from the EC50 data sets were determined.
6. 20th percentile SCVs from the MATC data sets were determined.

Calculated SCVs, based on EC50 and MATC data, are shown in Table III-8, along with the number of values (N) in the data base.

Table III-8. Species Chronic Values for Acetochlor and Metolachlor from the Species-mean EC50s and MATCs.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Acetochlor</th>
<th>Metolachlor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Value μg/L</td>
</tr>
<tr>
<td>EC50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th %tile</td>
<td>8</td>
<td>0.093</td>
</tr>
<tr>
<td>20th %tile</td>
<td>8</td>
<td>3.58</td>
</tr>
<tr>
<td>MATC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20th %tile</td>
<td>8</td>
<td>1.74</td>
</tr>
<tr>
<td>5th %tile</td>
<td>8</td>
<td>0.004</td>
</tr>
</tbody>
</table>

The 5th percentile EC50 for metolachlor and the 20th percentile MATC value for acetochlor in the shaded cells in Table III-8 are the primary basis or “starting points” for the proposed standards. Other information is used to confirm or adjust the proposed chronic standards, as discussed in the next two sections.

As noted, two aquatic plant species commonly used in herbicide toxicity tests, *Selenastrum capricornutum*, and *Lemna gibba*, are very sensitive to both acetochlor and metolachlor. The Agency is not excluding the data for these two species, but it is important, to ascertain the ecological importance of these two species in Minnesota, consistent with the protection level goals. Neither is considered ecologically important.

*Selenastrum* is a very minor component of the algae community in lake samples in Minnesota and is easily replaced by another genus of green algae, *Scenedesmus*. *Lemna gibba* does not occur in Minnesota; however, a related species of duckweed, *L. minor*, is very common. Data for metolachlor and other herbicides suggest that *L. minor* is not as sensitive as *L. gibba*. Therefore, neither of the two very sensitive species is considered to be "ecologically important"
in Minnesota. The Agency believes the proposed standards will protect the overall integrity of Minnesota aquatic plant (and animal) communities.

The Agency asked a scientist at the EPA Mid-Continent Ecology Division, Office of Research and Development to review the Agency’s approach to analyzing the plant data. In general, he felt that the Agency’s approach was sound (i.e., the essence of which is the use of the FAV calculations with chronic data).\(^4\) He made several suggestions concerning details of the Agency approach that could improve it, such as establishing consistent criteria for evaluating the plant data. The Agency adopted the suggestions, and we believe that it improved the overall analysis of the plant data and the proposed standards. The person providing the comments has had many years of experience working with toxicity data and developing aquatic life criteria.

\(^{4}\) Dr. Russ Erickson, EPA Mid-Continent Ecology Division, Office of Research and Development, Environmental Protection Agency, Duluth.
2. **Proposed Chronic Standard for Acetochlor** [V.G. reasonableness, acetochlor]

The Agency believes the 20th percentile MATC value of 1.7 µg/L from the plant data does not need to be adjusted based on analysis of the other plant toxicity data. This value will be protective of Minnesota aquatic plant communities, and 1.7 µg/L is the proposed chronic standard. Figure III-3 shows the proposed acetochlor chronic standard in the context of all the plant data.

There are eight species-mean EC50s and five species-mean MATCs for acetochlor. The SCV calculations are very sensitive to the number of toxicity values (N) used in the calculations, particularly when N is small. The Agency is using an N of eight for both the MATC and EC50 calculations (Table III-8, and Exhibit H-57). With the small N, calculated SCV values at the “tails” of the distribution, such as the 5th percentile, are more vulnerable to statistical distortion than values calculated more toward the center of the distribution, such as the 20th percentile. The large range in magnitude of the lowest four values, which are used to make the SCV calculations, can exacerbate the distortion (for example, 0.22 to 819 µg/L is the range of the lowest four MATCs for acetochlor). For these reasons the Agency places more confidence in the 20th percentile MATC SCV than in the 5th percentile EC50 SCV for acetochlor. The Agency feels justified in elevating N from five to eight for the SCV calculation with the MATC data for these reasons:

- There are NEs, NOECs or LOECs for three species, *Elodea*, *Myriophyllum* and *Lemna gibba*, with a range of 0.85 to 200 µg/L, which is higher than the lowest MATC of 0.22 µg/L.
- These three (species mean) values plus the five MATCs totals eight.
- There are eight EC50s.
- An N of five stretches the boundaries of the FAV calculation method.
- 1.7 µg/L, based on an N of eight, is reasonable in view of the body of the chronic data and will be protective of plant communities (Figure III-3).

Results from aquatic plant community or mesocosm studies (values identified with an “m” in Figure III-3) are not very helpful in developing the proposed standard because more than half of the tests were unable to show effects at the highest concentration tested. Although, the relatively high range of these data (19 – 200 µg/L) supports the protectiveness of the proposed 1.7 µg/L chronic standard.

In conclusion, the proposed standard of 1.7 µg/L is reasonable (Exhibit H-9). It is:

1. The 20th percentile of the available MATCs using an N of eight, including MATCs for the two most sensitive species, *Selenastrum capricornutum* and *Lemna gibba*.
2. Higher than the MATCs and EC50s for *S. capricornutum* and the MATC for *L. gibba*; the standard may not protect these two species from all harmful effects.
3. Below the EC-50s for *L. gibba*, and well below MATCs and EC50s for the other species tested.
4. Well below the EC50 of 47 \( \mu \text{g/L} \) for the nonnative African *Elodea*. This is the lowest EC50 (or MATC) for the next most sensitive species after *L. gibba* and *S. capricornutum*.

5. Below the calculated aquatic animal-based chronic value of 9.6 \( \mu \text{g/L} \) (Table III-6).

6. Below the lower of the two human health-based criteria, 6.5 \( \mu \text{g/L} \) (Table III-6).

3. **Proposed Chronic Standard for Metolachlor** [V.G. reasonableness, metolachlor]

The proposed chronic standard for metolachlor applies to both the 50:50 and 88:12 (s-metolachlor) formulations of the herbicide. This approach is consistent with the ecological risk assessment for s-metolachlor (88:12) published by EPA, which considered aquatic toxicity tests done on the two different formulas to be comparable (Exhibits H-68b and H-68c). The 5\(^{th}\) percentile SCV from the aquatic plant EC50 data of 36 \( \mu \text{g/L} \) is a reasonable “starting point” for the proposed chronic standard, but must be lowered based on the body of available toxicity data (Table III-8 and Exhibit H-58). The Agency believes the proposed standard of 23 \( \mu \text{g/L} \) will be protective of Minnesota aquatic plant communities. Figure III-4 shows the proposed chronic standard in the context of all the plant data.

The plant toxicity data set for metolachlor is far more robust than for acetochlor, in terms of number of species tested and available EC50s (18 for metolachlor, 8 for acetochlor). There are six MATCs for metolachlor. Because of the relatively large number of EC50s, the Agency places more confidence in the 5\(^{th}\) percentile SCV calculation from the EC50 data than in the 20\(^{th}\) percentile MATC SCV. The lower MATC-based SCV of 11.1 \( \mu \text{g/L} \) is calculated using an N of nine. We feel it is reasonable to supplement the number of MATCs with the three LOECs to arrive at an N of nine. The three LOECs range from 274 to 750 \( \mu \text{g/L} \), well above the lowest MATC of 4.8 \( \mu \text{g/L} \). The MATC-based SCV of 11.1 \( \mu \text{g/L} \) provides useful information on an appropriate standard in the context of all the data (Exhibit H-58).

The Agency believes that the 5\(^{th}\) percentile EC50 value of 36 \( \mu \text{g/L} \) should be lowered to 23 \( \mu \text{g/L} \) for the proposed chronic standard based on the following:

- A chronic test result of 41 \( \mu \text{g/L} \) is available for fathead minnow (Metolachlor 88:12). This chronic value divided by a “safety factor” of 2 is 21 \( \mu \text{g/L} \).
- A relatively low EC50 of 70 \( \mu \text{g/L} \) is available for coon tail (*Ceratophyllum demersum*), an important resident aquatic plant species. This EC50 is the third lowest after *S. capricornutum* and *L. gibba*. An estimated MATC of 23 \( \mu \text{g/L} \) for coon tail can be determined by dividing the EC50 of 70 \( \mu \text{g/L} \) by the mean of the five species-mean EC50/MATC ratios (3.027).
- The midway point (average) between the 5\(^{th}\) percentile EC50 (36 \( \mu \text{g/L} \)) and the 20\(^{th}\) percentile MATC (11 \( \mu \text{g/L}, \text{N = 9} \)) is 23.

A single low metolachlor MATC for a species of algae (diatom, *Navicula pelliculosa*) prompted further investigation into this value and the role this diatom species plays in Minnesota. The MATC for this species is 6.9 \( \mu \text{g/L} \); only two MATCs for the very sensitive green algal species, *Selenastrum capricornutum* are lower (Exhibit H-49). The Agency suspects this MATC may be an outlier, but we have no firm proof. The suggestive evidence is that it is 55 times lower than the EC50 of 380 \( \mu \text{g/L} \) for this species. An EC50/MATC ratio of 55 is many times larger than
typical EC50/MATC ratios, which average about three. The *N. pelliculosa* EC50 agrees reasonably well with the EC50s for another genus of diatom, *Najas* sp. EC50s for *Najas* sp. range from 100 to 750 μg/L (geometric mean of 311 μg/L, Exhibit H-49). Regardless of the concerns about the MATC for *N. pelliculosa*, it is included in the SCV calculation of the 20th percentile MATC because we cannot confirm that it is an outlier. No explanation is provided in the original study as to why these data are atypical.

*Navicula pelliculosa* is widely distributed in the United States; however it is seldom seen in samples from Minnesota lakes. Scientists at the St. Croix Watershed Research Station were consulted about this species. These scientists are the same diatom specialists that do the diatom reconstruction work to estimate pre-European trophic conditions in Minnesota lakes discussed in SONAR Book II, Section VI.C.3. They indicated that *N. pelliculosa* has been found in their samples but in small numbers and very uncommonly. It is reasonable, based on this information, to conclude that this diatom is not an ecologically significant species in Minnesota.

In conclusion, the proposed standard of 23 μg/L is reasonable (Exhibit H-10a). It is:

1. Higher than the MATCs for *Selenastrum capricornutum* and *Lemna gibba*, but below the geometric mean EC50s for these two sensitive species.
2. Higher than an MATC of 6.9 μg/L for the diatom, *Navicula pelliculosa*. The Agency believes this is reasonable because this species does not appear to be ecologically important in Minnesota, as discussed above.
3. Well below the MATC of 265 μg/L for the resident species *Lemna minor*, and all EC50s for the other species tested.
4. Below the lower of the two human health-based criteria of 561 μg/L (Table III-7).
5. Lower than the calculated animal-based chronic value of 30 μg/L (Table III-7).

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43 Dr. Mark Edlund, Associate Scientist (diatom ecology and evolution), St. Croix Watershed Research Station, part of the Science Museum of Minnesota.
Figure III-3. Plant Toxicity Data for Acetochlor Plotted Against Duration of Test, Showing the Proposed Chronic Standard.

Figure III-4. Plant Toxicity Data for Metolachlor Plotted Against Duration of Test, Showing the Proposed Chronic Standard.
H. STANDARDS OF OTHER STATES [V. reasonableness, acetochlor and metolachlor]

The Agency solicited information from other states through the Association of State and Interstate Water Pollution Control Administrators to find out if other states had adopted water quality standards for either acetochlor or metolachlor. Out of the 12 states that responded, none had a standard for acetochlor; the following indicated they had a standard for metolachlor.

Illinois: 130 µg/L, chronic standard based on aquatic toxicity
Montana: 100 µg/L, based on human health.
Nebraska: 100 µg/L, chronic standard based on aquatic toxicity
New York: 35 µg/L, draft criterion based on aquatic toxicity

The Agency is not aware of the data or methods used by Illinois, Montana or Nebraska in the development of their standards. The draft criterion for New York was developed by an EPA scientist on loan from EPA Region 5 (Chicago) to the New York Department of the Environment. The data and methods used by New York parallel closely those used by the Agency in that they used the Tier II method with the aquatic animal data (Exhibit H-60). The major difference is that New York used the Tier II method to arrive at their chronic criterion as well as the FAV and MS, whereas the Agency used aquatic plant data to develop the chronic standard.

I. HUMAN HEALTH-BASED CRITERIA, ACETOCHLOR AND METOLACHLOR [V. reasonableness, acetochlor and metolachlor]

1. Introduction [V.I. reasonableness, acetochlor and metolachlor]

Human health-based chronic water quality standards ensure long term protection for designated surface water uses: drinking water and fish consumption and recreation. Standards are based on inputs that are consistent across toxic pollutants (e.g., drinking water consumption rates: 2 liters/day, fish consumption intake rates: 30 grams/day, and adult body weight: 70 kilograms), and inputs that are chemical-specific (e.g., bioaccumulation factors-BAF and human health toxicity values: reference dose- RfD or cancer potency slopes-q1*). The details of setting human health based criteria are available in Minn. R. 7050.0218, subp. 6, 7, and 8 and Agency Guidance Manual (Exhibit HH-3). The chemical-specific values and final human health-based criteria for acetochlor and metolachlor are presented in Tables III-6 and III-7.

2. Acetochlor [V.I. reasonableness, acetochlor and metolachlor]

The Agency determines human health-based chronic standards based on the human health toxicity values recommended by the Minnesota Department of Health (MDH) for setting Health Risk Limits (HRLs) or Health Based Values (HBVs, values not promulgated into Minnesota Rule44). MDH recently reviewed acetochlor and its two common environmental degradates, 

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44 MDH develops HBVs when data are limited or prior to promulgation into Minn. Rules 4717.1700-4717.7800.
acetochlor-ESA and -OXA, because of detection in ground water and need for health protective values for drinking water use (Exhibit H-61). The MDH review provides comprehensive data for noncancer (systemic) effects, cancer evaluation, and more recently, considerations for infants and children (SONAR Book I, Section II.D.2).

The EPA classifies acetochlor as a “likely human carcinogen”. EPA recently published a cancer potency value (cancer slope factor, CFS) for lung and uterine tumors. MDH concurred with the CSF of 0.0327 mg/kg-d\(^{-1}\) for these tumors and recommended use of the CSF to calculate the human health criterion. MDH is proposing to use the CSF to develop a cancer HRL (Exhibit H-61). Protection from other cancers associated with acetochlor exposure, nasal turbinate and thyroid follicular cells, is expected based on the CSF and noncancer reference dose (RfD). Acetochlor has also shown adverse noncancer effects to the liver, kidney, and male reproductive system. At higher doses, termed “secondary endpoints” by MDH, acetochlor can affect the thyroid, pituitary, nervous system, and female reproduction. The EPA published a RfD of 0.02 mg/kg-d in the Integrated Risk Information System (IRIS)\(^4\) and TRED. EPA is also finalizing review of the common mechanism of action of acetochlor and another chloroacetanilide herbicides, alachlor, relative to nasal tumors.\(^5\) The results of this review will not change the acetochlor criteria. The human health-based criterion calculated with the CSF is lower than the criterion calculated with the RfD (Table III-6).

The MDH is currently conducting a comprehensive review of how HRLs (and HBVs) are determined, with a focus on ensuring that these limits for drinking water use of contaminated ground water are health protective for infants and children. As discussed in SONAR Book I (Section II.D.2), the final recommendations and promulgation into Minnesota Rules was delayed to take into account substantial comments from an expert science advisory panel. The draft HRL for acetochlor includes an adjustment factor for a higher infant and children’s drinking water intake rate (Exhibit H-61). The Agency did not apply the draft MDH adjustment factors in its calculation of human-health criteria because the final adoption of MDH’s proposal into Minnesota Rules is still pending. In consultation with MDH, the Agency may consider site-specific adjustments to the human health-based criteria in the future.

As mentioned, MDH has reviewed human health toxicity data on two common degradates of acetochlor, acetochlor-OSA and-ESA (Exhibit H-62). The reviews were initiated because of detections in Minnesota ground water and resultant need to determine health protective values (HRL or HBV) for drinking water use. At this time, MDH developed provisional HBVs for use on a site-specific basis by MDA. Preliminary review suggests that these degradates are less toxic to humans than acetochlor, but because of limited data leading to higher uncertainty factors the RfD for protection of non-cancer health effects is almost equal to the parent, acetochlor.


\(^{46}\) IRIS values have undergone extensive review and represent a consensus finding for EPA on human health toxicity. IRIS: Acetochlor (CASRN 34256-82-1). Available at: [www.epa.gov/iris](http://www.epa.gov/iris).

The other chemical-specific input that goes into setting human health-based criteria is the bioaccumulation factor (BAF). Unlike the RfD and CSF for which the Agency relies completely on EPA and MDH to provide, the BAF is determined by Agency staff from available data. Chemicals that are persistent in surface waters and have an affinity for fat or proteins can reach increasingly higher concentrations in the aquatic food chain. The BAF that is used in calculating standards is the amount of a chemical that accumulates in fish tissue after exposure through both the water they live in and the food they eat.

The data available for determining BAFs for acetochlor is limited, but is adequate to provide a sound BAF value for setting a human health-based criterion. Monsanto, the principal registrant for acetochlor, provided data on a laboratory measured bioconcentration factor (BCF) for bluegill sunfish (*Lepomis macrochirus*) (Exhibit H-63). Using radiolabeled acetochlor, bluegill sunfish were exposed for 28 days in a flow-through system. The resulting BCF for muscle (equivalent to edible tissue) based on total radioactivity was 40. Total radioactivity measures acetochlor and metabolites in the tissue. An additional study characterized 16.9 percent for the total radioactivity to the parent compound, acetochlor. The Agency utilized the total radioactivity BCF to account for metabolites that may also have toxic effects. Details for the final BAFs are found in the acetochlor summary sheet and Table 5 of Exhibit H-9.

3. **Metolachlor [V.I. reasonableness, acetochlor and metolachlor]**

The MDH has completed a toxicological review of metolachlor and its primary environmental degradates, metolachlor-ESA and -OSA (Exhibits H-64 and H-65). The review for the metolachlor HRL encompassed data relevant for human health assessments from studies using both metolachlor and s-metolachlor, with the final human health values applicable to both products as measured analytically as metolachlor. The basis for the noncancer toxicity values (RfD) and the most sensitive effect observed for metolachlor is decreased body weight. The Office of Pesticide Programs at EPA developed an RfD of 0.1 mg/kg-d in their 2002 Tolerance Registration Eligibility Decision. At higher doses, metolachlor can affect thyroid and liver weights and development in reduced body weight in rodents (secondary effects). EPA classifies metolachlor as a “possible human carcinogen” or Class C carcinogen, but determined that the RfD for noncancer protection would be also be protective of cancer (Exhibit H-68d).

In 1988, EPA developed a Lifetime Health Advisory value of 100 µg/L for metolachlor to use as a human health toxicity benchmarks in finished drinking water from community water supplies. The EPA states that an updated value is needed, because of the newer RfD set by the Office of Pesticide Programs is lower than the one used in 1988 of 0.15 mg/kg-d. The drinking water value is based on an extra 10 fold uncertainty factor applied to Class C carcinogens.

As stated with regard to acetochlor, the draft HRL for metolachlor includes an adjustment factor for a higher infant and children’s drinking water intake rate (Exhibit H-64); the Agency is not proposing to apply the draft adjustment factors at this time as final adoption of MDH HRL

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revisions into Minnesota Rules is still pending. In consultation with MDH, the Agency may consider site-specific adjustments to the human health-based criteria in the future.

The MDH has developed provisional HBVs for metolachlor-ESA and –OSA (OA in MDH memo) in response to requests from MDA after detection in ground water (Exhibit H-65). MDH reviewed limited data on human health toxicity data and has concluded there is evidence that the degradates are less toxic than metolachlor, however, the data is not complete and remains provisional.

The best available BAF information came from a laboratory BCF study. In a 34 day flow-through study using bluegill sunfish (Lepomis macrochirus), a total BCF of 13.9 was found in edible tissue (Exhibit H-66). The study further examined the contribution of the parent compound and various metabolites represented in the total radioactivity value and attributed 18 percent to metolachlor. The total radioactivity BCF is used to account for possible toxic intermediates. The metolachlor summary sheet (Table 5) provides more detail about the determination of the final BAF of 16.5 (Exhibit H-10a, Table III-7).

J. IMPLEMENTATION OF ACETOCHLOR AND METOLACHLOR STANDARDS [V. reasonableness, acetochlor and metolachlor]

1. Introduction [V.J. reasonableness, acetochlor and metolachlor]

The water quality standards for acetochlor and metolachlor will be implemented like other Class 2 standards. Minnesota R. 7050.0222, subp. 7, items B, C and D lay out the application of the acute and chronic water quality standards. The details on determining if surface waters are in compliance with the standards are established in the MPCA Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment: 305(b) Report and 303(d) List (latest version 2006) (Exhibit A-7). Professional judgment has a role in the final decision on compliance with standards and impairment determination, however, for numeric standards, such as pesticides and other chemicals under the heading of “toxics”, there are clear criteria given, such as minimum number of samples and number of violations of the standard. The guidance is meant to provide a transparent and scientifically-defensible framework to assist other parties undertaking monitoring programs in the state for which data may be used for impairment assessments and for stakeholders interested in the impaired waters assessment process itself.

2 Pesticide Registration and Surface water monitoring Data [V.J. reasonableness, acetochlor and metolachlor]

a) Acetochlor [V.J. reasonableness, acetochlor and metolachlor]

Referencing the Agency and Minnesota Department of Agriculture (MDA) Acetochlor Supplement (Exhibit H-4), acetochlor is an herbicide for control of unwanted plants or weeds

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50 The guidance is updated with each new 303(d) list and is available from the Agency in paper copy or electronically on the Agency website.
that is applied prior to emergence of crop plants. Acetochlor has a similar structure and mode of action in plants as other chloracetamide (chloroacetanilide) herbicides, including metolachlor and alachlor. Acetochlor is primarily used on corn crops in Minnesota. Other crops grown here that are suitable for acetochlor application are potatoes, soybeans, and other edible beans, but survey results suggest limited use on these crops. The EPA registered acetochlor for use in 1994 under conditions that use of other corn herbicides would decrease. Refer to the Introduction in the Acetochlor Supplement (Exhibit H-4) for important details on acetochlor and its registration, including:

- Full product uses,
- Trade names,
- Label requirements,
- And use-restrictions.

Registration of acetochlor for corn crops means environmental application in large areas of Minnesota, but primarily in the western, central, and southern counties (Exhibits H-5 and H-67). Minnesota Agricultural Statistics Service provides annual data on estimated use of pesticides in pounds of active ingredients and in 2004 3.8 million pounds of acetochlor were sold, ranking it number two in pounds of active ingredients sold for all corn herbicides. In 2004, MDA in cooperation with other state and national agencies completed the most comprehensive survey to date on herbicide, insecticide, and fungicide use on corn, soybean, wheat, and hay in Minnesota. This survey provides a sound framework for recording acetochlor use and distribution in Minnesota—see the Acetochlor Supplement for detailed results of the survey. The survey demonstrates common usage of acetochlor on corn crops surveyed.

The properties of a chemical affect the movement, accumulation, and breakdown in the environment. Understanding the fate of herbicides in the environment is especially important for protecting water resources. The Acetochlor Supplement (Exhibit H-4) provides a review of the fate and transport of acetochlor and describes common degradates, acetochlor-ethane sulfonic acid (acetochlor-ESA) and acetochlor oxanilic acid (acetochlor-OXA).

Surface water monitoring in Minnesota by the MDA and the United States Geological Survey (USGS) has shown acetochlor and two common degradates, acetochlor-ESA and -OSA are frequently detected (Exhibit H-4). The highest concentrations of acetochlor generally occur in May and June. Pre-emergent application in spring or fall for some products means the herbicide is available to run-off into surface waters with precipitation. The magnitude and duration of higher concentrations is influenced by the intensity and timing of the rainfall and stream characteristics. Another route of surface water detections is leaching into ground water that contacts streams. Details of detections and concentrations for acetochlor and other herbicides in Minnesota surface waters are available in the Tables of the Acetochlor Supplement from MDA annual monitoring reports (Exhibit H-4). An overview of MDA acetochlor monitoring data for the four surface water monitoring stations (network) operating from 2002 through 2004 is provided in the table below.


<table>
<thead>
<tr>
<th>Station-Rivers</th>
<th>Sample Type</th>
<th>2002</th>
<th>2003</th>
<th>2004 (Partial Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% Det.</td>
<td>Max. Conc. µg/L</td>
<td>Medians µg/L</td>
</tr>
<tr>
<td>Blue Earth</td>
<td>Storm-event</td>
<td>94%</td>
<td>1.5</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Base Flow</td>
<td>14%</td>
<td>0.025 (P)</td>
<td>nd</td>
</tr>
<tr>
<td>Le Sueur</td>
<td>Storm-event</td>
<td>89%</td>
<td>7.1</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Base Flow</td>
<td>25%</td>
<td>0.06</td>
<td>nd</td>
</tr>
<tr>
<td>Minnesota - Judson</td>
<td>Storm-event</td>
<td>80%</td>
<td>1.09</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Base Flow</td>
<td>0</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Middle Branch Whitewater</td>
<td>Storm-event</td>
<td>65%</td>
<td>9.6</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>Base Flow</td>
<td>33%</td>
<td>7.5</td>
<td>nd</td>
</tr>
</tbody>
</table>

Conc.: Herbicide Concentrations; Det.: Sample Detections; nd: Not Detected below Reporting Limit (RL=0.05 µg/L); P: Detected below Reporting Limit (½ RL= 0.025 µg/L)

b) Metolachlor [V.J. reasonableness, acetochlor and metolachlor]

Metolachlor, like acetochlor and alachlor, is a chloracetamide (chloroacetanilide) herbicide used to control unwanted plants in association with field corn and other crops (Exhibit H-5). A recent survey by MDA points to application on field corn crops as the primary use of metolachlor in Minnesota. Metolachlor is applied prior to emergence of crop plants either in the spring or fall. The general mode of action for metolachlor and other chloracetamide herbicides is toxic action on seedling development. EPA registered metolachlor in 1976 and s-metolachlor in 1997. As described fully in the Metolachlor Supplement (Exhibit H-5), the composition change of s-metolachlor has lead to a higher effectiveness in weed control and resultant decrease in the application rate. The Metolachlor Supplement also covers:

- Full product uses,
- Trade names,
- And label requirements.

Use of metolachlor for corn crops means environmental application in large areas of Minnesota, but primarily in the western, central, and southern counties (Exhibits H-5 and H-67). Minnesota Agricultural Statistics Service provides annual data on estimated use of pesticides in pounds of active ingredients; metolachlor use declined from 1996 until 2001 (Exhibit H-5), with estimates at approximately 2.7 million pounds s-metolachlor sold in 2004. The 2004 MDA survey on herbicide, insecticide, and fungicide use on corn, soybean, wheat, and hay in Minnesota found s-metolachlor was applied on 12 percent of the surveyed corn acres. This survey provides a
sound framework for recording metolachlor product use and distribution in Minnesota—see the Metolachlor Supplement (Exhibit H-5) for detailed results of the survey.

Characterizing the fate of herbicides in the environment is important for improving management for crop application and protecting water resources. Chemical properties such as persistence, water solubility, and degradation affect the distribution in the environment. The Metolachlor Supplement details the environmental fate of metolachlor and its degradates (Exhibit H-5). Like acetochlor, the oxanilic acid (OXA) and ethane sulfonic acid (ESA) degradates are commonly detected in surface and ground waters.

Monitoring in Minnesota by the MDA and the USGS frequently find metolachlor in surface waters (Exhibit H-5). As discussed in the Metolachlor Supplement, analytical methods for metolachlor do not distinguish between the two products, metolachlor and s-metolachlor. The highest concentrations of metolachlor have occurred in March, May, and June. Pre-emergent application in spring or fall for some products means the herbicide is available to run-off into surface waters with precipitation. The magnitude and duration of higher concentrations is influenced by the intensity and timing of the rainfall and stream characteristics. Another route of surface water detections is leaching into ground water that contacts streams. Details of detections and concentrations for metolachlor and other herbicides in Minnesota surface waters are available in the Tables of the Metolachlor Supplement (Exhibit H-5) from MDA annual monitoring reports. An overview of metolachlor monitoring data for the four surface water monitoring stations (network) operating from 2002 through 2004 is provided in the table below.


<table>
<thead>
<tr>
<th>Station-Rivers</th>
<th>Sample Type</th>
<th>2002</th>
<th>2003</th>
<th>2004 (Partial Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% Det.</td>
<td>Max. Conc. (µg/L)</td>
<td>Medians (µg/L)</td>
</tr>
<tr>
<td>Blue Earth</td>
<td>Storm-event</td>
<td>100</td>
<td>0.52</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Base Flow</td>
<td>57</td>
<td>0.035 (P)</td>
<td>0.035 (P)</td>
</tr>
<tr>
<td>Le Sueur</td>
<td>Storm-event</td>
<td>100</td>
<td>0.65</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Base Flow</td>
<td>75</td>
<td>0.28</td>
<td>0.035 (P)</td>
</tr>
<tr>
<td>Minnesota – Judson</td>
<td>Storm-event</td>
<td>100</td>
<td>0.65</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Base Flow</td>
<td>0</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Middle Branch Whitewater</td>
<td>Storm-event</td>
<td>70</td>
<td>4.3</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>Base Flow</td>
<td>33</td>
<td>3.84</td>
<td>nd</td>
</tr>
</tbody>
</table>

Conc.: Herbicide Concentrations; Det.: Sample Detections; nd: Not Detected below Reporting Limit (RL=0.05 µg/L); P: Detected below Reporting Limit (½ RL = 0.025 µg/L)
3. **Water Quality Assessments for Acetochlor and Metolachlor** [V.J. reasonableness, acetochlor and metolachlor]

The maximum standard (MS) based on aquatic animals is compared to one-day average water column concentration of the chemical. Chronic standards (CS) based on aquatic toxicity, aquatic plants in the case of acetochlor and metolachlor, is compared to a four-day average water concentration.

The Agency has guidance for determining if monitoring data shows that pesticide concentrations in a surface waterbody (lake or river segment) violate water quality standards (Exhibit A-7). The requirements are based on a minimum data set and a frequency of violations of a standard to list a waterbody as impaired on the 303(d) list. For pesticides that are seasonally applied and reach higher concentrations in the spring and summer during storm-events, the Agency has framed specific requirements for assessing pesticides with technical assistance from MDA. The Agency has used this approach for assessing atrazine for the 2004 and 2006 303(d) lists, and plans to use the same assessment methods with acetochlor and metolachlor.\(^{52}\)

The Agency relies on the pesticide monitoring program at MDA for use in assessing pesticide concentrations in surface waters.\(^ {29}\) Currently, MDA’s program focuses on comprehensive stream or river monitoring in the southern third of the state and supplements these sites with statewide survey data.\(^ {34}\) Monitoring in surface waters has acetochlor and metolachlor results since 1993. MDA and their cooperators also supply the Agency with stream-flow data, termed hydrographs. The hydrographs are an important aspect to assessing pesticide concentrations as they are influenced by changes in the amount and source of water entering and moving through a stream monitoring station. MDA sampling includes continuous flow-based sampling during storm-events at selected stations and grab samples at all stations and survey sites.

4. **Assessing Herbicide Mixtures** [V.J. reasonableness, acetochlor and metolachlor]

Assuming the proposed standards are adopted, the Agency will have standards for three chloracetamide herbicides: alachlor, acetochlor, and metolachlor. Their general mode of toxicity in vascular plants is similar and is suspected to act on molecular targets important in all plant species (i.e. fatty acid and protein synthesis). Limited evidence in algal species has shown additive effects with mixtures of chloracetamides, suggesting same mode of action in these plant groups as well.\(^ {53}\) Studies on effects to aquatic plants have also shown similarity in the most sensitive species. Situations may arise where comparing individual herbicides to their respective standards may not account for cumulative negative effects arising from exposure to multiple chemicals targeted at plants.

EPA and MDH are developing guidance and rules for addressing chemical mixtures, including mixtures of chemicals with similar modes of toxicity or toxicities of parent compounds

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\(^{52}\) MPCA. 2003 and 2005. Assessment of Atrazine Concentrations in the Middle Fork (Branch) of the Whitewater River for the 2004 and 2006 305b/303d Integrated Assessment and Root River for the 2006 305b/303d Integrated Assessment.

compared to their environmental degradates and biological metabolites.\textsuperscript{47,54} EPA published
detailed toxicity assessments of atrazine and its common environmental degradates\textsuperscript{55}; the
Agency has used their finding for assessing atrazine and degradate concentrations in surface
waters. The Agency is following this ongoing work and may consider application in future
impairment assessments. For example, use of an additive approach for mixtures of herbicides
from the same chemical class by using a hazard quotients (sum of the average four-day
concentration in surface waters/chronic standard for each herbicide) to assessing compliance to
water quality standards. Minn. R. 7050.0222, subp. 7, item D already requires this approach for
assessing samples with more than one carcinogenic substance.

5. Projected Exceedances of Standards [V.J. reasonableness, acetochlor and metolachlor]

Based on the assessment protocol described above in Section V.J.3, Agency staff have completed
a preliminary assessment of MDA monitoring data for acetochlor and metolachlor to try and
determine if there are waters that would not meet the proposed standards. The potential of future
listing of waterbodies for acetochlor or metolachlor impairment on the 303(d) list has
ramifications for cost estimates and affected parties. Examination of complete monitoring and
hydrograph data for the years 2002 to 2004 found:

- No stream stations or survey sites had any one-day average metolachlor concentrations
  that exceed the proposed maximum standard (MS; 271 µg/L) or four-day average
  concentrations exceeding the proposed chronic standards (CS; 23 µg/L);
- No stream stations or survey sites had any one-day average acetochlor concentrations
  above the proposed MS (86 µg/L);
- Three stream stations had four-day average acetochlor concentrations that exceed the
  proposed CS (1.7 µg/L): Middle Fork (Branch) of the Whitewater River (June 2002),
  Le Sueur River (May 2003, two four-day violations), and Seven Mile Creek (May 2004).

A limited review of MDA pesticide monitoring data and U. S. Geological Survey long-term
National Water Quality Assessment Program data in Minnesota going back to 1996 suggests that
the Agency would not find any violations of the proposed MS or CS for metolachlor or the
proposed MS for acetochlor. Individual sampling results at concentrations above the proposed
CS for acetochlor present the possibility of other violations and potential 303(d) listings.

Two violations of the CS in three years, given the minimum data set, meets the criteria for listing
a waterbody as impaired on the 303(d) list. At this time, the results on the Le Sueur River from
May 2003 meet the criteria for 303(d) listing; however, the Agency recently submitted the draft
2006 303(d) list of impaired waters to EPA, so will not complete another round of impaired
303(d) list will be based on more monitoring data (both older and newer), the final acetochlor
standard adopted into rule, and review by the professional judgment groups (Exhibit A-7).

\textsuperscript{54} MDH. 2004. Draft Minnesota’s Health Risk Limits for Ground Water Rule (Minn. R. 4714.7810 to 4717.7890)
and Draft Statement of Need and Reasonableness. MDH, Environmental Surveillance and Assessment Section.

\textsuperscript{55} EPA. 2003. Interim Reregistration Eligibility Decision for Atrazine: Case no. 0062. EPA; Office of Prevention,
Pesticides and Toxic Substances.
K. CONCLUSIONS, REASONABLENESS [V. acetochlor and metolachlor]

The proposed acute (FAV and MS) and chronic standards for acetochlor and metolachlor are based on EPA’s and the Agency’s methodology and rules for developing water quality standards. The methods used provide scientifically-defensible values for protecting the designated beneficial uses of Class 2 surface waters as required by the Clean Water Act. The proposed standards are based on complete background searches for relevant data, thorough assessment of the data for acceptability, and sound statistical and professional analysis of the acceptable data sets for both human health and aquatic organism toxicity.

The FAV and MS values are calculated using an approved “Tier II” method adopted by EPA for the Great Lakes Initiative in 1995 (Minn. R. ch. 7052) and adopted by the Agency for statewide use in 2000. The chronic standards are based on toxicity data for aquatic plants using the draft EPA criterion for atrazine as a guide. This is reasonable given the fact that herbicides are plant poisons. The proposed standards are listed in Tables III-6 and III-7.

L. ECONOMIC IMPACT [V. acetochlor and metolachlor]

1. Introduction [V.L. economics, acetochlor and metolachlor]

Benefits resulting from the adoption of water quality standards for the two corn herbicides, acetochlor and metolachlor are discussed under the required questions in Section V.C.2.

Promulgation of the new water quality standards for acetochlor and metolachlor are not expected to result in any additional costs or redirection of resources initially.

- The MDA has the primary responsibility for addressing pesticides in surface and ground waters and already monitors for acetochlor and metolachlor in corn-growing portions of the state.
- The MDA has already developed voluntary best management practices (BMPs) specifically for acetochlor from the advisory values developed previously by the Agency to address detections in surface waters. A metolachlor BMP was developed to address detections in ground water, and the MDA has been using the Agency’s previously developed metolachlor advisory value as a reference value to evaluate the need for metolachlor-specific surface water BMPs. The currently adopted BMP for metolachlor in ground water likely contributes to surface water protection.
- Current pesticide management activities that include acetochlor and metolachlor are voluntary for implementation by corn producers and have potential to reduce surface water impacts prior to any impairment.

Future costs or redirection of resources would stem from determination of impairment and listing of river segments or lakes on the 303(d) impaired waters list.
• Impaired waters listing results in regulatory requirements by the Clean Water Act to develop Total Maximum Daily Load (TMDL) studies.
• The Agency would incur costs requiring redirecting the available resources for TMDL development to address an acetochlor impairment; MDA would likely incur costs related to the TMDL.
• Implementation of strategies to return waters to compliance would likely affect and add costs to or redirect resources by the Agency, MDA, corn producers in listed watersheds, and potentially the principal registrant for acetochlor, Monsanto Company.

The Agency has not listed any surface waters for pesticide impairments, so cost estimates are based on consideration of costs related to TMDLs for conventional pollutants for which the loading to surface waters is dominated by nonpoint sources. To arrive at the estimates we consulted with Agency TMDL staff in the St. Paul and the Regional Offices, MDA experts in pesticide management, and other states that have done TMDLs for herbicides.

2. Initial Costs with Promulgation of Standards [V.L. economics, acetochlor and metolachlor]

a) Minnesota Pollution Control Agency [V.L. economics, acetochlor and metolachlor]

The adoption of new water quality standards in Minnesota Rule would likely be supported by surface water monitoring, assessment of monitoring data for compliance to standards, and setting effluent limits for surface water dischargers. The Agency is not expected to incur costs for acetochlor and metolachlor monitoring in surface waters. The MDA is the lead state agency for addressing pesticide impacts and has responsibility for surface and ground water monitoring. MDA has dedicated funds for pesticide monitoring and already includes acetochlor and metolachlor in their monitoring program. The Agency would see an increase in the amount of monitoring data to review and fully assess for compliance for impairment listing with the addition of the new standards, however, based on the preliminary review undertaken by Agency staff to support the proposed standards, the additional resources needed for the assessments could be adsorbed into normal work loads and current budgets. Because the principal source of acetochlor and metolachlor into surface waters is likely from nonpoint sources (rural land application and the subsequent leaching into ground water or runoff from precipitation) rather than point sources, there would be no costs for development of effluent limits or monitoring plans for dischargers with NPDES/SDS permits.

b) Minnesota Department of Agriculture [V.L. economics, acetochlor and metolachlor]

As described in the Acetochlor and Metolachlor Supplements (Exhibit H-4 and H-5), MDA has the lead role in pesticide monitoring. MDA has a long-term surface water pesticide monitoring program in the primarily agricultural areas of the state that has included sampling streams for acetochlor and metolachlor. MDA is continuously assessing and refining their pesticide monitoring program and in 2002 started supplementing data from the permanent stream stations with surveys of streams statewide. As MDA already monitors for acetochlor and metolachlor in corn-growing sections of the state, the addition of the water quality standards would initially not
result in additional monitoring costs. However, monitoring costs would likely increase over time if TMDL processes are implemented.

The MDA has already developed and is promoting BMPs for acetochlor and metolachlor, including changes in application rates and farming practices that are voluntary for corn producers and have potential to reduce concentrations in surface waters (Exhibit H-8). MDA has used the advisory values for acetochlor and metolachlor developed by the Agency to assess potential impacts of these herbicides to aquatic life and human health. MDA developed voluntary BMPs in 2004 specifically to address acetochlor in surface waters when the MDA Commissioner determined that, based on their Pesticide Management Plan, the detections in surface water met the criteria for further management. Metolachlor voluntary BMPs were developed in response to ground water detections, but the same BMPs also can reduce surface water impacts. As MDA has already put resources into chemical-specific voluntary BMPs, promulgation of the water quality standards for acetochlor and metolachlor will not necessarily require development of significantly new practices.

3. Costs for 303(d) Impaired Waters Listing and TMDL Study [V.L. economics, acetochlor and metolachlor]

a) Minnesota Pollution Control Agency [V.L. economics, acetochlor and metolachlor]

With the assessment of surface water monitoring data comes the possibility of identifying waters that do not meet the water quality standards for acetochlor and metolachlor. Waters not meeting standards are listed on the 303(d) list and included in the total maximum daily load (TMDL) program mandated by the CWA. The TMDL process requires a pollutant reduction study that determines the sources of the pollutant and necessary reductions needed to return the waters to compliance. The TMDL study would provide the basis for implementing voluntary and regulatory efforts to ensure sources reduce loads accordingly under the Agency’s TMDL implementation policies.

Total Maximum Daily Load studies require Agency funds and staff resources. The draft 2006 303(d) has 965 non-mercury impairment listings slotted to be addressed in 290 TMDL studies. The Agency has 15 years to complete a TMDL study for each listing. Once started the studies generally take about four years to complete, followed by one year of implementation planning. The Agency has not had a 303(d) listing for a pesticide, so cost estimates are based on information compiled for TMDLs for conventional pollutants such as fecal coliform, turbidity, excess nutrients and dissolved oxygen. Agency staffing estimate to complete each TMDL study typically ranges from 0.2 to 1.5 full-time equivalents (FTEs) per project year, with an average of 0.3 FTEs per year. Agency staffing estimates related to implementation activities for an approved TMDL typically averages 0.05-0.1 FTEs per year. Overall costs for TMDLs studies have primarily ranged from $50,000 to $400,000, with an average of $150,000. TMDLs for the largest river watersheds (Mississippi and Minnesota Rivers) have study costs closer to $1 million.

Funding for the studies comes from the Federal Section 319 Nonpoint Source Management Program grant and matching state funds. The Agency has approximately $1 million annually to allocate to TMDL study development. About two-thirds of funded projects are led by qualified local partners, including counties, soil and water conservation districts, and watershed management organizations. The Agency leads remaining projects. Activities include conducting additional monitoring and land-use assessments, computer modeling to develop pollutant load allocations and reductions, and facilitating stakeholder participation throughout the process. Costs are largely dependent on project complexity, which is relative to the type of pollutant causing the impairment, the geographic size of the watershed, and the variety and number of impairments being addressed.

A number of factors are considered for estimating the economic impact to the Agency for a possible 303(d) listing and TMDL study for acetochlor. First, is the relative priority of an acetochlor listing in comparison to the other 290+ TMDL studies on the Agency’s list. The Agency does not currently have adequate funding to initiate TMDL projects scheduled for a given year, so prioritization of a study for acetochlor would potentially delay start of another needed study and increase the project backlog. Estimates for a pesticide TMDL may be higher than average for a watershed impaired with a conventional pollutant, such as fecal coliform, because analytical costs for monitoring pesticides are higher and models will differ from those developed for more common conventional pollutants. The possible listings are on river sites and the Agency has found TMDL study costs are higher for river impairments than lakes.

Other states have 303(d) listings for pesticides and have completed TMDL studies. States have flexibility in the how to carry out TMDL studies, and TMDLs vary considerably in size, complexity, and the choice of tools used in the analysis, resulting in a wide range of costs. Upon request, the Agency received information from four states on their costs for herbicide TMDLs.

Iowa has completed two TMDL studies for atrazine: one on a reservoir and one on a lake; Iowa’s TMDL program coordinator estimates costs for the studies ranged from $10,000 to $15,000, not including monitoring costs. Kansas estimated they spent $5000 for a TMDL study plus $30,000 annually on monitoring. Kansas did not use models, thereby substantially reducing costs. Illinois has not completed their TMDL study, but estimates costs of $44,500 for a contractor to complete the study and implementation plan. Texas provided the Agency a very detailed account of all TMDL related costs. The TMDL study and implementation plan for an impaired drinking water reservoir (atrazine) in Texas cost approximately $520,000.

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b) Minnesota Department of Agriculture [V.L. economics, acetochlor and metolachlor]

The Agency would have the lead and oversee the funding for any TMDL study for pesticides. However, because of MDA’s expertise on pesticide issues and broad connections from the national to the local level with the agricultural community, MDA would play a key role in partnering with the Agency to assist with a TMDL study. Cooperation by the agencies would make the most use out of available resources. Costs to MDA may be offset by Federal Section 319 grants.

The MDA has also responded to requests by the Agency to increase monitoring at sites that have had elevated concentrations of pesticides with water quality standards. MDA and the Agency designed a sampling protocol to address these sites with ramped up monitoring for a number of years. MDA relies on partners for some of this sample collection, but does have increased analytical costs with the additional samples.

4. Costs of TMDL Implementation and Restoration Activities [V.L. economics, acetochlor and metolachlor]

   a) Minnesota Pollution Control Agency [V.L. economics, acetochlor and metolachlor]

As with the funding available to develop TMDL studies, a dedicated amount of funding from Federal Section 319 grants is used to implement restoration activities ($1.32 million dollars in Fiscal Year 2006.). The Agency would need to divert resources to TMDL implementation with the publication of a TMDL study for acetochlor. The Agency has estimated total costs related to TMDL restoration studies for all affected parties as ranging from $5 to $10 million in small watersheds, up to $40 million for large watersheds. Texas successfully returned the Aquilla Reservoir to compliance with the Federal atrazine drinking water standard and invested about $2.2 million in restoration projects.61 Of total TMDL costs, approximately 50 percent of the funding was from Federal sources and 25 percent from state agency budgets. The Agency estimates that 0.05 to 0.1 FTEs are required to provide adequate agency oversight per TMDL implementation project.57 For most nonpoint-related TMDLs, the Agency primarily contracts implementation activities to local government or watershed organizations, which receive a portion of the Federal Section 319 funds. In the case of a pesticide impairment, MDA would likely have a larger role than for other pollutants addressed thus far by the Agency in the TMDL program. The MDA or a local contractor would likely lead BMP implementation, monitoring, education/outreach, and other activities detailed in a TMDL implementation plan.

   b) Minnesota Department of Agriculture [V.L. economics, acetochlor and metolachlor]

The MDA would partner with the Agency to address implementation and efficiently utilize resources from both Agencies as outlined in MDA’s Pesticide Management Plan. Costs to MDA may be offset by Federal Section 319 funds from the Agency. MDA would likely utilize staff resources to assist with implementation; MDA is already involved with education and outreach to corn producers and other agricultural groups in response to publication of voluntary BMPs for acetochlor, metolachlor, and other corn herbicides; however, future costs and staffing needs
would be expected to increase in order to direct more resources to any impaired watersheds. There is also the strong likelihood of increased use of technical staff time for TMDL implementation, though the exact increase in FTEs is uncertain. MDA would likely have a lead role and see increased costs for effectiveness monitoring of acetochlor or metolachlor in any listed watersheds.

c) Cost to Corn Producers [V.L. economics, acetochlor and metolachlor]

Costs would likely be limited to corn producers in the impaired watershed, specifically those with crop land in sensitive areas near surface waters or with connections to surface waters. The majority of corn producers in Minnesota, however, would not be in impaired watersheds and would not likely incur costs. As addressed in the Acetochlor and Metolachlor Supplements (Exhibit H-4 and H-5), estimating costs to corn producers is difficult based on the complexity of predicting annual herbicide needs, available products, and market values of corn crops versus viable alternatives. Controlling losses of applied acetochlor or metolachlor from cultivated fields could be addressed through a variety of BMPs as presented in MDA's voluntary BMP publications (Exhibit H-8). In addition, costs associated with implementing a range of options, such as reduction in application rates, switching to lower-cost herbicides, installation of buffer strips, or taking cropland out of production, is highly dependent on the amount and location of crop acres with acetochlor or metolachlor application that can reasonably be linked to the surface water contamination.

Information is available to examine annual costs per acre in implementing BMPs for pesticides and other nonpoint source pollutants. Use of alternate corn herbicides is an option depending on the weed pressures for a given year. For example, estimates of costs of acetochlor per acre range from $12 to $35 based on product type and application rate, with alternatives ranging from $7 to $44 per acre.\(^\text{62}\) The Agency has estimated BMP costs for other nonpoint agricultural water pollutants: minimum tillage at $14/acre, stream buffers at $200/acre, and conservation easements in the Conservation Reserve Program at $100/acre/year.\(^\text{63}\)

The economic impact to individual corn producers may be minimized, because MDA is already implementing voluntary BMPs offering a variety of options for reducing acetochlor and metolachlor impacts, providing advanced notice for corn producers and local agricultural groups to respond to the detections of acetochlor and other herbicides in surface water. In the case of acetochlor, BMP implementation could reduce concentrations in impaired surface waters, returning them to compliance prior to any long-term impairment to the aquatic community or the need for more prescriptive BMPs. Voluntary BMPs are already being developed and implemented through education and incentive programs in the agricultural parts of the states to address TMDLs for other nonpoint pollutants (e.g. fecal coliform). The same BMPs should also reduce pesticide runoff. Kansas found that changes in less costly herbicide application practice and not structural changes resulted in significant decreases in surface water concentrations.\(^\text{59}\)

Texas corn producers did invest money in BMP implementation through cost-share programs at

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\(^{62}\) MDA. 2005. Atrazine alternatives for corn production in Minnesota (chart based on University of Minnesota Extension’s 2005 Cultural and Chemical Weed Control in Field Crops and other sources), J. Zachmann, St. Paul.

a total of $685,000. The timeframe associated with TMDL implementation would allow corn producers to apply for and receive financial incentives and cost-sharing participation for implementation of more costly BMPs that might require taking land out of production for planting and restoring native habitat.

d) Registrants [V.L. economics, acetochlor and metolachlor]

The registrants of acetochlor, primary Monsanto Company, may see a slight change in acetochlor sales as a result of 303(d) listing of a specific waterbody in a watershed of limited size. Review of pesticide monitoring data in Minnesota from MDA and USGS points to a small number of watersheds with acetochlor concentrations near or above the proposed chronic water quality standard. Options for reducing these concentrations include reduced application rates of the herbicide, a possible change in herbicide products, installation of stream buffers, acquisition of conservation easements, etc. Within an impaired watershed there is likely to be a subset of corn producers amendable to altering acetochlor use. Because acetochlor is widely used across the United States corn belt, a reduction in use by limited growers in Minnesota may only result in minor revenue losses for the registrants.

M. CONCLUSION, ECONOMIC IMPACT [V. acetochlor and metolachlor]

The Minnesota Department of Agriculture (MDA) identified acetochlor and metolachlor as the two top pesticides in need of water quality standards, because of frequent detections in surface waters, with some acetochlor concentrations near previous Agency advisory values. Also, acetochlor and metolachlor use in corn production is high relative to other pesticides in Minnesota.

If the proposed acetochlor and metolachlor standards are adopted state agencies, farmers and the pesticide registrants are likely to incur costs. Estimating future costs is very difficult for the reasons discussed in this Section. And some costs to growers may be at least partially offset by grants or incentive programs.
VI. UPDATE HUMAN HEALTH-BASED STANDARDS FOR BENZENE AND NAPHTHALENE

A. INTRODUCTION [VI. benzene and naphthalene]

The Agency adopted standards for benzene and naphthalene in the 1990 and 1994 revisions of Minn. R. ch. 7050, respectively. The same benzene chronic standard in Minn. R. ch. 7050 is also listed in Minn. R. ch. 7052. The Agency elected not to propose a change to the benzene standard in Minn. R. ch. 7052, because it would be the only change for that rule in this rulemaking. It is not cost-effective in terms of the extra time and staff resources needed to include Minn. R. ch. 7052 in this revision for this one small change. The more current benzene standards in Minn. R. ch. 7050 are applicable statewide and will be used in the Lake Superior Basin. Naphthalene is not a listed standard in Minn. R. ch. 7052, but is incorporated by reference in Minn. R. ch. 7052.0100, subp.1.

The Minnesota Department of Health (MDH) staff has recently completed toxicological reviews of benzene and naphthalene and other chemicals for which the Agency has current water quality standards. Of these, only benzene and naphthalene resulted in human health criteria that are lower than current water quality standards. For a range of reasons the revised toxicological reviews do not result in more stringent standards for other toxicants, at least until such time as the Agency proposes to use children-protection “adjustment factors” in the calculation of human health-based standards.

The Agency is proposing to update only the chronic standards; the acute toxicity-based final acute values and maximum standards will not change.

B. NEED TO UPDATE BENZENE AND NAPHTHALENE STANDARDS [VI. benzene and naphthalene]

Water quality standards for protecting human health take into account both exposure and health effects. Research advances in these areas need to be accounted for in regulatory applications, in this case updating human health-based water quality standards. Enhanced understanding of how and how much humans may be exposed to a chemical and the health outcomes from such exposure serve to decrease the uncertainty in setting standards for pollutants. Application of the newer data benefits users of Minnesota’s waters for drinking and recreational uses by increasing the reliability of the values used to protect surface and ground waters for meeting these beneficial uses.

The Agency relies on EPA and the expertise of staff at the Minnesota Department of Health (MDH) for providing human health toxicity information for developing human health-based drinking water quality criteria and standards. MDH staff working on revisions to Health Risk Limits (HRLs) for groundwater have recently reviewed toxicological data for benzene and naphthalene (Exhibits HH-5 and HH-6). Newer toxicological data available since the Agency standards were promulgated show health effects can occur at lower doses. The best available
toxicity data needs to be factored in when determining the numeric water quality standards for these chemicals (see table III-12). The human health-based chronic criteria values will be compared to criteria developed to protect aquatic organisms. The lowest or most stringent criteria values for each Class 2 designation will be promulgated into Minn. R. ch. 7050.0222 as chronic standards for that pollutant.

Table III-12. Results of MDH Toxicological Reviews and Example of Changes in Human Health-based Standards for Benzene and Naphthalene.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Current Reference Dose</th>
<th>MDH Updated Reference Dose</th>
<th>Current Cancer Potency Factor</th>
<th>MDH Updated Cancer Potency Factor</th>
<th>Examples</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Units: mg/kg-d</td>
<td>mg/kg-d</td>
<td>(mg/kg-d)^-1</td>
<td>(mg/kg-d)^-1</td>
<td>µg/L</td>
<td>µg/L</td>
</tr>
<tr>
<td>Benzene</td>
<td>NA (0.004)</td>
<td>0.0290</td>
<td>0.055*</td>
<td>9.7</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Naphthalene</td>
<td>0.04</td>
<td>0.02</td>
<td>NA</td>
<td>NA</td>
<td>129 (criterion)</td>
<td>65</td>
</tr>
</tbody>
</table>

*Cancer potency slope is basis for the most protective human health-based standard.
NA: Not applicable-no toxicity value is available or required for this chemical.

**Definitions from Minn. R. 7050.0218, subp. 3:**
Cancer potency factor- a factor indicative of a chemical's human cancer causing potential in units of inverse milligrams per kilogram-day (mg/kg-d^-1).
Reference dose— an estimate of a daily exposure to the human population, including sensitive subpopulations, that is likely to be without appreciable risk or deleterious effects over a lifetime in units of milligrams per kilogram-day (mg/kg.d).

C. REASONABLENESS OF PROPOSED BENZENE AND NAPHTHALENE CHRONIC STANDARDS, REQUIRED INFORMATION [VI. benzene and naphthalene]

1. **Introduction** [VI.C. reasonableness, benzene & naphthalene]

Minnesota Stat. § 14.131 requires that this SONAR, as part of demonstrating the reasonableness of the proposed amendments, include information about affected parties, costs and other topics that are covered in the following 11 sections. The discussion in these sections pertains only to the proposed benzene and naphthalene standards.

2. **Classes of Persons Affected by the Proposed Rule Amendments, Including those Classes that Will Bear the Costs and Those that Will Benefit** [VI.C. reasonableness, benzene and naphthalene]

Current water quality standards based on the most up-to-date scientific data benefit all users of Minnesota’s waters and all citizens in general. Citizens rely on the Agency to set standards and effluent limits that protect human health and the environment. An important aspect of this responsibility is to ensure accuracy in standards. The CWA specifically requires states to revise...
water quality standards every three years to maintain their accuracy and reliability. The revisions to the benzene and naphthalene standards are based on the best scientific data. The standards are designed to protect the beneficial uses of surface waters and therefore benefit direct users and provide assurance to other citizens in general that pollutants in Minnesota’s surface waters are being addressed.

As fully covered in Section VII.E, Economic Impact, the promulgation of the revised human health-based standards for benzene and naphthalene will not result in any costs.

3. **Estimate of the Probable Costs to the Agency and Other Agencies of Implementing and Enforcing the Rule Amendments, and Any Anticipated Effect on State Revenues** [VI.C. reasonableness, benzene and naphthalene]

The Agency does not expect there to be any additional costs to any party as a result of promulgation of the revised benzene and naphthalene water quality standards, including State Revenues (Section VII.E.).

4. **Determination of Whether There Are Less Costly or Less Intrusive Methods of Achieving the Rule Amendments’ Purpose** [VI.C. reasonableness, benzene and naphthalene]

There are no other options for achieving the purpose of updated benzene and naphthalene standards.

5. **Describe Any Alternative Methods for Achieving the Purpose of the Proposed Rule Amendments that the Agency Seriously Considered and the Reasons Why They Were Rejected in Favor of the Proposed Amendments** [VI.C. reasonableness, benzene and naphthalene]

The Agency initially planned to update more human health standards taking into account additional protection for infants and children. As described in SONAR Book I Section II.D.2. and Section VI.A. in this Book, the Agency postponed those plans. No other alternatives for updating the benzene and naphthalene standards were considered.

6. **Estimate of the Probable Costs of Complying with the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [VI.C. reasonableness, benzene and naphthalene]

The Agency does not expect any costs to affected parties as described in Section VII.E.
7. **Estimate of the Probable Costs of Not Adopting the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties [VI.C. reasonableness, benzene and naphthalene]**

The Agency believes there could be intangible “costs” to Minnesotans if water quality standards are not revised to reflect the most current and scientifically defensible data. Minnesotans place a high value on our water resources for drinking water and fish consumption, recreation, and healthy ecosystems (see example discussion for benefits of eutrophication standards in Book II, Section V.B). The Agency has a mandate to protect these designated beneficial uses and part of that is having accurate and reliable water quality standards. At certain levels of exposure, benzene and naphthalene can affect human health; benzene is classified as a known human carcinogen (See Section VII.D.2). Revised chronic water quality standards aim to protect humans from detrimental effects, which both can have direct and indirect “costs” to human health and quality of life and resultant true monetary losses.

8. **Differences Between the Proposed Rule and Existing Federal Regulations and the Need for and Reasonableness of Each Difference [VI.C. reasonableness, benzene and naphthalene]**

Federal regulations in the CWA and laid out in EPA guidance and water quality criteria documents provide the requirements and guidelines to develop water quality standards; the updated benzene and naphthalene standards developed by the Agency are consistent with these parameters. The CWA gives states the authority to promulgate water quality standards. EPA has published ambient water quality criteria for benzene in 2002; the Agency modified the standard based on the higher fish consumption rate used in Minnesota over the default general population rate used by EPA and used different bioaccumulation factors based on more defensible and newer methods (Section III.C.4).


Minnesota Stat. § 14.002 requires state agencies, whenever feasible, to develop rules and that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency’s regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals.

The standards for benzene and naphthalene are “prescriptive” as are all numeric standards. The general concepts of how prescriptive or flexible a rule should be are discussed more in SONAR Book I, Section VIII.I.

Minnesota Stat. § 14.131 requires the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made.

The Agency outlined its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I, and its compliance with these specific statutes in Section IV.C.10.

11. **Consultation with the Commissioner of Finance Regarding Fiscal Impacts on Local Governments** [VI.C. reasonableness, benzene and naphthalene]

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency provided the Department of Finance with a copy of the proposed rule and SONAR at the same time as these items were sent to the Governor’s Office. This timing allows the fiscal impacts and fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with the Governor’s Office review.

12. **Agency Determination Regarding Whether Cost of Complying with Proposed Rule in the First Year After the Rule Takes Effect Will Exceed $25,000** [VI.C. reasonableness, benzene and naphthalene]

The cost of complying with the revised benzene and naphthalene chronic standards in the first year after they take effect will not exceed $25,000 for: (1) any one business that has less than 50 full-time employees; or (2) any one statutory or home rule charter city that has less than ten full-time employees, because there are no cost to outside parties attributed to the benzene and naphthalene standards.

D. **REASONABLENESS OF PROPOSED BENZENE AND NAPHTHALENE CHRONIC STANDARDS** [VI. benzene and naphthalene]

1. **Introduction** [VI.D. reasonableness, benzene & naphthalene]

The MDH is the lead agency on setting or providing guidance on human health toxicity recommendations and has completed thorough reviews of benzene and naphthalene to establish toxicity values. The Agency applies the health review data to the established methods to set human health-based chronic criterion, as described in Minn. R. ch 7050.0218, subp. 6 and the BAF (bioaccumulation factor) methods described in Minn. R. ch. 7050.0218, subp. 7, with other guidance available in Exhibit HH-3.
2. **Benzene** [VI.D. reasonableness, benzene]

Benzene is a natural component of coal and petroleum, produced by extraction from these sources. Benzene is one of the top organic chemicals produced in the United States. Primary uses for benzene include gasoline additive, intermediate in chemical manufacturing, commercial solvent, and chemical ingredient in dye, paints, and detergents.

Benzene is a volatile organic chemical (VOC), meaning that it readily vaporizes into air. Its use in gasoline means exposure is primarily from automobile emissions and volatilization at filling stations. Other air sources include emissions from industrial facilities using benzene and burning of coal, petroleum products, and wood (forest fires are a natural source of benzene). Benzene is also found in cigarette smoke, which can also contribute significantly to exposure.

Detection of benzene in ground or surface waters is rare and likely the result of direct input from improper disposal or spills and leaking underground gasoline storage tanks. Nationwide, surface water samples have found benzene in 15 percent of samples analyzed for VOCs at concentrations typically between 1-2 µg/L. In Minnesota, annual river sampling by the Metropolitan Council Environmental Services (MCES) in the seven county Twin Cities metropolitan area has only detected benzene twice from 1978-2004 (Reporting Limit 1 µg/L).

The recent toxicological review by MDH for the HRL revisions showed that benzene is a more potent carcinogen than previously determined (Exhibit HH-5). Benzene is a known human carcinogen with tumor sites in the blood system, resulting in leukemia. MDH concurred with the 2000 benzene health assessment by the EPA Integrated Risk Information System (IRIS), the principle source of human health toxicity evaluations for non-pesticides. The IRIS review determined a range of cancer potency slopes for benzene from 0.015 to 0.055 (mg/kg-d)\(^{-1}\). MDH is using the upper bound cancer slope factor of 0.055 (mg/kg-d)\(^{-1}\) for setting the cancer HRL, which is consistent with the results of the EPA IRIS assessment. Using the larger cancer slope factor provides the most health protection and results in a lower (more stringent) standard. At higher doses (based on a reference dose of 0.004 mg/kg-d), benzene exposure is also linked to noncancer adverse effects to the blood system and developmental effects.

The Agency established the chronic standards for benzene in Minn. R. 7050 in 1990 and updated the human health-based WQS in 1994 (Exhibit HH-7). Table III-12 lists the current human health-based criteria based on a cancer potency factor of 0.0290 (mg/kg-d)\(^{-1}\). The human health-

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based criteria for Classes 2A and 2Bd were also promulgated as the chronic standards, because these values are more stringent than the aquatic toxicity criterion of 114 µg/L. For Class 2B surface waters, the aquatic toxicity criterion value is the most stringent and applied as the chronic standard. Using the updated cancer slope factor and previously developed bioaccumulation factor (BAF) results in revised human health-based criteria that are more stringent than the current Class 2 water quality standards (Table III-13). All Class 2 chronic standards for benzene will now be based on protection of human health (Exhibit HH-8). While the changes in chronic standards are relatively small, because benzene is a carcinogen, any exposure has some increased risk for developing cancer, and standards need to reflect the latest findings on cancer potency.

Table III-13. Current and Proposed Benzene Standards in Minn. R. ch. 7050.

<table>
<thead>
<tr>
<th>Benzene Parameters</th>
<th>Current Values</th>
<th>Proposed Values (Revised values are in bold.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toxicity-based (Tox)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Class 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Standard</td>
<td>4,487 µg/L</td>
<td>4,487 µg/L</td>
</tr>
<tr>
<td>Final Acute Value</td>
<td>8,974 µg/L</td>
<td>8,974 µg/L</td>
</tr>
<tr>
<td>Chronic Criterion</td>
<td>114 µg/L</td>
<td>114 µg/L</td>
</tr>
</tbody>
</table>

| **Human Health-based (HH)** |                |                                               |
| All Class 2                |                |                                               |
| Reference Dose             | NA             | 0.004 mg/kg-d                                 |
| Cancer Potency Factor*     | 0.0290 (mg-kg-d)^-1 | **0.055 (mg-kg-d)^-1**                      |
| Class 2A                   |                |                                               |
| Bioaccumulation Factor l/kg| 16             | 16                                            |
| Chronic Criterion          | 9.7 µg/L       | **5.4 µg/L**                                  |
| Class 2Bd                  |                |                                               |
| Bioaccumulation Factor l/kg| 4              | 4                                             |
| Chronic Criterion          | 11 µg/L        | **6.0 µg/L**                                  |
| Class 2B/C/D               |                |                                               |
| Bioaccumulation Factor l/kg| 4              | 4                                             |
| Chronic Criterion          | 186 µg/L       | **98 µg/L**                                   |

| **Final Water Quality Standards** |            |                                               |
| Maximum Standard            |              |                                               |
| Class 2A                    | 9.7 µg/L (HH) | **5.4 µg/L (HH)**                            |
| Class 2Bd                   | 11 µg/L (HH)  | **6.0 µg/L (HH)**                            |
| Class 2B/C/D                | 114 µg/L (Tox)| **98 µg/L (HH)**                             |

*Basis for chronic criterion; calculation with reference dose results in a higher value.

3. **Naphthalene** [VI.D. reasonableness, naphthalene]

Naphthalene is a chemical formed naturally in coal tar and crude oil. Based on sources and chemical structure, naphthalene is classified as a PAH (polynuclear aromatic hydrocarbon); a

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group well known for being released from combustion or burning of organic carbon, including wood, coal, petroleum products, cigarettes, and meats. Naphthalene is also extracted and used in chemical processes for producing plastics, dyes, pharmaceuticals, insecticides, and mothballs.

Naphthalene is also classified as a VOC. Exposure evaluations find that humans are primarily exposed to naphthalene from inhalation of smoke and exhaust from combustion of wood and petroleum in automobile exhaust and power plants. Ambient air concentrations are highest in urban areas. Indoor air concentrations can exceed those of ambient air with cigarette and mothball exposure.

Occurrence of naphthalene in surface and ground waters would result from direct releases or runoff from land contamination. Ground water contamination has occurred from improper disposal or spills of petroleum based products and general urban sources and contamination. National monitoring of surface waters has shown median concentrations of 3.9 µg/L in urban areas and 0.4 µg/L in rural areas, but generally measured concentrations above analytical reporting limits are uncommon. River monitoring by the MCES around the metropolitan area between 1978-2004 has not detected naphthalene (above a Reporting Limit 2 µg/L). A limited statewide survey of Minnesota’s surface waters by the Agency and USGS did not find naphthalene above the Reporting Limit of 0.5 µg/L.

As previously stated, MDH has recently competed a toxicological evaluation of naphthalene (Exhibit HH-6). Naphthalene is classified as a carcinogen, but sufficient data is lacking to determine an oral cancer potency slope needed for determining risk for water ingestion. MDH concurred with the 1998 naphthalene health assessment in IRIS. IRIS set a reference dose of 0.02 mg/kg-d based on decreased body weight in a rodent study and uncertainty factors. Other effects at higher doses observed in animals and humans include hematological, developmental, nervous system, and death.

The Agency promulgated the current naphthalene standards in Minn. R. 7050 in 1994 (Exhibit HH-9). The lowest chronic criterion for all Class 2 waters is based on toxicity to aquatic organisms. The aquatic toxicity-based criterion and water quality chronic standard is 81 µg/L. Based on the previous reference dose 0.04 mg/kg-d, the human health-based criteria were at concentrations less stringent than the aquatic toxicity-based value (see Table III-14). Use of the previously developed BAF and updated reference dose results in human health-based criterion that is lower than the aquatic toxicity standard for Class 2A waters; Agency proposes to promulgate the human health-based criterion for Class 2A as the chronic standard (Exhibit HH-10).

---


<table>
<thead>
<tr>
<th>Naphthalene Parameters</th>
<th>Current Values</th>
<th>Proposed Values (Revised values are in bold.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toxicity-based (Tox)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Class 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Standard</td>
<td>409 µg/L</td>
<td>409 µg/L</td>
</tr>
<tr>
<td>Final Acute Value (FAV)</td>
<td>818 µg/L</td>
<td>818 µg/L</td>
</tr>
<tr>
<td>Chronic Criterion</td>
<td>81 µg/L</td>
<td>81 µg/L</td>
</tr>
<tr>
<td><strong>Human Health-based (HH)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Class 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference Dose</td>
<td>0.04 mg/kg-d</td>
<td>0.02 mg/kg-d</td>
</tr>
<tr>
<td>Cancer Potency Factor*</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Class 2A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bioaccumulation Factor I/kg</td>
<td>77.61</td>
<td>77.61</td>
</tr>
<tr>
<td>Chronic Criterion</td>
<td>130 µg/L</td>
<td>65 µg/L</td>
</tr>
<tr>
<td>Class 2Bd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bioaccumulation Factor I/kg</td>
<td>38.80</td>
<td>38.80</td>
</tr>
<tr>
<td>Chronic Criterion</td>
<td>177 µg/L</td>
<td>88.5 µg/L</td>
</tr>
<tr>
<td>Class 2B/C/D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bioaccumulation Factor I/kg</td>
<td>38.80</td>
<td>38.80</td>
</tr>
<tr>
<td>Chronic Criterion</td>
<td>477 µg/L</td>
<td>238.5 µg/L</td>
</tr>
<tr>
<td><strong>Final Water Quality Standards</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Standard (MS)</td>
<td>409 µg/L (Tox)</td>
<td>409 µg/L (Tox)</td>
</tr>
<tr>
<td>Final Acute Value (FAV)</td>
<td>818 µg/L (Tox)</td>
<td>818 µg/L (Tox)</td>
</tr>
<tr>
<td>Chronic Standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2A</td>
<td>81 µg/L (Tox)</td>
<td>65 µg/L (HH)</td>
</tr>
<tr>
<td>Class 2Bd</td>
<td>81 µg/L (Tox)</td>
<td>81 µg/L (Tox)</td>
</tr>
<tr>
<td>Class 2B/C/D</td>
<td>81 µg/L (Tox)</td>
<td>81 µg/L (Tox)</td>
</tr>
</tbody>
</table>

4. Implementation of Benzene and Naphthalene Standards [VI.D. reasonableness, benzene & naphthalene]

Water quality standards are an important factor in setting effluent limits in NPDES (National Pollutant Discharge Elimination System) and State Disposal System (SDS) permits and establishing clean-up goals at spill and remediation sites. Because direct sources of contaminated wastewater are the primary route for VOCs to enter surface waters, it is important and reasonable to set standards and keep them current on these pollutants. In August 2005, there were 46 active NPDES and/or SDS permits for benzene: 31 contaminated ground water pump-outs, seven tank farms, and five other types. The Agency has 18 active NPDES/SDS permits with naphthalene effluent limits; 13 of the permits are for contaminated ground water pump-outs, three for processes at industrial facilities, and two of other types.
E. ECONOMIC IMPACT [VI. benzene and naphthalene]

1. Introduction [VI.E. economics, benzene & naphthalene]

Water quality standards designed to protect the beneficial uses of surface waters are requirements of the Clean Water Act. Economics is not taken into consideration when determining water quality criteria and standards – these values are driven strictly by toxicological and other scientific data (Clean Water Act Sections 303(a) and 304(a); Minn. R. ch. 7050 and 7052). However, economics must be considered when water quality standards are implemented. And Minnesota Stat. ch. 14 requires the review of costs of rule changes to affected parties.

Changes to water quality standards can affect the effluent limits and monitoring requirements for pollutants in NPDES and SDS permits. A combination of state and federal permit rules, facility or permit type, best available, economically-achievable technology, classification of surface water, contaminant (or indicator contaminant) characteristics, and analytic methods determine the resultant effluent limit for permit holders. Effluent limits are established based on the more stringent of a technology-based effluent limitation (TBEL) or applicable water quality-based effluent limit (WQBEL). The EPA-approved analytical methods and detection limits, as listed in 40 CFR 136, can become effluent limits if analytical detection limits are at higher concentrations than the TBEL or WQBEL. Ultimately, the effluent limit ensures that the applicable water quality standard for that pollutant is not exceeded in the receiving water.

2. Benzene [VI.E. economics, benzene]

The adoption of the proposed human health-based standards for benzene in Minn. R. ch. 7050 will have no effect or very minimal effect on NPDES/SDS permit holders because:

- Best, available, affordable, and commonly used treatment systems by permit holders generally remove benzene to concentrations below 1-5 µg/L;
- The decreases in chronic standards needed to protect human health are relatively small and remain above the TBEL (see Tables III-13 and III-14);
- The proposed human health-based standards for drinking water protection are at almost the same concentrations as the current effluent limit of 6 µg/L already in place for these waters;
- Current analytical methods and detection limits will still be adequate for ensuring compliance.

Current effluent limits for benzene are primarily set at chronic water quality standards (Table III-15). Discharge points to surface water (and for some SDS permits, ground water) have effluent limits at the current or past chronic standard for that classification of water. Benzene effluent limits for dischargers into Class 2A or 2Bd waters, which are protected for drinking water use, are 6 µg/L based on statewide 1990 benzene human health-based standards. The Agency revised

these standards in 1994 to the current standards of 9.7 and 11 µg/L, respectively, based on a new cancer potency slope, but the effluent limits would have remained at the more stringent concentration to meet anti-backsliding requirements for NPDES permits. Current dischargers into any 2B/C/D surface waters have effluent limits based on the aquatic toxicity-based standard of 114 µg/L, which has been in Minn. R. ch. 7050 since 1990.

Table III-15. Comparison of Proposed Benzene Standards and Current NPDES Effluent Limits.

<table>
<thead>
<tr>
<th>Water Quality Standards</th>
<th>Proposed Values 7050 (Basis)</th>
<th>Current NPDES Effluent Limits (Basis)</th>
<th>Proposed NPDES Effluent Limits-Contaminated Groundwater (Basis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Superior</td>
<td>NA</td>
<td>No permits</td>
<td>5 µg/L (TBEL)</td>
</tr>
<tr>
<td>Class 2A</td>
<td>5.4 µg/L (HH)</td>
<td>6 µg/L (WQBEL)</td>
<td>5 µg/L (TBEL)</td>
</tr>
<tr>
<td>Class 2Bd</td>
<td>6.0 µg/L (HH)</td>
<td>6 µg/L (WQBEL)</td>
<td>5 µg/L (TBEL)</td>
</tr>
<tr>
<td>Class 2B/C/D</td>
<td>98 µg/L (HH)</td>
<td>114 µg/L (WQBEL)</td>
<td>5 µg/L (TBEL)</td>
</tr>
</tbody>
</table>

The typical treatment systems used for removal of benzene and other VOCs, air stripping and carbon adsorption or granular activated carbon, are highly effective (Exhibit HH-11). Review of removal capabilities show air stripping at 95 percent removal efficiencies, and activated carbon at better than 99 percent. Multiple systems or a combination of both may be needed to reduce high source concentrations of benzene or other VOCs to levels below detection. These treatment systems are considered best available, economically achievable technology.

The Agency is required by the Clean Water Act to use the best available treatment technologies to meet effluent limits (Exhibit HH-11). The proven high removal efficiency, readily available and economically achievable technology reduces benzene concentrations below water quality standards or WQBELs (Table III-14). EPA guidance on VOC treatment technology has recommended a TBEL of 5 µg/L for benzene. A review of monitoring results submitted to the Agency in Discharge Monitoring Reports (DMRs) by NPDES/SDS permit holders (2001 to 2005) supports the effectiveness of treatment technology, with median benzene concentrations below 1 µg/L.

Federal regulations by the U. S. EPA generally provide the basis for approved analytical methods for NPDES permit holders. The EPA lists approved methods in 40 CFR 136 by pollutant. Approved methods for benzene analysis include three EPA Methods (602, 624, 1624B) and five Standard Methods (6200 B [20th], 6210 B [18th, 19th], 6200 C [20th], and 6220 B [18th, 19th]). The Agency also includes MDH laboratory methods based on the approved EPA 40 CFR 136 list in NPDES permit requirements (MDH 465E, replaced by MDH 498-equivalent to EPA Method

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The methods cover a suite of VOCs that include benzene and have detection limits ranging from 0.01 to 10 µg/L. The EPA methods are still adequate to detect benzene at the proposed lower standards.

Monitoring is required for some NPDES/SDS permit holders, some with effluent limits and some without. DMRs from 2001 to 2005 show that most facilities use analytical methods with reporting limits (highest detection limit) at 1 µg/L. Occasionally the reporting limit was 10 µg/L, but that was at facilities with an effluent limit of 114 µg/L. Current analytical methods and reporting limits are adequate for current and proposed benzene water quality standards.

Revisions to water quality standards for benzene are not expected to affect NPDES or SDS permits or remediation responses. The proposed standards are close to existing limits and above technology limits. No changes in recommendations or requirements for handling contaminated water are expected. In addition, many sites with benzene limits are contaminated ground water pump-outs or industrial processes with limits for multiple pollutants. The effluent limits for these other pollutants may be more stringent, driving the treatment process; therefore, changes in the benzene effluent limits will have no effect.

3. **Naphthalene** [VI.E. economics, naphthalene]

Like benzene, the adoption of the proposed human health-based standards for naphthalene in Minn. R. ch. 7050 will have no effect or minimal effect on NPDES or SDS permit holders because:

- The decrease in a chronic standard needed to protect human health is small and only occurs in Class 2A waters (see Tables III-13);
- The proposed human health-based standards for drinking water protection and fish consumption in Class 2A, 65 µg/L, is still above the 50 µg/L effluent limit already in place for most NPDES/SDS permits (Table III-15);
- Available and commonly used treatment systems by permit holders generally remove naphthalene to concentrations below 1-20 µg/L;
- Current analytical methods and detection limits will still be adequate for ensuring compliance.

NPDES permit effluent limits for naphthalene for direct discharges to surface waters were set at 50 µg/L (Table III-16). Lowering the Class 2A chronic standard to 65 µg/L would not affect the effluent limit as it is already more stringent. Review by EPA of treatment technology for naphthalene found 20 µg/L to be an achievable limit; the Agency is proposing to use this value as the effluent limit for naphthalene in most NPDES/SDS permits (Exhibit HH-11).

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Table III-16. Comparison of Proposed Naphthalene Standards and Current NPDES Effluent Limits.

<table>
<thead>
<tr>
<th>Water Quality Standards</th>
<th>Proposed Values</th>
<th>Current NPDES Effluent Limits</th>
<th>Proposed NPDES Effluent Limits-Contaminated Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>7050 (Basis)</td>
<td>65 µg/L (HH)</td>
<td>50 µg/L</td>
<td>20 µg/L (TBEL)</td>
</tr>
<tr>
<td>Class 2A</td>
<td>81 µg/L (Tox)</td>
<td>50 µg/L</td>
<td>20 µg/L (TBEL)</td>
</tr>
<tr>
<td>Class 2Bd and 2B/C/D</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The monitoring results from NPDES/SDS permitted facilities have shown that common technology used to remove naphthalene and other PAHs and VOCs, air stripping and carbon adsorption, is very effective (Exhibit HH-11). Based on chemical characteristics related to volatilization and adsorption to carbon (Henry’s Law constant), naphthalene is expected to be removed to low concentrations (at or below laboratory reporting levels) by standard treatment technologies. With only a few exceptions, naphthalene concentrations are found below 1 µg/L in DMRs covering 2001 through 2005.

The EPA lists several approved methods for analysis of naphthalene in 40 CFR 13671; naphthalene can be analyzed by methods for semivolatiles (EPA Method 625 and 1625 B, Standard Method 6410 B [18th, 19th, 20th] and for PAHs (EPA Method 610; Standard Method 6440). MDH also has comparable methods available covering the range of analyses (402, 498, 473, and PAH scans). Except for the MDH selective PAH scan with a detection limit of 50 µg/L, all other methods have detection limits ranging from 1 to 10 µg/L. As such, the proposed change in the naphthalene standard should have no impact on analysis of this pollutant.

Some facilities with NPDES/SDS limits and requirements monitor discharges for naphthalene. Review of DMRs demonstrates that most have analytical methods that achieve reporting limits of <1 µg/L and all have reporting limits less than 50 µg/L. Facilities already have in place analytical methods and labs that can comply with a lower chronic standard for naphthalene.

F. CONCLUSIONS [VI. benzene and naphthalene]

The proposed changes to benzene and naphthalene human health-based chronic standards are needed to meet the current risk assessments associated with these chemicals. The proposed standards reflect the most recent expert analysis of human health effects from EPA and MDH, and are reasonable. Updating numeric standards meets the requirements of the Clean Water Act.

The technology-based treatment requirements for benzene and naphthalene that have been included in NPDES/SDS for many years can meet the proposed standards. Current analytical methods are adequate to measure concentrations at the levels of the proposed chronic standards. There will be only minimal, if any, economic impact from the adoption of the proposed standards.
VII. ADOPTION OF *E. coli* STANDARD

A. INTRODUCTION [VII. *E. coli*]

1. **Background and Recreational Uses** [VII.A. introduction, *E. coli*]

Bacteriological water quality standards are the only standards designed specifically to protect people from getting sick while swimming. It is the role of the bacteriological standard to protect the recreation part of the Class 2 aquatic life and *recreation* beneficial use, and to meet the swimmable part of the Clean Water Act goal of achieving “fishable/swimmable” waters where attainable (CWA, § 101(a)(2)). Just as the term “fishable” is a surrogate for protection of the entire aquatic community, not just fish, the term “swimmable” is a surrogate term for any form of swimming-like recreation (see below).

The Agency’s current Class 2 bacteriological standard, fecal coliform bacteria, is shown in Table III-17, along with the proposed *Escherichia coli* (*E. coli*) standard. The proposed *E. coli* standard will replace the current fecal coliform standard. Exhibit EC-3 provides background information on the Agency’s fecal coliform standard, pathogenic organisms and fecal bacteriological issues in general.

Water contaminated with bacteria from human or animal fecal material can cause illness in humans if ingested. Illnesses in humans are generally limited to gastroenteritis (nausea, vomiting, fever, headache and diarrhea), but more serious illness and even death are a possibility. The risk to people depends on the type of recreational activity. For purposes of bacteriological standards, recreation in or on the water is divided into two types:

1. **Primary body contact** – any type of water recreation during which the accidental ingestion of a small amount of water is likely. This is often referred to as “incidental” ingestion. Examples include swimming, snorkeling, SCUBA, water skiing, kayaking, tubing and wading by young children.
2. **Secondary body contact** – any type of water recreation during which the accidental ingestion of a small amount of water is unlikely. Examples include boating, canoeing, fishing and wading by older children and adults.

Wading is usually considered a secondary body contact activity; i.e., there is little chance of someone inadvertently ingesting small quantities of water while wading. The Agency does not disagree with this in general, except that we believe wading by children can and should be considered primary body contact. Children may spend hours wading and playing in shallow water doing the things kids do, digging in the sand or mud, splashing water, hunting for frogs or crayfish, etc. There is ample opportunity for these children to fall in, splash water on their faces

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76 *Escherichia coli* or *E. coli* is written in italics because it is the scientific name of a species of bacteria.
77 Gastroenteritis caused by drinking contaminated water is often called “acute gastroenteritis” because onset is within hours or days of exposure. However, the geometric mean standard is analogous to other “chronic” standards; it is meant to protect swimmers exposed over both the short and long-term.
78 Some well known waterborne diseases caused by fecal bacteria include cholera and typhoid fever.
or put their hands in their mouth. The Agency believes this activity should be considered primary body contact, and it could occur in almost any type of waterbody.

It is worth noting that the Agency has quantified incidental ingestion as 10 milliliters of water ingested per day (0.01 liter/day). This value was adopted in 1990 for the purpose of calculating human health-based water quality standards for waters protected for recreation but not for drinking\textsuperscript{79}. This is the amount of water, about one mouthful, the Agency assumes people ingest each day while swimming or doing other types of primary body contact recreation. This value, 0.01 liter/day, however, does not enter into the calculation of the existing fecal coliform standard or the proposed $E. coli$ standard.

In Minnesota the vast majority of surface waters (all Class 2 waters) rivers, streams, lakes, ponds and wetlands are protected for swimming, \textit{for which the waters are usable} (emphasis added). Thus, all class 2 waters are protected for at least the potential, if not actual swimming use. All Class 2 waters have essentially the same bacteriological standard now and will have if the proposed $E. coli$ standard is adopted (the current 10 percent maximum standard for trout waters and warm waters is different, see Section VII.E.3).

Limited resource value waters (Class 7) are protected for secondary body contact. All of the approximately 240 Class 7 waters have been individually assessed and their classification changed though rulemaking. Most are channelized, low-flow ditches that often stop flowing in a dry year (see Section XI).

Because Minnesota’s assignment of primary body contact use is nearly universal (Class 7 waters are the exception), the “where usable” phrase, emphasized above, is very important. The phrase is repeated for each subclass of Class 2 waters.\textsuperscript{80} It gives the Agency the necessary flexibility to assess a given waterbody on a site-specific basis to determine whether swimming or any Class 2 use, is usable or attainable in that waterbody. The Agency is well aware that many Class 2 surface waters may not provide suitable opportunities for swimming for a variety of reasons (e.g., inaccessible, unsafe, too swift, too shallow, too muddy, too weedy, too much boat traffic, etc.). Some waterbodies may be suitable for swimming only part of the summer season. Given the huge number of lakes and wetlands and the thousands of miles of rivers and streams, and seasonal variability, the Agency cannot possibly know ahead of time whether a given waterbody might be used for primary body contact. A waterbody may appear to be unsuitable for swimming to most observers but still provide primary body contact recreation opportunities for some. It is appropriate in Minnesota, which is so rich in water resources, that primary body contact use is assumed to be attainable and the use protected, until such time that a waterbody-specific analysis is carried out which demonstrates (with reasonable assurance) that the use is not attainable. In the Agency’s many years experience implementing water quality standards, problems associated with the current classifications system seldom become an issue, and if they do, current water quality rules provide the flexibility to deal with the issues.

\textsuperscript{79} Minn. R. 7050.0218, subp. 6.
\textsuperscript{80} Minn. R. 7050.0222, subp. 2, 3, 4 and 5.
Table III-17. Current Fecal Coliform and Proposed *E. coli* Standards (in Shaded Cells) Shown for Class 2 and Class 7 Waters.

<table>
<thead>
<tr>
<th>Use</th>
<th>Water Classification and Type</th>
<th>Monthly geometric mean of not less than 5 samples, cfu/100 ml</th>
<th>10 % of values not to exceed, cfu/100 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fecal coliform</td>
<td><em>E. coli</em></td>
</tr>
<tr>
<td>Primary Body Contact*</td>
<td>Class 2A Trout waters</td>
<td>200</td>
<td>126</td>
</tr>
<tr>
<td></td>
<td>Class 2B, 2C, 2D Warm waters</td>
<td>200</td>
<td>126</td>
</tr>
<tr>
<td>Secondary Body Contact**</td>
<td>Class 7 Limited resource value waters</td>
<td>1000</td>
<td>630</td>
</tr>
</tbody>
</table>

*Standard applicable from April 1 through October 31
**Standard applicable from May 1 through October 31

cfu = colony forming units

2. History of Bacteriological Ambient Standards in Minnesota [VII.A. introduction, *E. coli*]

The bacteriological standard adopted in the first statewide water quality rule in 1967 was for total coliform bacteria (see Figure III-5). The standards were 1000 organisms per 100 ml for Class 2A and 2B waters and 5000 organisms per 100 ml for Class 2C waters. No conditions, such as monthly geometric mean, minimum number of samples, etc. were specified. In 1973, the standards were changed to fecal coliform bacteria, the narrative guidance was added, and the Class 2C standards were “upgraded” to be the same as the Class 2B waters, as shown below. They have remained largely unchanged since.

<table>
<thead>
<tr>
<th>Fecal coliform organisms</th>
<th>200 most probable number per 100 milliliters as a monthly geometric mean based on not less than 5 samples per month, nor exceed 400 most probable number per 100 milliliters in more than 10 % of all samples during any month.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 2 A waters</td>
<td>(primary body contact)</td>
</tr>
<tr>
<td>Fecal coliform organisms</td>
<td>200 most probable number per 100 milliliters as a monthly geometric mean based on not less than 5 samples per month, nor equal or exceed 2000 most probable number per 100 milliliters in more than 10 % of all samples during any month.</td>
</tr>
<tr>
<td>Class 2 B and 2C waters</td>
<td>(primary body contact)</td>
</tr>
</tbody>
</table>

The 1973 standards were applicable year-round, as was the fecal coliform effluent limit, even though there is very little swimming in Minnesota in the winter months. In 1980 the Agency proposed to make the fecal coliform standard applicable only during the warm months, and
seasonally applicable standards were adopted in 1981. Class 2 standards were applicable from March 1 through October 31 and Class 7 standards were applicable from May 1 through October 31. The fecal coliform effluent limits were changed to seasonal limits as well, to match the ambient standards. In 2000, the season for Class 2 waters was shortened by one month, from April 1 though October 31. Again, the effluent limit was changed to match. Since 1973 the narrative portion of the standard has been altered from time to time to reflect improved analytical methods, and to clarify sampling procedures. The Agency also promulgated Class 7 (limited resource value) waters in the 1980 rulemaking.

The proposed change from a fecal coliform to \textit{E. coli} affects the ambient standard only, i.e., the standard applicable to surface waters. The existing fecal coliform effluent limit is not proposed for change (Section VII.G).

3. **Indicator Organisms** [VII.A. introduction, \textit{E. coli}]

Neither the existing fecal coliform nor the proposed \textit{E. coli} standards measure waterborne pathogens directly. Both are \textbf{indicators} of the potential presence of waterborne pathogens. It would be impractical and very expensive to try to measure the many potential human pathogens individually in surface waters. Since the early 1900s the monitoring of fecal contamination in water has relied on the measurement of indicator organisms. The preferred indicator organism has changed over the years (e.g., Exhibit EC-4).

Almost all the bacteria in human feces, over 96 percent, are in the fecal coliform group (Figure III-5). And about 95 percent of the fecal coliforms are \textit{E. coli}. \textit{Escherichia coli} is the dominant species of bacteria in the feces of all warm-blooded animals. Given these numbers, the very strong relationship between levels of fecal coliform and \textit{E. coli} discussed in Section VII.D.5 is not surprising.

Most fecal bacteria are not pathogenic, and are a natural and important component of fecal material. Indeed, the presence of bacteria in the guts of warm-blooded animals is important for survival. Figure III-5 shows the relationships between various bacterial groups, indicators and some pathogens.
Figure III-5. Fecal Bacteria Indicators, Relationships of Indicator Groups and Species.

**Bacterial Indicators**

- **Total Coliforms**
  - *Citrobacter*
  - *Enterobacter*
  - *Fecal Coliform*

- **Fecal Streptococcus**
  - *Enterococci*
    - *Streptococcus faecalis*
    - *S. facaelis liquifaciens*
  - *Viridans*
    - *S. bovis*
    - *S. equinis*
  - *S. faecium*
  - *S. avium*

**Notes:**

*Klebsiella* occurs in the human gut, some species are pathogens, but *Klebsiella* also may come from non-human sources such as paper mill wastewater. 

*Streptococcus faecalis liquifaciens* is associated with soil, plants and insects. 

*S. bovis* and *S. equines* are associated with non-human animals, and are short lived in water. 

*S. avium* is from the feces of fowl.

Not all waterborne pathogenic organisms are bacteria. Viruses and parasitic protozoans can cause gastroenteritis and other illness, and the measurement of fecal bacteria does not include these organisms (Exhibits EC-3 and EC-4). Common examples are:

- **Viruses:** Enteric viruses including hepatitis A, Norwalk-type, rotaviruses and reoviruses; and
- **Protozoans:** *Giardia limblia, Cryptosporidium parvum.*

No single indicator organism or standard can predict the risk of gastroenteritis consistently in all environments at all times, for the reasons summarized here:

- Wide array of pathogens associated with gastroenteritis;
- Not all pathogens are measured by the test for the indicator group or organism;

---

81 In the spring of 1993 Milwaukee’s municipal drinking water supply was contaminated with *Cryptosporidium.* An estimated 400,000 people became ill. At the time Milwaukee was in compliance with all state and federal drinking water standards. USDA Water Quality Program Water Treatment Notes. Fact sheet no. 15, 1996, updated in 2004.
• Variation in survival rates of pathogens/indicators in the water environment;
• Natural variability in pathogen/indicator relationships; and
• Analytical variability.

In spite of these drawbacks the very large body of literature in this area supports the use of indicators to predict risk, and there is ample support for the \textit{E. coli} levels proposed by the EPA as standards (e.g. Exhibits EC-4 and EC-5). The use of an indicator standard to define a safe or acceptable level of fecal contamination is well supported by science, as well as decades of practice.

4. Analytical Methods [VII.A. introduction, \textit{E. coli}]

A detailed discussion of analytical methods for measuring \textit{E. coli} and fecal bacteria in water is outside the scope of this SONAR. Many of the Agency’s bacterial samples are analyzed by the Minnesota Department of Health (MDH) Environmental Laboratory using a membrane filter method (Exhibit EC-6a). In the side-by-side paired analyses of fecal coliform and \textit{E. coli} samples, the membrane filter method was used for both indicators.

The switch to \textit{E. coli} as the preferred indicator has prompted EPA to review and approve several new, simpler and less costly analytical methods for measuring \textit{E. coli}. In July 2003 EPA approved five new methods and EPA is reviewing additional methods at this time (Exhibits EC-6b and EC-6c). A major advantage of at least some of the newer \textit{E. coli} methods is that the cost per analysis is far less than the cost of a membrane filter analysis.\footnote{Beginning with the 2006 summer season, bacteria samples collected as part of the Agency’s Milestone (routine) monitoring program are being analyzed for \textit{E. coli} using the Quanti-Tray method ($10.00 per sample) rather than the membrane filter method ($41.00 per sample).} Also, the new methods can perform as well as the more expensive membrane filter method.

MDH does not analyze all of the Agency’s bacteriological samples. Because of the short “holding time” of six hours for bacteriological samples, the Agency has contracted with eight private labs around the state for bacteriological sample analyses (holding time is the maximum recommended time between taking the sample and the analysis to assure an accurate measurement, as established by EPA and \textit{Standard Methods}). The shorter travel time to the closest contract lab means samples can arrive at the lab for analysis within the six-hour time requirement. The per analysis costs charged by these labs are generally in the $12.00 to $15.00 range, depending on the method and whether it is for fecal coliform or \textit{E. coli} (Exhibit EC-24).

The analysis of bacteriological samples normally takes a minimum of 24 hours. Entities that monitor beaches have faced for years the problem of waiting for sample results to make critical decisions about posting warnings or closing beaches for swimming. These entities are forced to post warnings or close beaches based on yesterday’s bacterial levels. Methods that can return results in as little as two hours are being investigated (Exhibit EC-7).
5. **Agency Goals in Changing from Fecal Coliform to *E. coli* [VII.A. introduction, *E. coli*]**

The Agency is proposing to adopt *E. coli* standards that are consistent with the EPA criterion (Exhibit EC-1) and are approvable by EPA. The Agency’s goal is to replace the current fecal coliform standard with an *E. coli* standard with as little disruption as possible to ongoing programs, while making minor improvements to the narrative part of the standard. Specifically it is the Agency’s intent to:

1. Keep the protection level for swimmers the same as it is now;
2. Not significantly increase or decrease the number of waters considered impaired for swimming in the future;
3. Not have to change the current assessment methods for determination of bacteriological impairment;
4. Minimize the impact on ongoing bacteriological total maximum daily load (TMDL) studies;
5. Make the transition from a fecal coliform to an *E. coli* data base as smooth as possible with minimum additional cost;
6. Not impact the Minnesota Beach program on Lake Superior beaches; and
7. Not impact the monitoring and assessment of beaches by local entities responsible for beach safety.

The Agency strongly believes that the proposed *E. coli* standard is consistent with these goals, and that it will be at least as protective of recreational uses as the current standard. These goals will be discussed further in the *reasonableness* sections.

6. **How Bacteriological Standards are Used [VII.A. introduction, *E. coli*]**

By and large, bacteriological standards are used in two rather distinctly different ways.

1. The monitoring of water at organized public beaches to warn swimmers of unsafe conditions, or to close beaches to swimming, if necessary, to protect the health of swimmers.

2. Assess surface waters for possible exceedance of the standards through a review of bacteriological data over a 10-year period. A variation of this use would be the more intensive monitoring of bacteria associated with special studies, or as part of a TMDL study, to identify sources, allocate loadings, and assess the effectiveness of remedial measures. The standard is also used to make de-listing decisions (removal from the 303(d) list) following the remedial steps.

The first use listed above is not normally the role of the Agency. Except for the Beach monitoring program on Lake Superior, discussed in Section VII.F.1, the Agency does not monitor public beaches. Organized beaches are typically monitored for fecal bacteria by the
local entity that is responsible for maintaining and staffing the beach.\footnote{An organized beach is a beach area with a lifeguard, parking areas and probably toilet and changing facilities.} For example, city or county governments or park and recreation boards have this responsibility for the beaches on metro area lakes. These entities regularly sample the water at their beaches, assess the results, and post warnings or close beaches as necessary. They also try to educate beach-goers on ways to minimize risks. Representatives of the metro area entities meet periodically to discuss issues of mutual interest, such as the number and frequency of samples needed to make decisions, appropriate standards or thresholds to use to trigger warnings, choice of analytical methods, and consistency in approaches (Exhibit EC-19). All seven of the metro area jurisdictions that monitor Twin Cities area beaches and belong to a “Beach Monitoring Committee” have made the change to \textit{E. coli} (Exhibit EC-19). Agency staff has attended some of the Beach Monitoring Committee meetings to explain its plans to replace the fecal coliform standard with \textit{E. coli}.

Most of the Agency’s long-term bacteriological data is a result of monitoring at a network of 80 stations throughout the state, called Milestone stations.\footnote{The number of Milestone stations has varied slightly over the years; see this Web page for information on the Milestone monitoring program: http://www.pca.state.mn.us/water/milestone.html.} Milestone stations are sampled once per month (except for two months in the winter) two out of every five years. Essentially all Milestone stations are on rivers and not associated with designated beaches. As noted, the Agency’s fecal coliform data are used mostly to assess the overall quality of the state’s rivers, to assess waters for potential impairment, and to look for trends over time. The Agency has developed protocols in guidance (Exhibit A-7) to make the best use of data from the Milestone monitoring program, which collects samples only once each month. The Milestone program cannot meet the specified minimum of five samples per month (Table III-17), and the protocol describes an assessment approach that matches as well as possible the requirements of the standards with the constraints of the Milestone program. In the last eight to ten years the Agency has done more special localized studies on fecal bacterial levels, some associated with TMDLs. These localized studies include more frequent monitoring at more locations (Exhibits EC-8 and EC-9). The Agency’s lake sampling program focuses on nutrients and trophic conditions, and fecal bacteria are normally not measured in lakes.

B. NEED TO ADOPT \textit{E. coli} STANDARD [VII. \textit{E. coli}]

1. \textbf{Introduction} [VII.B. need, \textit{E. coli}]

The EPA issued the current bacteriological criteria document in 1986 (Exhibit EC-1). States were slow to adopt the recommended new criteria. As of June 2003, 17 states had adopted an \textit{E. coli} standard for freshwaters, an additional three adopted an enterococci standard; three of the 20 states had adopted both \textit{E. coli} and enterococci standards.\footnote{EPA 2003. Bacterial water quality standards for recreational waters (freshwater and marine waters) status report. EPA-823-R-03-008. In a November 2003 draft of EPA’s implementation guidance (Exhibit EC-2), EPA says 23 states have adopted either \textit{E. coli} or enterococci standards.} In a little more recent survey of states by New York (May 2004), to which 30 states responded, two more states indicated they had adopted a new standard based on the EPA criteria. It is significant, however, that of the 17 states responding “no” to having adopted a new standard in the New York survey, all but two...
indicated they were planning to do so, including Minnesota. It may be that the new epidemiological studies that support *E. coli* as a better indicator plus newer/cheaper analytical methods have helped overcome earlier reluctance on the part of states to adopt *E. coli*. At this time, three EPA Region 5 states, Indiana, Michigan and Ohio have adopted an *E. coli* standard; and three have not, Illinois, Wisconsin and Minnesota.

It is a fact that the Agency has delayed adopting an *E. coli* standard for many years. Agency staff had concerns about the adequacy of the data supporting the 1986 EPA criteria, and questioned how much of an improvement *E. coli* would be over fecal coliform as an indicator standard. In spite of EPA’s claim in the criteria document that *E. coli* is a superior indicator, the Agency felt that making the change was a low priority relative to other needs for the Agency rulemaking resources. What has changed and why the Agency is proposing to adopt *E. coli* now establishes the need for making the change.

The EPA has published a series of implementation guidance documents, mostly draft (Jan. 2000, May 2002, Nov. 2003, and March 2004) to assist states with many of the questions and issues surrounding bacteriological standards, including identifying risk levels, selecting an appropriate criterion, how to implement the standard, and how to deal with the transition from the old to the new standard. The Agency commented on the May 2002 draft implementation guidance in a letter dated August 6, 2002 (Exhibit EC-20). The March 2004 guidance is included as Exhibit EC-2 because it provides useful insight into EPA’s recommendations and reasoning; however, EPA’s final position and guidance on numerous questions is contained in the response to comments and discussions in the final promulgation of standards for states covered under the BEACH act (69 FR 67218, Exhibit EC-17; see Section VII.F.1).

2. **Additional Support for *E. coli* as an Indicator of Potential Illness** [VII.B. need, *E. coli*]

Since EPA published the *E. coli* and enterococci criteria in 1986 new studies have supported *E. coli* as a better indicator of potential gastroenteritis than fecal coliform. EPA re-evaluated the epidemiological studies on which the 1986 criteria are based and concluded that there was no basis to recommend a change in the criteria (Exhibit EC-2 and EC-17, page 67235). EPA also reviewed the epidemiological studies conducted since 1984 (most conducted at marine beaches) and concluded that, taken together, they did not support a change to the 1986 criteria (Exhibit EC-2, page 76). Others have reviewed data they have collected, as well as the available epidemiological studies, and come to the same conclusion; i.e., EPA’s recommended *E. coli* and enterococci criteria are superior to other indicators (e.g., Exhibits EC-5 and EC-10). As noted, all the jurisdictions that monitor Twin Cities area beaches have changed to *E. coli* (Exhibit EC-19).

3. **EPA Criteria and EPA Guidance to Adopt** [VII. need, *E. coli*]

The EPA criteria document recommends an *E. coli* or enterococci indicator for fresh waters and an enterococci indicator for marine waters. EPA has been urging states to update their bacteriological standards since the new criteria appeared in 1986. As time has gone by, EPA has been applying increasing pressure on states that have not adopted the new criteria to do so (e.g., Exhibit EC-2 and EC-17, page 67228). Several years ago, the Agency agreed to adopt an *E. coli*
standard, and committed to this in the inter-agency program plan agreements with EPA (Environmental Project Performance Agreement).

4. Promulgation of Criteria Under BEACH Act [VII.B. need, E. coli]

On November 16, 2004, under the BEACH act, EPA promulgated the 1986 E. coli and enterococci criteria as standards for Minnesota and 20 other states that failed to adopt the criteria on their own by the April 10, 2004, deadline. The BEACH act only pertains to coastal and Great Lakes states and only to waters at coastal (marine) and Great Lakes beaches. While EPA has already promulgated the criteria for the Lake Superior beaches in Minnesota, EPA still encourages states to adopt their own standard based on local information, which is what the Agency is proposing to do. EPA’s action enhances the need for Minnesota to complete the change from fecal coliform to E. coli. It is preferable to have standards for one indicator rather than two. The Minnesota Beach monitoring program from its inception in 2003 has measured both E. coli and fecal coliform (see Section VII.F.1).

5. Increased Interest in Bacterial Contaminants [VII.B. need, E. coli]

There appears to be an increased interest in assessing bacterial contaminants in surface waters among governments at various levels and by other responsible parties. Associated with this new emphasis on monitoring is a desire to use the best indicator(s) available with which to assess results. The recent monitoring done by the Minnehaha Creek Watershed District is an example (Exhibit EC-11). Also, the listing of waters as impaired due to fecal bacteria seems to have elevated, not only interest in waterborne fecal bacteria, but increased the level of scrutiny on bacteriological standards as well. There is a legitimate need to use the best tools available to assess surface waters, and to have the best thresholds (standards) available for the subsequent TMDL studies. More intensive monitoring is usually the first step in the TMDL study. This monitoring will lay the foundation for ultimate de-listing of the waterbody when compliance with the standards is achieved. The time is right to make the change to a better indicator standard.

C. REASONABLENESS OF PROPOSED E. COLI STANDARDS, REQUIRED INFORMATION [VII. E. coli]

1. Introduction [VII.C. reasonableness, E. coli]

Minnesota Stat. § 14.131 requires that this SONAR, as part of demonstrating the reasonableness of the proposed amendments, include information about affected parties, costs and other topics that are covered in the following 11 sections. The discussion in these sections pertains only to the proposed E. coli standard.

2. Classes of Persons Affected by the Proposed Rule Amendments, Including those Classes that Will Bear the Costs and Those that Will Benefit [VII.C. reasonableness, E. coli]
Minnesotans and visitors to Minnesota that engage in any form of water-orientated recreation could be affected by the proposed change from a fecal coliform to \textit{E. coli} standard. More specifically, individuals that swim (including all forms of full body contact) such that inadvertent ingestion is possible, may be affected. But it is very unlikely that many will notice the change. Also, the Agency believes the overall affect on these individuals will be negligible because the \textit{E. coli} standard that is replacing the fecal coliform standard should provide essentially the same level of protection to the swimming public. There could be a modest benefit to the swimming public due to the change because evidence suggests that \textit{E. coli} is a better indicator of potential gastroenteritis than fecal coliform, and some of the new analytical methods for \textit{E. coli} are less expensive. These benefits will be largely invisible to the general public.

The local units of government that manage and monitor the bacterial quality at local swimming beaches will be affected by the change in standards. However, direct impacts are difficult to define, due in part to the fact that some of these entities (those in the Twin Cities metro area) have already started monitoring for \textit{E. coli}. The Agency would encourage any that have not switched, to do so when the new standard is adopted (assuming it is). Possible costs might be associated with becoming familiar with the new standards, deciding on thresholds for the posting of warnings/closings, and meeting with other local entities to discuss the changes. They may wish to make some adjustments to their beach monitoring programs as a result of the change, but the change in standards itself does not require any changes to their monitoring and beach posting protocols. Analytical cost should be about the same for fecal coliform or \textit{E. coli}, but cost savings with \textit{E. coli} are a possibility. Substantial costs will be incurred if parties decide to monitor for both fecal coliform and \textit{E. coli} during the transition period.

A sector of outside parties that probably will experience some added costs are the certified analytical laboratories that do bacteriological analyses for clients. Typically these labs have some “start-up” costs when they develop and offer new analytical services. They may need to purchase new equipment and supplies, train or possibly hire staff, research approved methods and perform trial runs, apply for certification for the new methods, and prepare new promotional and marketing materials. The Agency is not aware of the typical range for such costs, but many affected labs have already gone through this process because many programs and jurisdictions are already requesting \textit{E. coli} analyses.

The following local groups have indicated an interest or may be interested in the change to \textit{E. coli}; this list is not intended to be complete.

- County health departments
- City health departments
- Park and recreational boards or departments
- Watershed districts and lake associations
- Minnesota Department of Health
- Environmental and citizen groups
- Private analytical laboratories
- Municipal wastewater treatment plant operators
- Other state and federal agencies
The Agency’s Beach program on Lake Superior currently monitors for both fecal coliform and *E. coli*, but they plan to discontinue fecal coliform after the standard changes (Section VII.F.1).

In summary, the change from a fecal coliform to an *E. coli* standard could result in modest increased costs to entities that monitor beaches due to transition planning, and to analytical laboratories that incur start-up costs. Otherwise, there should be no other added costs for local units of government or any other entity due to this change.

3. **Estimate of the Probable Costs to the Agency and Other Agencies of Implementing and Enforcing the Rule Amendments, and Any Anticipated Effect on State Revenues** [VII.C. reasonableness, *E. coli*]

The Agency has already incurred increased costs as a result of the potential change to *E. coli*, and is likely to incur additional costs in the future. Future costs are difficult if not impossible to estimate because amounts depend on monitoring decisions that have not been made yet. Potential costs to the Agency due to the change in standards are discussed in Section VII.J. The change will not impact overall Agency budgets, staff needs or state revenues. The change to *E. coli* will not mean any added costs to other state agencies.

4. **Determination of Whether there Are Less Costly or Less Intrusive Methods of Achieving the Rule Amendments’ Purpose** [VII.C. reasonableness, *E. coli*]

There are no options open to the Agency that conceivably could be less costly and less intrusive than what the Agency is proposing, and would still satisfy EPA’s criteria and guidance. The Agency’s clearly stated goal is to make the change to *E. coli* with the least impact to ongoing bacteriological activities as possible (Section VII.A.5). Duplicate monitoring was needed to support the proposed standard, and additional duplicate monitoring is likely as part of the transition from one indicator to the other. The Agency believes it has proposed an *E. coli* standard that achieves the goals and meets EPA requirements for an *E. coli* standard that is “as-protective-as” the EPA criterion. The Agency is promoting using the minimum amount of added monitoring needed during the transition period.

5. **Describe Any Alternative Methods for Achieving the Purpose of the Proposed Rule Amendments that the Agency Seriously Considered and the Reasons Why They Were Rejected in Favor of the Proposed Amendments** [VII.C. reasonableness, *E. coli*]

The most logical alternative to replacing the existing fecal coliform standard with *E. coli* is to retain the former and do nothing. In fact, until a few years ago, this alternative was the Agency’s position since the *E. coli* criterion was published in 1986. The Agency believes that this alternative is no longer a realistic option, and the Agency has not considered any other options. The reason the Agency has decided to make the change now is outlined in the *Need* section. In summary, the reasons are:

- Evidence suggests that *E. coli* is a better indicator of gastroenteritis that fecal coliform;
- EPA has made the adoption of either *E. coli* or enterococci criteria by states a high priority;
EPA has already promulgated an *E. coli* standard for Minnesota applicable to Lake Superior beaches under the BEACH act; and

- A range of analytical methods are available for *E. coli*, some of which are less expensive than methods for fecal coliform.

The Agency prefers to adopt an *E. coli* standard of its own development based on an analysis of Minnesota data; and to adopt a standard that is consistent with our transition goals, rather than risk having EPA promulgate a criterion for us.

6. **Estimate of the Probable Costs of Complying with the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [VII.C. reasonableness, *E. coli*]

The possible costs to outside parties are largely due to the need to plan for and execute the transition to the new *E. coli* standard (Section VII.C.2). There are no added costs to outside parties resulting from future compliance with the new standard because compliance will be achieved as it has under the existing fecal coliform standard.

7. **Estimate of the Probable Costs of Not Adopting the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [VII.C. reasonableness, *E. coli*]

It is unlikely that there will be direct costs to outside parties if the *E. coli* standards are not adopted. Many entities that monitor swimming beaches and the Agency’s own Beach program on Lake Superior are already using *E. coli*. These programs are not likely to change back to monitoring for fecal coliform. Not changing the fecal coliform standard would render much of the paired fecal coliform/*E. coli* monitoring and other transition planning unnecessary, but these costs have already been incurred.

It is conceivable that there might be some cost savings if the standard was not adopted. For example, it would simplify the analysis of the Agency’s long-term fecal coliform data base for water quality assessments and trend analysis. No transition would be required from fecal coliform to *E. coli*. Also, laboratories are already set up and experienced in doing the fecal coliform tests and they would not need to develop methods for *E. coli* (but it appears that many have already assumed these start-up costs).

8. **Differences Between the Proposed Rule and Existing Federal Regulations and the Need for and Reasonableness of Each Difference** [VII.C. reasonableness, *E. coli*]

The proposed *E. coli* standards are consistent with federal regulations and guidance.


Minnesota Stats. §§ 14.002 and 14.131 require state agencies, whenever feasible, to develop rules and that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency’s regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals.
The proposed numeric *E. coli* standards are “prescriptive” as are all numeric standards, and there is little that can be done to make a numeric standard less prescriptive. Flexibility enters into the process when standards are implemented, which is true for all numeric standards.

The general concepts of how prescriptive or flexible a water quality rule should be are discussed more in SONAR Book I, Section VIII.I.


Minnesota Stat. §§ 14.131 and 14.23 require the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made.

These specific notification requirements are discussed in Section IV.C.10 and will not be repeated here. The Agency outlined its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I.

11. **Consultation with the Commissioner of Finance Regarding Fiscal Impacts on Local Governments** [VII.C. reasonableness, *E. coli*]

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency provided the Department of Finance with a copy of the proposed rule and SONAR at the same time as these items were sent to the Governor’s Office. This timing allows the fiscal impacts and fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with the Governor’s Office review.

12. **Agency Determination Regarding Whether Cost of Complying with Proposed Rule in the First Year after the Rule Takes Effects will Exceed $25,000** [VII.C. reasonableness, *E. coli*]

The cost of complying with the proposed *E. coli* standards in the first year after they take effect will not exceed $25,000 for: (1) any one business that has less than 50 full-time employees; or (2) any one statutory or home rule charter city that has less than ten full-time employees. The Agency believes that business small or large will not be impacted by this change. Small cities might be impacted if their responsibilities include managing and monitoring a public beach; however, the transition to *E. coli* will not cost more than $25,000 in the first year.

D. **REASONABLENESS, EPA BACTERIOLOGICAL CRITERIA AND DATA ANALYSIS** [VII. *E. coli*]

1. **Introduction and Assumed Risk** [VII.D. reasonableness, *E. coli*]
As stated under Need the Agency’s goal in making the change from fecal coliform to E. coli is to make the change with as little disruption to current practices and ongoing programs as possible, including retaining the current level of protection to swimmers assumed by the fecal coliform standard.

In proposing the E. coli criteria EPA recommended a 99.2 percent level of protection to exposed individuals. This translates to an accepted risk level of eight illnesses per 1000 swimmers (0.8 %). This is based on the risk level EPA attributed to the preceding fecal coliform criterion of 200 cfu/100 ml; and EPA selected an E. coli level (126 cfu/100 ml) that provided the same level of protection (Exhibit EC-1). Similarly, the Agency assumes the current fecal coliform standard provides a 99.2 percent level of protection, and intends to retain that level of protection in the adoption of the Class 2 E. coli standards.

The Agency knows from its own experience and data analysis, and EPA readily acknowledges, that the true risk to swimmers can only be estimated at best (Exhibit EC-2, page 19). This reality does not negate the fundamental premise underlying any bacteriological indicator standard, which is: as the number of indicator organisms increases the chance of exposed individuals becoming ill also increases. This premise has been widely accepted for decades. However, the increase in risk as bacterial counts increase is not linear. If indicator counts get above a certain level (levels equated with a risk greater than 2 percent), the risk of getting sick increases sharply (Exhibit EC-2, page 9). The proposal to retain the assumed risk at 0.8 percent is reasonable.

2. EPA E. coli Criteria [VII.D. reasonableness, E. coli]

The 1986 EPA bacteriological criteria document (Exhibit EC-1) includes criteria for E. coli and enterococci. EPA says states can use either indicator for fresh waters, but recommended only enterococci for marine waters. Most states have selected E. coli over enterococci as the standard for fresh waters and Minnesota is doing the same. The Agency sampled fecal coliform, E. coli and enterococci together in the mid 1980s. These data suggested that the EPA enterococci criterion of 33 cfu/100 ml would be considerably more stringent than the current fecal coliform standard. As a result, the Agency abandoned any further investigation of enterococci and focused on E. coli.

The EPA E. coli criteria are shown in Table III-18. As mentioned, the calendar month geometric mean of 126 cfu/100 ml is based on a risk level of eight cases of gastroenteritis per 1000 exposures (swimmers). The geometric mean standard is calculated as follows (Exhibit EC-1).

\[
E. \text{coli} \text{ (geometric mean)} = \text{Antilog}_{10} \left( \frac{\text{illness rate}/1000 + 11.74}{9.40} \right)
\]

\[
E. \text{coli} \text{ (geometric mean)} = \text{Antilog}_{10} \left( \frac{8 + 11.74}{9.40} \right)
\]

\[
E. \text{coli} \text{ (geometric mean)} = \text{Antilog}_{10} 2.1 = 126 \text{ cfu}
\]

The 0.8 percent risk level is incorporated into the 10 percent maximum standard (10 % MS) by including the 126 cfu/100 ml geometric mean value in the calculation, as follows:

\[
86 \text{ cfu} = \text{colony-forming units.}
\]
10 % MS = Antilog_{10} ((\log_{10} 126) + (\text{Conf. Level Factor}) \times (\log \text{ Standard Deviation}))
10 % MS = Antilog_{10} ((2.1) + (1.25) \times (0.8)) = 3.10
10 % MS = Antilog_{10} (3.10) = 1259 \text{ cfu/100 ml (rounded to 1260 cfu/100 ml)}

Where: Confidence level factor determined by area under normal probability curve (the one-sided z value)
Log standard deviation is the standard deviation of the log transferred 2000-2002
Milestone \textit{E. coli} data (see Section VII.D.5)

The EPA allows states to exercise risk management discretion in the selection of an \textit{E. coli} standard, as long as it meets EPA’s “as-protective-as” requirements (EC-17). The areas of flexibility suggested by the EPA criteria are listed below. The full range of options is shown in Table III-18. How the flexibility enters into determining Minnesota’s proposed 10 percent MS is detailed in Section VII.E.2.

**Geometric Mean Standard**

1. States are allowed to select their own risk level, as expressed in the gastroenteritis illness rate per 1000 exposures. EPA recommends a risk level in the range of 8 to 10 illnesses per 1000 swimmers for fresh waters. The Agency is proposing 8 illnesses/1000.

**10 Percent Maximum Standard**

1. The standard can vary with a designated level of use, as shown in Table III-18. Levels of use are assigned different confidence limits.
2. The standard can reflect the variability in local bacteriological data. EPA will accept a site-specific log standard deviation for \textit{E. coli}. In the absence of site-specific data, EPA suggests a log standard deviation of 0.4.
Table III-18. EPA *E. coli* Geometric Mean Criteria at Three Illness Rates, and Ten Percent Maximum Criteria for Four Levels of Primary Body Contact Use (Exhibits EC-1 and EC-17)\(^87\).

<table>
<thead>
<tr>
<th>Parameter/Criteria</th>
<th><em>E. coli</em> 30-Day Geometric Mean Criteria</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illness Rate per 1000 Exposures</td>
<td>Geo. Mean cfu/100 ml</td>
<td>126</td>
<td>161</td>
<td>206</td>
</tr>
<tr>
<td>Level of Primary Body Contact Use</td>
<td>Designated beach area</td>
<td>Moderate Use</td>
<td>Light Use</td>
<td>Infrequent Use</td>
</tr>
<tr>
<td>CL or percentile value, one-sided</td>
<td>75%</td>
<td>82%</td>
<td>90%</td>
<td>95%</td>
</tr>
<tr>
<td>Factor (z value)</td>
<td>0.675</td>
<td>0.935</td>
<td>1.28</td>
<td>1.65</td>
</tr>
<tr>
<td>10 % MS cfu/100 ml</td>
<td>235</td>
<td>298</td>
<td>409</td>
<td>575</td>
</tr>
</tbody>
</table>

CL = confidence limit

The Agency has used the flexibility described above in proposing a 10 percent maximum standard that is larger than the numbers in the EPA criterion shown in Table III-18. The reasons for departing from the EPA criteria numbers, and why the Agency believes strongly that the proposed 10 percent maximum standard being proposed is well supported and reasonable, are described in Section VI.E.2. The Agency’s proposed calendar month geometric mean standard of 126 cfu/100 ml is the same as the EPA geometric mean criterion.

3. **Advantages of *E. coli* as an Indicator** [VII.D. reasonableness, *E. coli*]

The EPA makes a strong argument in Exhibit EC-1 that *E. coli* has a much stronger correlation with the risk of gastroenteritis than fecal coliform. In Exhibit EC-2 (Appendix B) EPA reaffirms the 1986 criteria through a reevaluation of the original epidemiological studies upon which the *E. coli* criteria are based, and several more recent epidemiological studies.

A major advantage of *E. coli* over fecal coliform is that the *E. coli* analysis does not measure a group of bacteria that can occur in high numbers but contribute little to illness risk. The fecal coliform analysis can include this group, called *Klebsiella* (see Figure III-5). It is preferable to have an indicator that does not include organisms like *Klebsiella* that can lead to an overestimation of risk. Most species of *Klebsiella* are commonly considered to be opportunistic and low risk pathogens that have not been associated with any disease outbreaks in swimmers. High levels of *Klebsiella* in surface waters have been associated with wastewater discharges from paper mills and wood product operations.

\(^{87}\) The 10% MS values in the 1986 criteria document and in 69 FR 67221 (Exhibit EC-17) differ slightly, the Agency is using the latter.
The advantages of *E. coli* can be summarized as follows:

- *E. coli* is highly specific to warm-blooded animal fecal sources.
- *E. coli* does not enumerate Klebsiella species. Use of fecal coliform may overstate health risks, particularly in waters with a high wood waste component.
- Studies of swimmers in fresh water show *E. coli* to be an effective indicator of the risk of gastroenteritis.
- EPA strongly supports the use of *E. coli* as a freshwater indicator.
- *E. coli* is already being used by some entities that monitor beaches, and the trend among states is to adopt *E. coli* for fresh waters.
- *E. coli* can be correlated with the Agency’s historical fecal coliform data base.
- Costs of laboratory analysis for *E. coli* are generally about the same, but range from substantially less to slightly more expensive than fecal coliform.

### 4. Human Versus Animal Sources of Fecal Bacteria [VII.D. reasonableness, *E. coli*]

Analyses for neither the current fecal coliform nor the proposed *E. coli* indicators distinguish human versus animal sources of fecal bacteria. We make the assumption that the risk to swimmers is the same regardless of the source of the bacteria. This is consistent with EPA’s revised policy on this issue (Exhibits EC-2, page 28 and EC-20). Conventional opinion is that there is a greater chance of pathogens being present if the bacterial source is human rather than animal. Nonetheless, the concern about exposure to animal fecal bacteria is increasing, and several recent incidents described in Exhibit EC-2 lend credence to this concern (including the *Cryptosporidium* outbreak in Milwaukee that caused over 400,000 illnesses and about 100 deaths). It remains difficult, if not impossible, however, to quantify the risk to humans from animal fecal bacteria because the *E. coli* criterion is based on epidemiological studies where the contamination was dominated by human sources.

Aside from the uncertainties about risk and the need to be protective, there is little practical means of quickly identifying the source of fecal coliform or *E. coli* bacteria in a surface water sample. Methods are available or under development to identify the sources of fecal bacteria; not only to differentiate between animal and human, but through DNA typing, to narrow the source of the fecal material to dog, cow, horse, geese, etc. These methods are still somewhat experimental and expensive. The Agency’s assumption that all fecal bacteria provide the same level of risk is consistent with past Agency practice, EPA’s revised policy, practical limitations and a protective approach; it is a prudent and reasonable policy.

### 5. Analysis of Paired Fecal Coliform and *E. coli* Data [VII.D. reasonableness, *E. coli*]

In order to understand the relationship between fecal coliform and *E. coli* levels in surface waters, the Agency initiated paired monitoring of fecal coliform and *E. coli*. Paired sampling is the collection of a sample for both fecal coliform and *E. coli* analysis at the same sampling
station at the same time. The results are side-by-side or paired fecal coliform and *E. coli* levels, which allows the Agency to establish the relationships between the two indicators.

The first paired study focused on the rivers in the metro area (Exhibit EC-12), and was carried out in response to the publication of the epidemiological research by Dufour in 1984. Dufour’s work (Exhibit EC-13) became the basis for the EPA freshwater criteria (Exhibit EC-1). Paired monitoring was expanded state-wide through the network of Milestone monitoring stations in the mid 1980s. State-wide paired monitoring was resumed in the early-2000s when the Agency decided to adopt an *E. coli* standard. The analysis described in this reasonableness section is based on the two state-wide paired studies (which have not been published in reports), supplemented by the site-specific Zumbro River study (Exhibit EC-8).

Thus, three sets of paired data, which together form a very robust data set, support the proposed *E. coli* standards.

1. Data collected in the mid 1980s from about 80 Milestone stations (rivers),
2. Data collected from 2000 – 2002 from about 89 Milestone stations, and
3. Data from the special study on the Zumbro River.

The analysis of these data focused on three questions concerning the relationship between fecal coliform and *E. coli* levels, as follows:

1. Define the relationship between fecal coliform and *E. coli* levels in rivers;
2. Determine the *E. coli* levels that are “equivalent” to current fecal coliform standards; and
3. Calculate the level of exceedances of potential *E. coli* standards, and compared these to exceedances of the current standards.

In addition, we were interested in the variability in *E. coli* levels measured in rivers statewide, because the 10 percent maximum standard selected by states can vary from the EPA criterion based on local variability. The results of these analyses form the basis for the proposed *E. coli* standards (Exhibit EC-14).

A brief description of the analysis and the results follow:

1. **Relationship.** Log *E. coli* plotted against log fecal coliform for the three data sets combined shows a strong direct relationship, as shown in Figure III-6.

2. **Equivalency.** *E. coli* levels “equivalent” to the current fecal coliform standards were determined by fitting a line through the center of the data (the “SD” line) that lies between the two regression lines (*E. coli* as a function of fecal coliform and fecal coliform as a function of *E. coli*). Because the data are not normally distributed “equivalent” values may be thought of as the *E. coli* value at the same percentile as 200 and 2000 fecal coliform. The results suggest the proposed *E. coli* standard may be slightly more stringent than the current standard (Table III-19).
3. **Exceedance.** The projected number of exceedances of proposed *E. coli* values compared to exceedances of the fecal coliform standard, based on the 2000-2002 data, are shown in Table III-20. This analysis also suggests that the proposed standard may be slightly more stringent than the current standard.

Figure III-6 shows the natural log *E. coli* plotted against natural log fecal coliform. The strong relationship between the two indicators is not unexpected since *E. coli* is a major component of fecal coliform bacteria. Results of paired monitoring carried out in Illinois, shown in Figure III-7, shows a similar strong relationship. Other investigators have reported finding similar positive relationships (e.g., Exhibits EC-10, EC-21 and EC-22). This lends confidence to the notion that the transition from one indicator to the other can be made easily and with minimal impact on ongoing programs. Lines representing 200 and 126 cfu/100 ml fecal coliform and *E. coli* on the log X and Y axes are drawn in Figure III-6 to show where they interest in the mass of data. The point of intersection is close, but not exactly in the middle of the mass of data points, which is consistent with the results of the “equivalency” and “exceedance” analyses.

Results of the “equivalency” analysis are shown in Table III-19. The “ideal” or perfect results of this analysis would be for the proposed *E. coli* standards (126 and 1260 cfu/100 ml) to be exactly equivalent to (match exactly) the current fecal coliform standards. For the most part, the equivalent *E. coli* values are larger than the proposed standards, except for the Zumbro River data, which is lower than the target value (*E. coli* value of 110 equivalent to 200 fecal coliform). In contrast, the *E. coli* value equivalent to 2000 fecal coliform from the same data is much higher (1960 cfu/100 ml), which may reflect the greater variability in the smaller data set (Table III-19).
Figure III-6. Log Fecal Coliform Plotted Against Log E. coli From the Three Paired Data Sets, Plus Percent Exceedances.

Figure III-7. Data from Illinois, Fecal Coliform Plotted Against E. coli (Data from Bob Mosher, Illinois EPA).
This indicates as well that the proposed *E. coli* standards may be more stringent than the current standards, but given the variability of bacteriological data, and the many other uncertainties that enter into setting an indicator standard, the Agency believes the proposed *E. coli* standards are consistent with the Agency’s goals and are reasonable.

Table III-19. *E. coli* Levels Equivalent to 200 and 2000 Fecal Coliform from the Three Data Sets (cfu/100 ml).

<table>
<thead>
<tr>
<th>Data Set</th>
<th><em>E. coli</em> at 200 fc</th>
<th><em>E. coli</em> at 2000 fc</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milestone, 1980s</td>
<td>170</td>
<td>1770</td>
<td>660</td>
</tr>
<tr>
<td>Milestone, 2000-‘02</td>
<td>150</td>
<td>1500</td>
<td>643</td>
</tr>
<tr>
<td>Zumbro River</td>
<td>110</td>
<td>1960</td>
<td>84</td>
</tr>
<tr>
<td>Target <em>E. coli</em></td>
<td>126</td>
<td>1260</td>
<td></td>
</tr>
</tbody>
</table>

fc = fecal coliform

The third part of this analysis was to determine the number of exceedances of the proposed *E. coli* values compared to exceedances of the fecal coliform standard. This analysis helps the Agency predict whether the number of waterbodies that will be considered impaired due to fecal bacteria in the future will go up, down or stay about the same. The goal is for them to stay about the same. The results using the more recent 2000-2002 data are shown in Table III-20. This analysis shows that the proposed *E. coli* standards are exceeded slightly more often than the fecal coliform standards. For example, an *E. coli* level of about 1500 cfu/100 ml is more comparable to the current fecal coliform maximum standard of 2000 cfu/100 ml. These results are consistent with the other analyses, that the proposed standard may be slightly more stringent than the current standard.

Table III-20 shows exceedances for a range of values around the proposed 10 percent MS of 1260, because the Agency’s proposed 10 percent MS is larger than the EPA maximum criteria. Based on the large Minnesota data set, however, the proposed standard is as-protective-as the EPA criteria (Section VII.E.2).

<table>
<thead>
<tr>
<th>Indicator Levels</th>
<th>Percent Exceedance</th>
<th>No. of Milestone Stations Showing Exceedances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 643</td>
<td>n = 89</td>
</tr>
<tr>
<td><strong>Geometric Mean</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>126 <em>E. coli</em></td>
<td>28 %</td>
<td>20</td>
</tr>
<tr>
<td>200 fecal coliform</td>
<td>24 %</td>
<td>16</td>
</tr>
<tr>
<td><strong>10 % Maximum</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 <em>E. coli</em></td>
<td>10 %</td>
<td>35</td>
</tr>
<tr>
<td>1000 <em>E. coli</em></td>
<td>5 %</td>
<td>25</td>
</tr>
<tr>
<td>1260 <em>E. coli</em></td>
<td>5 %</td>
<td>22</td>
</tr>
<tr>
<td>1400 <em>E. coli</em></td>
<td>4 %</td>
<td>21</td>
</tr>
<tr>
<td>1500 <em>E. coli</em></td>
<td>3 %</td>
<td>19</td>
</tr>
<tr>
<td>2000 <em>E. coli</em></td>
<td>2 %</td>
<td>13</td>
</tr>
<tr>
<td>2000 fecal coliform</td>
<td>3 %</td>
<td>16</td>
</tr>
</tbody>
</table>

In the box in the upper left of Figure III-6 is the percent exceedance of the fecal coliform standard and the proposed *E. coli* standard for all three data sets. The *E. coli* standard was exceeded more often in the statewide data, but not in the more local Zumbro River data.

Assessment of the variability in Minnesota *E. coli* data is the final part of the Agency’s analysis of the three data sets (this analysis involves only the *E. coli* data). The Minnesota data show considerable more variability than the EPA data used to support the national criteria (Exhibit EC-1). The log standard deviation for all Milestone stations (2000-2002 data) is 0.803. When the data are divided into four geographic quadrants (Northeast, Southeast etc.), the log standard deviations range from 0.679 to 0.804. Log standard deviations for the more site-specific Zumbro River data are slightly greater (range: 0.776 to 0.887 at four stations).

The greater variability in the Minnesota data is not surprising. The EPA log standard deviation of 0.4 reflects variability measured at ocean or large lake beaches during the epidemiological studies upon which the EPA criteria are based. The source of fecal contamination at these beaches was from continuous discharge of apparently inadequately disinfected domestic wastewater. The variability measured in Minnesota’s rivers reflects both point and nonpoint sources. As expected, the relative contribution from nonpoint source runoff increases dramatically during wet periods (Exhibit EC-9, page 53). Typically very high bacteria counts are measured in rivers during runoff events, and much lower counts are measured during dry or base-flow periods. The resulting large range between high and low values increases the variability of bacterial data.
In conclusion, this analysis of the Minnesota paired data suggests that the proposed *E. coli* standard may be slightly more stringent than the current fecal coliform standard, and result in a slight increase in the number of waterbodies considered impaired by fecal bacteria. However, because of the variability in the Minnesota data, and the uncertainties associated with bacterial indicators, the analysis does not support proposing a geometric mean standard different from the EPA criterion of 126 cfu/100 ml. Compliance or non-compliance with any bacteriological standard is more a function of sample timing (wet or dry periods) than which indicator is used.

E. REASONABLENESS OF PROPOSED *E. COLI* STANDARDS [VII. *E. coli*]

1. Proposed 30-Day Geometric Mean *E. coli* Standard [VII. E. reasonableness, *E. coli*]

The Agency is proposing to adopt the EPA *E. coli* criterion of 126 cfu/100 ml as the Minnesota standard, to be met as a geometric mean over a calendar month. As described in the previous Section, the analysis of the paired fecal coliform and *E. coli* measurements indicates that an *E. coli* standard of 126 is reasonably equivalent to the current standard. This will achieve the goal of retaining the eight illnesses per 1000 exposure protection level that the current standard is estimated to provide. The proposed geometric mean standard is consistent with the EPA criteria and guidance, and is reasonable.

2. Proposed 10 Percent Maximum Standard [VII. E. reasonableness, *E. coli*]

The Agency is proposing 1260 cfu/100 ml as the 10 percent maximum standard (10 % MS) for both Class 2 and Class 7 waters. As noted, this number is larger than the EPA 10 percent MS criteria, which range from 235 to 576 cfu/100 ml (Exhibit EC-1). This section of the SONAR will explain the basis for this value and why it is “as protective as” the EPA criteria. To begin with, the Agency proposed 10 percent MS is based on the EPA-recommended protection level of 99.2 percent of all swimmers. The Agency strongly believes that the proposed standard is substantially supported by the very robust paired data sets. The proposed 10 percent MS is reasonable for Minnesota’s surface waters. In fact, the data indicate this value is probably more stringent than the current 10 percent MS fecal coliform standard of 2000 cfu/100 ml.

As previously stated, the EPA criteria and guidance allow some flexibility to states to determine the appropriate maximum standard. Flexibility enters into the development of the 10 percent MS in three areas: 1) the selection of a risk level, 2) the selection of a recreational use category and 3) the determination of local variability.

**Risk Level.** The Agency is retaining the risk level of eight illnesses per 1000 swimmers (exposures). This is at the “low” or protective end of the EPA suggested range for fresh waters of 8 to 10 illnesses per 1000 (0.8 to 1.0 percent). Both the geometric mean and 10 percent MS should be and are, based on the same risk level.

**Level of Recreational Use.** EPA provides a range of 10 percent maximum criteria based on the level of expected primary body contact use the waterbody is likely to support. The use levels are described as: “designated beach area”, “moderate full body contact”, “lightly used full body
“contact” and “infrequently used full body contact” (Tables III-18 and III-21). While “beach area” is pretty much self-explanatory, EPA does not explain the other descriptors in the criteria document (they are defined in Exhibit EC-17). The Agency’s analysis shows that the proposed 10 percent MS falls between “moderate” and “light” use categories, or roughly in the middle of EPA’s range of uses.

Variability. The EPA criterion (Exhibit EC-1, page 16) and Exhibit EC-17 (page 67221) say the 10 percent MS should be, “based on a site-specific log standard deviation;” or, if local data are insufficient, states should use the EPA standard deviation of 0.4. As shown, the Minnesota E. coli data is more variable than the EPA data (log standard deviation of 0.8 for the 2000-2002 Milestone data, see Section VII.D.5). The Agency feels it is reasonable to use the Minnesota statewide data to determine a “Minnesota-specific” 10 percent MS. This standard deviation reflects the variability the Agency has encountered in the past measuring fecal bacteria levels in rivers, and there is no reason to believe that this variability will be less in the future. The use of the Minnesota-specific log standard deviation of 0.8 is reasonable.

The Agency believes the EPA primary body contact use descriptors (beach area, etc), shown in Table III-18, have limited relevance to the Minnesota situation because our standards apply to all Class 2 waters, which range from very heavily to never used for swimming. Still, it is useful to show where the proposed E. coli 10 percent MS fits, in the context of EPA’s primary body contact descriptors. Associated with the descriptors are one-sided upper percentile confidence limits (C.L.) and a factor representing the area under a normal distribution curve (the “z” value). The lower the C.L. the less confident one is that a measurement exceeding the criterion will result in illness; i.e., the lower the C.L. the more stringent the criterion. Using the Minnesota log standard deviation of 0.8 and the proposed 10 percent MS of 1260 cfu/100 ml one can “back” calculate the confidence limit. The result is a C.L. of about 89 percent, which is slightly more protective than EPA’s “lightly used” full body contact category (Table III-21). Thus, the proposed 10 percent MS falls about in the middle of the EPA range of primary body contact use levels using the log standard deviation of 0.8.

Table III-21. Proposed 10 Percent Maximum E. coli Standard of 1260 cfu/100 ml (shaded cells) Compared to EPA E. coli Maximum Criteria.

<table>
<thead>
<tr>
<th>Log Standard Deviation</th>
<th>Geometric mean 0.8 % risk</th>
<th>10 % Maximum Standard Related to the EPA Use Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beach area</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>75% C.L.</td>
<td>82% C.L.</td>
</tr>
<tr>
<td>0.4 (EPA)</td>
<td>126</td>
<td>235</td>
</tr>
<tr>
<td>0.8 (MPCA)</td>
<td>126</td>
<td>437</td>
</tr>
</tbody>
</table>

The “equivalency” and “exceedance” analyses plus the log standard deviation of 0.8 are the primary basis for the proposed 10 percent MS. These analyses place the potential standard in a range of about 1200 to 1500 cfu/100 ml. Once this range was established, the Agency felt it was reasonable to apply a multiplier of 10 to the geometric mean standard to determine the exact proposed 10 percent MS of 1260. This maintains the same factor of 10 difference in the current

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Class 2B, 2C and 2D fecal coliform standards. The 10 percent MS to geometric mean ratios are shown in Table III-22.

Table III-22. Ratios of 10 Percent Maximum to Geometric Mean Standards, Proposed *E. coli* Compared to Current Fecal Coliform Standard.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Geometric mean</th>
<th>Maximum</th>
<th>Ratio, 10%MS/GM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E. coli</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2A</td>
<td>126</td>
<td>1260</td>
<td>10</td>
</tr>
<tr>
<td>Class 2Bd, 2B, 2C, 2D</td>
<td>126</td>
<td>1260</td>
<td>10</td>
</tr>
<tr>
<td>Class 7</td>
<td>630</td>
<td>1260</td>
<td>2</td>
</tr>
<tr>
<td><strong>Fecal Coliform</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2A</td>
<td>200</td>
<td>400</td>
<td>2</td>
</tr>
<tr>
<td>Class 2Bd, 2B, 2C, 2D</td>
<td>200</td>
<td>2000</td>
<td>10</td>
</tr>
<tr>
<td>Class 7</td>
<td>1000</td>
<td>2000</td>
<td>2</td>
</tr>
</tbody>
</table>

Besides the greater variability in the Minnesota data, it is important to consider two additional factors when evaluating whether the Agency’s proposed 10 percent MS is protective enough, in light of where it falls in the range of EPA use categories (Table III-21). First is the probable significant contribution of bacteria from animal sources when counts are high, and second is how the bacteriological standard is used by the Agency.

The high fecal bacteria levels measured in rivers during runoff events are probably dominated by animal sources and the relative contribution from human sources is reduced (Exhibit EC-9, page 53). This introduces additional uncertainty in estimating the illness risk to swimmers. It is likely that the dominance of animal sources tends to reduce the risk of gastroenteritis in humans (Section VII.D.4).

The second factor that supports the Agency’s proposed 10 percent MS is the way the Agency implements the standard. As explained in Section VII.A.6, the Agency uses the standard primarily to assess rivers for potential impairment and to look for long-term trends in fecal bacteria levels. The standard is also used by entities to assess fecal bacteria levels at public beaches, but they can and have established their own protocols and thresholds for this purpose (Sections VII.A.6 and VII.F.1).

Finally, both the proposed geometric mean standard and the 10 percent MS, shown in Table III-20, show about the same level of increased exceedances, when compared to exceedances of the current standards. This suggests that the two parts of the proposed standard are similar in the level of protection provided.

In conclusion, the proposed 10 percent MS:

- Has as its foundation the EPA-recommended level of protection for swimmers of eight illnesses per 1000 exposures (99.2%);
- Is about mid-way between EPA’s “beach” and “infrequent” use levels for MS criteria;
- Is calculated using a log standard deviation representative of the variability in fecal bacterial levels in Minnesota rivers;
- Is about equivalent to, and is expected to be exceeded about a frequently as, the current fecal coliform standard of 2000 cfu, based on the analysis of the paired data sets; and
- Has the same factor of 10 relative to the monthly geometric mean standard as the current standard.
3. **Proposed Change to Class 2A Ten Percent Maximum Standard [VII.E. reasonableness, *E. coli*]**

The ratios in Table III-22 point out an aspect in the current fecal coliform standard that the Agency is proposing to change. Currently trout streams and lakes (Class 2A waters) have a more stringent 10 percent MS (400 cfu/100 ml) than is applicable to warm water habitats (Class 2B, 2C and 2D waters, 2000 cfu/100 ml). The Agency is proposing to make the 10 percent MS the same for all Class 2 waters. The Agency believes that the more stringent standard for trout waters is not needed, and that swimmers in any category of Class 2 waters should receive the same level of protection. The current standard dates to 1973, and seems to be a hold over from a time when trout waters were possibly given “special status,” including more stringent standards, that may not have been based on sound science. There seems to be no valid reason for providing a higher level of protection to swimmers in trout waters. In fact, most of the primary body contact recreation in Minnesota takes place in non-trout lakes and rivers, including such heavily used resources as the St. Croix River and Metro area lakes. If the proposed *E. coli* standards are protective of swimmers, and the Agency believes they are, this proposed change will not adversely impact trout streams or their users.

4. **Proposed *E. coli* Standards for Limited Resource Value Waters [VII.E. reasonableness, *E. coli*]**

The bacteriological standards applicable to limited resource value (Class 7) waters are designed to protect for the types of water recreation where emersion in the water is unlikely, such as wading and boating (secondary body contact). The Agency proposes to replace the current Class 7 standard with an *E. coli* standard that provides the same level of protection (see Table III-17 and the next section).

EPA does not provide an *E. coli* criterion for secondary body contact recreation. The EPA epidemiological studies, the basis for the primary body contact criteria, focused on swimmers and did not address risks for secondary body contact. EPA guidance suggests states apply a factor of five times the primary body contact geometric mean (Exhibit EC-2, page 45). Based on this guidance, the Agency is proposing a Class 7 monthly geometric mean standard of 630 cfu/100 ml. The factor of five is consistent with the difference between the current primary and secondary body contact fecal coliform geometric mean standards. The proposed 10 percent MS standards for Class 7 and Class 2 waters are the same, as is the case for the current fecal coliform standard. The proposed 10 percent MS of 1260 cfu/100 ml for Class 7 and all Class 2 waters (including trout waters) means that all surface waters of the state will have the same 10 percent MS.

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89 For example, all trout waters in Minnesota are protected as a source of drinking water even though most are not used for this purpose.
5. Narrative Portion of Proposed Standards [VII.E. reasonableness, *E. coli*]

The proposed *E. coli* standards are shown below with the associated narrative portions.

<table>
<thead>
<tr>
<th>All Class 2 Waters</th>
<th><em>Escherichia (E.) coli</em> bacteria. Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions over any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 7 Secondary body contact</td>
<td><em>Escherichia (E.) coli</em> bacteria. Not to exceed 630 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions over any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between May 1 and October 31.</td>
</tr>
</tbody>
</table>

The major elements of the narrative portion of the standard are essentially the same as the current standard; unchanged are:

1. A geometric mean of all samples, but no less than five,
2. Averaged over a calendar month, and
3. No more than 10 percent of samples individually can exceed the maximum standard.
4. The standards are applicability only during the warmer months.

The narrative portion of the proposed standard is the same as the current narrative with one exception. The proposed new language is the phrase “*representative of conditions*”. The intent of including this phrase is to instruct people that monitor for *E. coli* to sample at a frequency and interval so the samples have a reasonable chance of representing bacteriological conditions over the full calendar month. The Agency wishes to avoid a situation where five samples are taken on five consecutive days and none taken the rest of the month, for example; or five samples taken only during rain and runoff events, and none during dry periods. The Agency is interested in a geometric mean value that reasonably represents the bacteriological conditions over the full month, whether it is a wet or dry month. The Agency understands that when sampling is started in a given month, one does not know just how representative the sampling will end up being at the end of the month. Sampling schedules and the uncertainty of future weather conditions mean the sampling for any individual month may or may not be “reasonably” representative. Sampling at regular intervals each and every month is one way to deal with this issue. Over time, the possible bias from one month to the next tends to balance out as the number of months sampled increases. The Agency is not expecting perfect representation, but we want to advise people not to select an obviously unrepresentative sampling regime (unless the specific purpose of the monitoring dictates otherwise).
For a time the Agency considered changing “calendar month” to “30 days”, but in the end decided against making this change for the reasons outlined below:

- There is a concern that using “30-days” may introduce the opportunity or even the incentive to bias the selection of the 30-day period to include or exclude data to fit one’s purpose.
- Calendar month seems to have worked without difficulty over the years; i.e., there does not seem to a “problem” that needs fixing.
- Our current assessment methods are geared to assessing data by calendar month.

The current fecal coliform standard says the maximum standard should not be exceeded in more than 10 percent of the samples taken in a month. The Agency proposes to retain the 10 percent language in the *E. coli* standard. Specifying the maximum standard as not-to-be-exceeded by any sample would be unrealistically stringent. A single sample maximum together with the very high fecal bacteria counts associated with runoff events would result in many more exceedances of the standard, which would be inconsistent with, 1) the current standard, 2) a reasonable level of risk of gastroenteritis (0.8 percent), and 3) EPA guidance. EPA explicitly says the maximum standard is not intended to be applied as a single sample maximum (Exhibit EC-17, page 67255).

6. **Role of Minnesota Department of Health** [VII.E. reasonableness, *E. coli*]

The Minnesota Department of Health (MDH) staff were contacted early in the process of developing the proposed *E. coli* standard and they have not commented on the proposed standards. MDH, like the Agency has little to do with the actual monitoring of public beaches and the posting of warnings or closings. However MDH is contacted if there is an incidence of gastroenteritis or other illness, suspected to be caused by a waterborne pathogen.

The MDH Infectious Disease Epidemiology, Prevention and Control Division investigates outbreaks of gastroenteritis anywhere in the state. They interview the people that got sick, take samples, try to pinpoint the source of the pathogens, the source of the contamination, and recommend action if needed. MDH compiles all cases investigated over the calendar year and publishes a report describing each case.**90** Cases are reported in five categories: confirmed food-borne and waterborne, probable food-borne and waterborne, and non-food and non-water related cases. The data in Table III-23 are taken from the reports for the years 1995 – 2004.

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90 Reports available through this Web site.  
http://www.health.state.mn.us/divs/idepc/dtopics/foodborne/outbreaksummary.html

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Confirmed water</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<td>2</td>
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<td>0</td>
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<tr>
<td>Drinking, other</td>
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<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
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<tr>
<td>Probable water</td>
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<tr>
<td>Beach</td>
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<td>1</td>
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<td>1</td>
<td>0</td>
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<tr>
<td>Confirmed Food</td>
<td>39</td>
<td>41</td>
<td>46</td>
<td>39</td>
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<td>40</td>
<td>39</td>
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<tr>
<td>Probable Food</td>
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<td>15</td>
<td>16</td>
<td>21</td>
<td>22</td>
<td>14</td>
<td>3</td>
<td>na</td>
<td>na</td>
<td>18</td>
</tr>
<tr>
<td>Non-food, non-water</td>
<td>55</td>
<td>55</td>
<td>57</td>
<td>47</td>
<td>56</td>
<td>31</td>
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<td>11</td>
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<tr>
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<td>112</td>
<td>131</td>
<td>86</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
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The reason for presenting the information in Table III-23 is to point out the relative uncommon occurrence of reported cases of gastroenteritis at beaches. Only 13 cases of gastroenteritis contracted at beaches were reported in the 10-year period shown in the shaded rows in Table III-23. The investigation of the eight cases at beaches from 2000 to 2004 reported that the pathogen causing the illnesses was viruses in three cases, Cryptosporidium in two, Shigella at two, E. coli at two and both Cryptosporidium and Shigella at one. Thus, the causes of the illness were often non-bacterial pathogens. Interestingly in the three cases (two due to viruses and one due to Cryptosporidium/Shigella) where fecal coliform samples were taken, all three reported measured levels below the current standard of 200 cfu/10 ml. Typically, in the beach cases, the suspected sources are traced to babies with dirty diapers in the water, or contamination from a swimmer recently ill with gastroenteritis symptoms.

7. Standards Adopted by Other States [VII.E. reasonableness, E. coli]

EPA has tabulated the progress states and tribes have made in adopting bacteriological standards consistent with the 1986 criteria. EPA’s most recent list is dated June 2003 (Exhibit EC-23). While this is not a very up-to-date listing, it provides a sampling of the E. coli values states are adopting as standards. Of the 18 states EPA lists as having adopted E. coli, all but one (Maine) adopted 126 cfu/100 ml, or a number very close, as a 30-day or monthly geometric mean. Most states adopted E. coli 10 percent MSs ranging from 235 to 576 cfu/100 ml, matching the EPA criteria. None had adopted a 10 percent MS as high as 1260 cfu/100 ml, however, a few included options to use a number higher than 235 - 576 if local data support a higher number.

Based on this sample of states, Minnesota is outside the norm in proposing an E. coli 10 percent MS of 1260 cfu/100 ml. In spite of this the Agency feels strongly that our proposed standards are well supported by the extensive paired data sets discussed here. Based on these data, we can conclude with confidence that the proposed E. coli standards will provide the same, if not a slightly greater level of protection, than the current fecal coliform standard. This raises the
question, however: does the current standard, in place since 1973, provide an adequate or desired level of protection to swimmers? This is a difficult question to answer definitively. However, the infrequency of reported cases of gastroenteritis at beaches (Table III-23) would suggest that the current standard is adequately protective.91 This question may be open for future discussions, and it may be almost as much a policy decision as a science-based one. For example, as the human and domestic animal populations continue to expand in Minnesota, as we gain more information on the health risks from animal fecal contamination, and as we lean more about the survival and persistence of fecal bacteria in sediments and the natural environment, there may be a need to reevaluate bacteriological standards again. Indeed, EPA has discussed plans to revise the bacteriological criteria in the future as new epidemiological data becomes available.

For now the available information, including the 30 plus year history, suggests that the current fecal coliform provides adequate protection; and that the Agency’s goal for promulgating an \( E. coli \) standard that is “equivalent” to the current standard is also protective and reasonable.

F. REASONABLENESS, IMPLEMENTATION AND TRANSITION TO \( E. coli \) STANDARD [VII. \( E. coli \)]

1. Beach Program on Lake Superior and EPA Promulgation of \( E. coli \) Criteria [VII.F. reasonableness, \( E. coli \)]

   a) Minnesota Beach Program [VII.F. reasonableness, \( E. coli \)]

In October of 2000 the BEACH act (Beach Environmental Assessment and Coastal Health) was passed (Exhibit EC-15). The purpose of this amendment to the Clean Water Act was to protect the health of swimmers at the nation’s major beaches92. The act defines “coastal recreation waters” as:

- Great Lakes waters, and
- Marine coastal waters, including estuaries, that are designated by the state for primary body contact (swimming).

Under the BEACH act the Agency began monitoring 34 beaches along the North Shore in 2003. The EPA provides funds to the states to support the monitoring and notify the public. Samples are collected at beaches from Duluth harbor to the Canadian border once a week at all beaches and twice weekly at nine priority beaches (Exhibit EC-18).93 Samples are analyzed by a contract lab. The \( E. coli \) and fecal coliform maximum criteria/standards of 235 and 400 cfu/100 ml, respectively, are the triggers the Agency uses to post “water contact not recommended at

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91 The Agency is aware that some cases will go unreported or may be attributed to other causes.
92 In 2001 EPA estimated that there were 910 million trips to the nation’s beaches each year, during which people spent $44 billion. EPA Environmental News, EPA Administrator releases funds for beaches, May 25, 2001.
this time” signs at beaches that exceed these triggers (Exhibit EC-18). The warnings are advisory and the beaches are not officially “closed”, but postings generally have that effect.

From its inception the Minnesota Beach program monitored for both fecal coliform and E. coli. Because EPA has promulgated an E. coli criterion for coastal and Great Lakes beaches (see below), the Minnesota Beach program discontinued monitoring for fecal coliform beginning with the 2006 monitoring season, and is now monitoring for E. coli alone. The proposed change to the state-wide standard will have essentially no impact on the Minnesota Beach program since the Agency has been using an E. coli criterion consistent with the values promulgated by EPA.

The decision to discontinue fecal coliform monitoring is supported by the following statistics from the 2003 Beach sampling season.

1. The E. coli criterion of 235 cfu/100 ml triggered 22 advisories.
2. The fecal coliform standard of 400 cfu/100 ml triggered 22 advisories.
3. An E. coli criterion of 126 cfu/100 ml would have triggered an additional 28 advisories.
4. A fecal coliform standard of 200 cfu/100 ml would have triggered an additional 26 advisories.

These results show a remarkable consistency between the two indicators at both the 10 percent MS and geometric mean levels, which suggests that the continued analysis of fecal coliform would not add very much to the decision making process.

b) EPA Promulgation of E. coli Criteria [VII.F. reasonableness, E. coli]

Under EPA’s administration, the BEACH act required coastal and Great Lakes states to adopt bacteriological criteria as protective as the EPA criteria by April 2004. If states failed to act by the deadline, the law further required EPA to adopt criteria for those states (Exhibits EC-16a and EC-16b). Minnesota was one of 21 states (out of 30 affected by the BEACH act) that did not meet the deadline. EPA promulgated standards on November 16, 2004, that supplement but do not replace standards the states already have in place (Exhibit EC-17).94

The EPA promulgated standards for both E. coli and enterococci for the fresh water beaches of the Great Lakes, and states have the option of using one or the other (Exhibit EC-17, page 11). As stated, the Agency has been using E. coli since before the EPA promulgation, and will continue to use E. coli rather than enterococci. The E. coli criteria promulgated for Minnesota are the 1986 EPA criteria, including both a geometric mean of 126 cfu/100 ml, and the range (235-575 cfu.100 ml) for the maximum standard (10% MS). The range for the 10 percent MSs reflects various levels of primary body contact use described previously (Table III-18). By Minnesota’s use of the E. coli criterion of 235 cfu/100 ml, presumably the Agency has thereby “adopted” this value as the Lake Superior beach standard, as a result of the EPA promulgation. Use of the EPA “beach” maximum criterion of 235 cfu/100 ml is an appropriate trigger for this program since it is clearly being applied to beaches.

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94 Of the six EPA Region 5 states, Indiana and Michigan met the deadline, Illinois, Ohio, Wisconsin and Minnesota did not.
Clearly the Agency’s proposed statewide 10 percent MS of 1260 cfu/100 ml is more lenient than the 235 cfu/100 ml 10 percent MS adopted for use at the Lake Superior beaches. The promulgation of a different statewide standard by the Agency will not affect the Beach program. The Beach program will continue to use the 235 cfu/100 ml trigger after the E. coli statewide standards are adopted.

The Agency asked EPA staff at Region 5 if the use of a trigger for the Lake Superior beaches more stringent than the proposed statewide standard was acceptable, and they agreed that it was. The reasons EPA gave for accepting a potentially different statewide standard are: first, the two standards are used for completely different purposes; and second, the use of a precautionary approach at beaches is warranted. The Agency agrees with these reasons. As explained in Section VII.A.6, the Agency uses the statewide standard most often with historical data to make impairment decisions. The question being asked in this context is: are fecal bacterial levels below the standard over the long-term, and is the recreational (swimming) use being protected. It is appropriate for a beach monitoring program to use a different E. coli level to trigger a recreational advisory. In the beach context, the question being addressed is, is the water safe for recreation right now? The immediate protection of human health is the first priority; the goal being to avoid making a decision that the bacteria levels are safe when they were really unsafe. Also, a decision must be made as soon as results are back (usually a minimum of 24 hours) based on very few samples. A conservative single sample maximum is the right trigger in this situation.

The Agency is proposing, as part of the adoption of an E. coli standard, to eliminate the more stringent 10 percent MS for trout waters. Under the proposal, all surface waters (Class 2 and Class 7) would have the same 10 percent MS (see Section VII.E.3). This should have no impact on the Agency’s Beach program (Lake Superior is a trout water) because of our use of the E. coli criterion and EPA’s promulgation.

The standards promulgated by EPA will remain in effect for Lake Superior after the adoption of the proposed standards, but the Agency is not proposing to include them in Minn. R. ch. 7050 because of their limited applicability. Also, Minn. R. ch. 7052 might be the logical place for the Lake Superior standards.

Under the BEACH act, EPA expects states to begin replacing fecal coliform effluent limits with E. coli limits in NPDES/SDS permits as they are reissued. This is discussed in Section VII.G below.

2. Other Beach Monitoring Programs [VII.F. reasonableness, E. coli]

The entities that monitor public beaches face decisions similar to those faced by the Agency in the Beach program. Cities, counties, park boards and other entities that monitor beaches need to establish protocols for monitoring and decision making, plus select a criterion/standard. The entities with this responsibility in the metro have done so, and they meet regularly to discuss issues of mutual interest. Many of these entities have already changed over to monitoring E. coli

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95 Personal communication, October 22, 2003.
and many use EPA’s 10 percent MS of 235 cfu/100 ml criterion as the main trigger (Exhibit EC-19). Again, the Agency agrees that the more stringent threshold is appropriate in the context of a public beach, which may be crowded with swimmers (i.e., obvious potential for fecal contamination from human sources), and because of the need to make rapid decisions based on few samples.

3. **Transition to E. coli Standard** [VII.F. reasonableness, E. coli]

The Agency and outside entities that monitor for fecal bacteria, such as watershed districts for example, will want to make the transition from fecal coliform to *E. coli* when the new standard is adopted (if they have not already done so). We think this change can be made with little difficulty and little extra expense, in keeping with the Agency’s goal of making this change as simply as possible.

The advice the Agency has been giving to interested parties for some time regarding the transition is:

1. Explore laboratory capabilities and costs for *E. coli* analyses prior to switching.
2. Begin monitoring for *E. coli* at a time that best suits the particular project. For example, start with the new indicator at the beginning of a recreational season. Some parties have anticipated the change and started monitoring for *E. coli* already. Projects beginning monitoring in 2007 should begin *E. coli* monitoring. Projects that have been monitoring for fecal coliform and plan to finish monitoring in 2007 may wish to continue with fecal coliform for the final year, or do some duplicate monitoring.
3. Monitoring can be continued using the same procedures, at the same interval and frequency that was used with fecal coliform.
4. A period of duplicate monitoring is not considered necessary, unless the determination of the local relationship between the two indicators is important for the project. A decision on whether to afford duplicate monitoring should be made on a case-by-case basis. The potential doubling of analytical costs will be a major consideration. If a local fecal coliform/*E. coli* relationship is not needed, relationships reported in the literature or the Agency’s statewide relationships can be used. An important consideration for decision makers is that, while local differences in fecal coliform/*E. coli* relationship have been demonstrated, given the variability in bacteria levels and other uncertainties, locally measured differences may not be significantly different or even accurate (especially if the data set is small).
5. Newly obtained, as well as historical, fecal coliform data can still be compared to the “old” fecal coliform standard for as long as fecal coliform samples are taken and the historical data are relevant. The Agency is not recommending the continued monitoring of fecal coliform unless there are valid reasons for doing so. Over time the *E. coli* data will replace the fecal coliform data. The transformation of one indicator data set to the other using conversion factors is not necessary, but is an option.

For large-scale projects such as a basin-wide or watershed bacteria TMDL addressing multiple impairments, establishing a relationship between the indicators may be needed. Large regional TMDLs are expensive undertakings (see Section V.L.3). An investment in at least some paired
monitoring may be worth the expense in these situations to help establish supportable delisting
goals. In addition to project scale or scope, the interests of stakeholders should be taken into
consideration. If some stakeholders feel strongly about the need to investigate fecal coliform/E.
coli relationships, a good-faith effort to address the question may be warranted.

G. REASONABLENESS, NO CHANGE TO FECAL COLIFORM EFFLUENT LIMIT
[VII.G. E. coli]

The Agency is proposing no change to the current monthly mean fecal coliform effluent limit of
200 cfu/100 ml, applicable from April 1 – October 31 (May 1 – October 31 for Class 7 waters).
This effluent limit is part of Minnesota’s definition of minimum, technology-based treatment
required of all discharges that treat domestic wastewater. Including fecal coliform as a minimum
treatment (technology-based) limit is a Minnesota requirement. Limits for fecal bacteria are not
part of the federal technology-based definition of secondary treatment (40 CFR 133.103). Also,
the Agency questions whether a change to an E. coli effluent limit is needed to comply with
federal regulations on water quality-based effluent limits (except discharges to Lake Superior) as
discussed below.

All of the existing Minn. R. 7050.0211, subp. 1 is shown below, to show the fecal coliform limit
in the context of the other secondary treatment requirements.

7050.0211 FACILITY STANDARDS.

Subpart 1. Minimum secondary treatment for municipal point source and other
point source dischargers of sewage. It is established that the agency shall require
secondary treatment as a minimum for all municipal point source dischargers and other
point source dischargers of sewage. For purposes of this part, municipal has the
adjective meaning of municipality as defined in part 7001.1020, subpart 18. Secondary
treatment facilities are defined as works which will provide effective sedimentation,
biochemical oxidation, and disinfection, or the equivalent, including effluents conforming
to the following:

<table>
<thead>
<tr>
<th>Substance or Characteristic</th>
<th>Limiting Concentration or Range*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Five-day carbonaceous biochemical oxygen demand*</td>
<td>25 milligrams per liter</td>
</tr>
<tr>
<td>Fecal coliform group organisms **</td>
<td>200 organisms per 100 milliliters</td>
</tr>
<tr>
<td>Total suspended solids*</td>
<td>30 milligrams per liter</td>
</tr>
<tr>
<td>Oil</td>
<td>Essentially free of visible oil</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>See subpart 1a</td>
</tr>
</tbody>
</table>
pH range 6.0 - 9.0

Toxic or corrosive pollutants
Concentrations of toxic or corrosive pollutants shall not cause acute toxicity to humans or other animals or plant life or directly damage real property or exceed the final acute value unless the effluent satisfies the whole effluent toxicity test below. If a whole effluent toxicity test performed on the effluent results in less than 50 percent mortality of the test organisms, the effluent will not be considered acutely toxic unless the commissioner finds that the test species do not represent sensitive organisms in the affected surface water body or the whole effluent test was performed on a sample not representative of the effluent quality. The final acute and whole effluent toxicity test are defined in part 7050.0218, subpart 3, items O and HH, respectively.

*The arithmetic mean for concentrations of five-day carbonaceous biochemical oxygen demand and total suspended solids shall not exceed the stated values in any calendar month. In any calendar week, the arithmetic mean for concentrations of five-day carbonaceous biochemical oxygen demand shall not exceed 40 milligrams per liter and total suspended solids shall not exceed 45 milligrams per liter.

**Disinfection of wastewater effluents to reduce the levels of fecal coliform organisms to the stated value is required from April 1 through October 31 (Class 2 waters) and May 1 through October 31 (Class 7 waters) except that where the effluent is discharged 25 miles or less upstream of a water intake supplying a potable water system, the reduction to the stated value is required year around. The stated value is not to be exceeded in any calendar month as determined by the geometric mean of all the samples collected in a given calendar month. The application of the fecal coliform group organism standards...
shall be limited to sewage or other effluents containing admixtures of sewage and shall not apply to industrial wastes except where the presence of sewage, fecal coliform organisms, or viable pathogenic organisms in such wastes is known or reasonably certain. Analysis of samples for fecal coliform group organisms by either the multiple tube fermentation or the membrane filter techniques is acceptable.

The Agency believes there is little advantage to replacing the 200 cfu/100 ml fecal coliform limit with an \textit{E. coli} limit of 126 cfu/100 ml, at least at this time. The Agency decided early in the planning phase of this rulemaking not to propose a change to the fecal coliform effluent limit because of the amount of time and effort required seemed inconsistent with the gain. The Agency may propose a change to the effluent limit in a future rulemaking, especially if inexpensive analytical methods are approved by EPA. Potential savings in analytical costs would be an important incentive for dischargers to make the change to \textit{E. coli}.

The primary function of a bacterial effluent limit is to assure the wastewater treatment plant operator, and the Agency, that the effluent is being adequately treated with a disinfectant to assure a complete or near-complete kill of fecal bacteria before discharge to the receiving stream. This can be accomplished equally well by using either indicator. The Agency believes the advantages of changing the effluent limit to \textit{E. coli} are limited to:

- The state would have one fecal bacteria indicator for ambient waters and effluents, as it has now; and
- Eliminate any question about compliance with EPA guidance or regulations (Exhibit EC-2, page 52).

The Agency believes the disadvantages, at least for this rulemaking, are:

- The time, effort and expense to the Agency of informing about 600 dischargers that they will need to switch from fecal coliform to \textit{E. coli} by a certain date, including;
- Fielding questions and dealing with problems that arise anytime a wide-scale change is made to a common and long-standing effluent limit, even if the changes seems simple and straightforward.
- The change could result in increased cost to dischargers for \textit{E. coli} analyses, depending on the choice of analytical methods, the availability of contract labs, and whether the discharger will experience any start-up costs (cost savings are a possibility too, if less expensive methods are approved by EPA).
- The change may result in an unintended increase in the number of violations of the bacteriological effluent limit (based on the relationship between effluent fecal coliform and \textit{E. coli}), which in turn;
- Could lead to increased use of chemicals, such as chlorine on the part of operators, to meet the new effluent limit.

Paired fecal coliform and \textit{E. coli} data from the chlorinated effluents of six Minnesota wastewater treatment plants indicate that a fecal coliform count of 200 organisms per 100 ml relates to 179 \textit{E. coli} per 100 ml (n = 15 pairs, \(R^2 = 0.91\)). While this is a very small sample size, it may
indicate that an *E. coli* effluent limit of 126 cfu/100 ml might be more stringent than the current limit (Figure III-8).
The EPA guidance on the implementation of *E. coli* standards and the promulgation of the final BEACH act rule (December 16, 2004, 69 FR 67217) could impact the Agency’s decision not to change the fecal coliform effluent limits at this time.

The EPA guidance in Exhibit EC-2 offers states flexibility if assigning effluent limits for bacterial indicators, but seems to imply that a newly adopted *E. coli* standard should be the basis for future effluent limits. Pertinent language from Exhibit EC-2 (page 52) is quoted below:

> With respect to determining whether WQBELs for bacteria are needed for a specific discharge, the Agency expects permitting authorities to use the same approach that applies to other pollutants. Thus, the permitting authority must include a WQBEL in the NPDES permit for a discharger if it determines that a pollutant (including all bacteria pollutants) is or may be discharged at a level which will cause, have reasonable potential to cause, or contribute to an exceedance of any state or tribal water quality standard. See 40 CFR 122.44(d)(1)(i). When a state or authorized tribe adopts, and EPA approves, new water quality criteria for *E. coli* and/or enterococci, the permitting authority (in most cases, the state) must immediately begin implementing these criteria through limits incorporated into any new or reissued NPDES permit, unless the state or tribal water quality standards authorize another approach. Additionally, if the state or authorized tribe chooses to retain an existing water quality criterion for fecal coliforms, the permitting authority must continue to implement this criterion in the form of a WQBEL as well, unless otherwise specified in the state or tribal water quality standards. [emphasis added, WQBEL means water quality-based effluent limit]

The bolded portion of the above quote seems to provide states the flexibility to retain fecal coliform limits if they choose to do so. In essence Minnesota is authorizing “another approach” by retaining the fecal coliform limit, in the belief that is can perform in the role of an “end-of-pipe limit” effluent limit as well as *E. coli*. EPA adds that the effluent limit should be applied in
the form of a WQBEL (water quality-based effluent limit). In this case, the fecal coliform limit is not just water quality-based limit but the limit is the water quality standard (see below).

The CFR reference in the quote above deals with requirements to set effluent limits if a pollutant is discharged in amounts that will cause an exceedance of a water quality standard downstream (i.e., a WQBEL). It is shown below.

[40 CFR 122.44] (d) Water quality standards and State requirements: any requirements in addition to or more stringent than promulgated effluent limitations guidelines or standards under sections 301, 304, 306, 307, 318 and 405 of CWA necessary to:

(1) Achieve water quality standards established under section 303 of the CWA, including State narrative criteria for water quality.

(1) Limitations must control all pollutants or pollutant parameters (either conventional, nonconventional, or toxic pollutants) which the Director determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State water quality standard, including State narrative criteria for water quality.

(iii) [then] ...the permit must contain effluent limits for that pollutant.

The CFR and EPA’s discussion of *E. coli* effluent limits in the guidance is in terms of WQBELs. WQBELs are set at a level needed to protect in-stream water quality standards below a discharge. They typically vary with available dilution – the more dilution provided by the receiving stream, the greater the acceptable WQBEL concentration (up to certain defined maximums). In a simplified example, if the receiving stream provides no dilution (a zero 7Q₁₀ flow), the effluent limit must equal the water quality standard to avoid a downstream exceedance; if the ratio of receiving stream flow to discharge flow is 1 to 1 (at the 7Q₁₀), the effluent limit concentration can be double the standard (assumes concentration of pollutant upstream is zero). Minnesota’s fecal coliform limit equals the geometric mean ambient standard. Thus, the limit is applied with no allowance for dilution to all dischargers; i.e., as if every discharge is to a zero flow stream.

An effluent limit equal to the ambient standard essentially guarantees that the water quality standard in the receiving water cannot be exceeded as long as the discharger is in compliance with their permit limit. Furthermore, meeting the existing 200 cfu/100 ml fecal coliform limit should mean that an “equivalent” *E. coli* limit would be met as well (see Economic Analysis [Section VIII] on page 67237 of Exhibit EC-17). The existing fecal coliform limit will accomplish the goal of preventing water quality exceedances of an *E. coli* standard. Also, the disinfection of sewage effluents, particularly when chlorine is used, has an “all or none” aspect to it. That is, if disinfection as adequate to meet the limit, the bacterial kill is often near complete, and if disinfection is inadequate, bacterial levels will often be well above the 200 limit.
The BEACH act is more explicit (Exhibit EC-15):

[40 CFR 131.41(f)] ... All dischargers shall promptly comply with any new or more restrictive water quality-based effluent limitations based on the water quality criteria set forth in this section.

The Federal Register (Exhibit EC-17) says EPA expects states will begin incorporating *E. coli* into their water quality programs, including as effluent limits in NPDES/SDS permits (Exhibit EC-17, pages 67228 and 67240). This discussion centers on the same requirements concerning WQBELs in 40 CFR 122.44 discussed above, except the BEACH act only pertains to discharges to Lake Superior in Minnesota. The Agency believes that the same points made above for retaining the fecal coliform limit, (i.e., the limit equals the water quality standard, the limit is not a WQBEL *per se*, and the limit is more technology-based), applies equally to Lake Superior discharges.

The state of Michigan whose dischargers to the Great Lakes are subject to the BEACH act has retained a fecal coliform limit. EPA indicates that this has caused little problem in terms of implementing bacteria related TMDLs, as long as the state can demonstrate that the fecal coliform limit is comparable to an *E. coli* limit. EPA has made this demonstration on a broad scale (Exhibits EC-1 and EC-17).

While the Agency is not proposing to change the fecal coliform effluent limit in this rulemaking, *E. coli* monitoring and even limits may be added to NPDES/SDS permits now in consultation with the permittees. These “limits” may take the form of non-enforceable numbers included as special requirements in the permit. The fecal coliform limit would still be the enforceable limit. This approach may be amenable to all parties, particularly for dischargers to Lake Superior prior to making a formal change to the rule. A few dischargers have expressed interest in monitoring for *E coli* for their own interest. The Agency would encourage this.

In summary, the Agency is not proposing to change the existing fecal coliform effluent limit in Minn. R. 7053.0215 for the reasons outlined below.

- The choice of indicator organism is not critical in the context of bacterial disinfection and effluent limits.
- Compliance with either indicator will assure the protection of the receiving waters for swimming and compliance with the proposed *E. coli* standard.
- The current fecal coliform limit equals the current fecal coliform water quality standard and does not change as dilution increases.
- Very extensive ambient data and limited effluent data show that fecal coliform and *E. coli* counts are comparable (although a limit of 126 cfu *E. coli* may be more stringent than 200 cfu fecal coliform).
- *E. coli* limits, special conditions or monitoring could be added to permits now in consultation with the permittee.

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96 E-mail to MPCA from EPA staff in Region 5, September 27, 2006.
Retaining the current fecal coliform effluent limit in NPDES permits is cost-effective and reasonable at this time.

H. CONCLUSIONS, REASONABLENESS [VII. E. coli]

The Agency’s goal is to replace the current fecal coliform standard with an *E. coli* standard that meets EPA’s requirements, and:

- Provides the same level of protection to swimmers the fecal coliform standard does;
- Causes the least amount of disruption to ongoing bacteriological monitoring and programs;
- Minimized transition costs; and
- Does not significantly impact the water quality assessment process and the number of waters that will be considered impaired in the future due to fecal contamination.

The Agency believes these are reasonable goals and that the proposed *E. coli* standards accomplish them.

The proposed *E. coli* standards are based on the analysis of a very robust data set of paired fecal coliform/*E. coli* data that show the proposed standards are about as protective as, or slightly more protective as, the current standard. The narrative portion of the proposed standard is essentially unchanged from the current standard.

The key factors upon which the proposed *E. coli* standards are based are:

1. Achieve a protection level of eight illnesses per 1000 exposures for both the geometric mean and 10 percent maximum (10 percent MS) standards, consistent with the more protective end of the protection-level range recommended by EPA (8 – 10 illnesses per 1000);
2. Adopt a geometric mean standard that is the same as the EPA geometric mean criterion;
3. Select a geometric mean and 10 percent MS, based on the “relationship,” “equivalency“ and “exceedance” analysis of paired data, that is consistent with the current standard and EPA guidance;
4. Use a log standard deviation (0.8) that reflects the variability in fecal bacterial levels observed in Minnesota rivers to define the “use protection level” for the 10 percent MS;
5. Remove the more restrictive 10 percent MS for trout waters so all Class 2 waters receive the same level of protection for swimming; and
6. Adopt a secondary body contact geometric standard for Class 7 waters five times the primary body contact geometric mean standard.

The proposed *E. coli* standards for both Class 2 and Class 7 waters are both needed and reasonable.

I. ECONOMIC IMPACT OF PROPOSED E. COLI STANDARD [VII. E. coli]
This Section will focus on potential costs of adopting an *E. coli* standard. Possible benefits cannot be quantified, but use of an improved indicator standard should improve the ability of responsible entities to assess conditions at swimming beaches to protect the health of swimmers. And it should improve the Agency’s assessment of overall recreational suitability of surface waters throughout the state.

The proposed change in bacteriological standards will cost the Agency some money, and it will mean added costs to certain outside entities as well. A large portion of these costs have already been incurred by the Agency and by at least some of the outside parties. Future costs will not change the overall Agency budgets or staff resources.

The largest potential cost to the Agency is the possible need to monitor for both indicators, fecal coliform and *E. coli*, during the transition period. The added cost of duplicate samples is due largely to the costs of the extra analyses. The additional cost of the analyses could range from a low of about one third more to over twice as much, depending on the lab used and the choice of analytical methods. It is impossible to predict future added costs for the additional analyses because we don’t know which of the several monitoring programs will decide duplicate samples are needed. It is reasonable to assume that some additional staff time will be required to review the results of the duplicate sampling.

Duplicate fecal coliform/*E. coli* sampling as part of the Agency’s long-term (routine) Milestone station monitoring program was discontinued several years ago, and the Agency has no plans to resume paired analyses in that program. The Agency took hundreds of duplicate samples at Milestone stations in the late-1980s and again in the early-2000s to establish the fecal coliform/*E. coli* relationships needed to support the proposed *E. coli* standards (Section VIII.D.5). Some of the Agency’s more site-specific monitoring programs that focused on fecal bacteria have also discontinued paired analyses. In general, water quality standards staff is not recommending the continuation of paired monitoring unless there is a specific need to establish the local fecal coliform/*E. coli* relationship. Watershed, TMDL and monitoring program managers, on a case-by-case basis, may decide that they need the paired results. These decisions are ongoing and can change each sampling season. It is difficult to predict which programs may decide to take paired samples; and, if they do, we don’t know the number of samples, the choice of labs and analytical methods that will be used.

Examples of the plans, in some cases tentative, for bacteriological monitoring as part of several ongoing localized monitoring programs are:

- South East Regional fecal coliform TMDL. No additional bacteriological monitoring is scheduled for 2006. It has not been determined at this time whether duplicate or just *E. coli* analyses will be performed when bacteriological sampling resumes.
- Special Study, South Branch Root River (associated with the SE TMDL). Fecal coliform and *E. coli* analyses using the MDH lab and the membrane filter method were carried out (funding provided by EPA Clean Water Partnership 319 grant). The continuation of paired sampling is uncertain at this time.
• Special Study, Blue Earth River (part of a fecal coliform TMDL). Mostly fecal coliform monitoring only; some paired monitoring. Analyses for *E. coli* were done with the relatively inexpensive Quanti-Tray method. This phase of the monitoring is winding down.

• Special Study, South Branch Whitewater River. Bacteriological monitoring is planned for 2006 and 2007 using the MDH lab, but the method has not been determined at this time (funding provided by EPA 319 grant).

• Ongoing Special Study, North Shore streams. No bacteriological monitoring planned for the foreseeable future.

Once the need for duplicate analyses subsides, the change to *E. coli* could mean savings in analytical costs for the Agency. The change to *E. coli* expands the choices of analytical methods, and some of the newer methods are considerably cheaper than the heretofore preferred membrane filter method. The Agency’s Milestone station monitoring program changed from fecal coliform to *E. coli* for the 2005 summer sampling season. Each year about 27 of the 80 milestone stations are sampled once per month for seven months. In 2005, *E. coli* samples were analyzed using the membrane filter method, which is more expensive than a fecal coliform membrane filter analysis ($41.00 vs. $35.00, FY ‘05 costs). The higher cost of the *E. coli* membrane filter analysis is due to extra steps in the analysis that requires additional staff time. Starting in April 2006, *E. coli* samples are being analyzed using the much less expensive Quanti-Tray method. Table III-24 shows the increased costs incurred using the membrane filter method, and the projected cost savings in 2006 of using the Quanti-Tray method, using FY ‘06 prices.

Table III-24. Monitoring at Milestone Stations – Costs per Year for Fecal coliform and *E. coli* Analysis Using Membrane Filter and Quant-Tray Methods, MDH Lab, FY ’06 Prices.

<table>
<thead>
<tr>
<th>Analysis For:</th>
<th>Method</th>
<th>Cost per analysis, FY2006 prices</th>
<th>Approx. no. of samples per year (27 X 7 = 189)</th>
<th>Total cost per year</th>
<th>Cost Increase in 2005 (+)</th>
<th>Cost Saving in 2006 (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecal Coliform</td>
<td>Membrane filter</td>
<td>$37.00</td>
<td>189</td>
<td>$6,993.00</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>Membrane filter</td>
<td>$44.00</td>
<td>189</td>
<td>$8,316.00</td>
<td>+ $567.00</td>
<td>- $6,048.00</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>Quanti-Tray</td>
<td>$12.00</td>
<td>189</td>
<td>$2,268.00</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Potential cost savings for the Agency’s regional monitoring programs that monitor for fecal bacteria may not be as dramatic as the Milestone monitoring example shown in Table III-24. Depending on location, these programs may be more likely to use local contract labs, and the

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97 Monitoring at Milestone stations is rotated through 10 major watersheds in Minnesota. Three to four watersheds are monitored each year so each Milestone station is sampled every other or every third year. Each year approximately 27 Milestone stations are sampled. The fecal coliform and proposed *E. coli* standards only apply from April 1 through October 31, or seven months out of the year.

98 MDH prices changed on July 1, 2006, the beginning of the fiscal year (FY), which is in the middle of the sampling season. For simplicity just FY ’06 costs are used in Table III-24.
differences in analytical costs between fecal coliform vs. *E coli* for a range of methods is usually not as great, or they may be the same (Exhibit EC-24).

There will be no increase in analytical expenses for Minnesota’s Beach program due to the change to *E. coli*. The contract for analytical services for the Beach program currently has the same cost ($10.50) for both fecal coliform and *E. coli*. With the discontinuation of fecal coliform monitoring in the spring of 2006, the analytical costs for this program have been reduced by half.

We do not expect any other state agency, including the Minnesota Department of Health, to be impacted monetarily by the proposed amendments.

Possible added costs to outside parties, mainly entities that monitor public beaches and the analytical labs that might incur some start-up costs, are discussed in Section VII.C.2.
VIII. CLASS 3 INDUSTRIAL USE CLASSIFICATION CHANGES

A. INTRODUCTION AND CLASS 3 USE [VIII. class 3]

1. Introduction [VIII.A. introduction, class 3]

The Agency is proposing to change the Class 3 industrial use sub-classification applicable to most surface waters of the state from Class 3B to 3C. This would be accomplished by changing the “default” industrial use classification for most surface waters from Class 3B to 3C. For consistency, the Agency also proposes to change the classification of 106 specifically-listed waters in Minn. R. 7050.0470 from 3B to 3C. This will have the effect of relaxing the Class 3 chlorides\(^99\) and hardness water quality standards applicable to most surface waters. The Class 3 standards are listed in Table III-25 (Minn. R. 7050.0223). The Class 3C standards are highlighted in the shaded columns. The Class 2B (aquatic life and recreation) standards are included for comparison.

Table III-25. Class 3 Industrial Use Water Quality Standards. Class 2B Aquatic Life Standards Shown for Comparison.

<table>
<thead>
<tr>
<th>Substance, characteristic or pollutant, units</th>
<th>Class 3A</th>
<th>Class 3B</th>
<th>Class 3C</th>
<th>Class 3D*</th>
<th>Class 2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorides (Cl), mg/L</td>
<td>50</td>
<td>100</td>
<td>250</td>
<td>Mb</td>
<td>230</td>
</tr>
<tr>
<td>Hardness, mg/L</td>
<td>50</td>
<td>250</td>
<td>500</td>
<td>Mb</td>
<td>Na</td>
</tr>
<tr>
<td>Ca+Mg as CaCO(_3)</td>
<td>6.5</td>
<td>6.0</td>
<td>6.0</td>
<td>Mb</td>
<td>6.5</td>
</tr>
<tr>
<td>pH, minimum, su</td>
<td>8.5</td>
<td>9.0</td>
<td>9.0</td>
<td>Mb</td>
<td>9.0</td>
</tr>
</tbody>
</table>

* Mb means maintain background. Class 3D applies to wetlands.

2. Class 3 Beneficial Use and Water Quality Standards [VIII.A. introduction, class 3]

As described in Section IX.A below and in Book I, Section II.B.1, Minnesota assigns multiple water use classifications to surface waters of the state. Included in this multi-use classification system is Class 3, which is divided into four subclasses, Class 3A, 3B, 3C, or 3D (Table III-25).

Most of the waters affected by the proposed Class 3B to 3C changes are classified pursuant to the “Unlisted Waters” provisions of Minn. R. 7050.0430. Minnesota R 7050.0430 is sometimes referred to as the “default classification” since all non-wetland surface waters of the state that are not specifically listed in Minn. R. 7050.0470 are assigned the following “default” use classifications: Class 2B, 3B, 4A, 4B, 5, and 6. The Class 4 (agriculture and wildlife), Class 5 (aesthetic enjoyment and navigation), and Class 6 (other uses) make up the “core set” of use classes assigned to all surface waters of the state. The assignment of the Class 2B (aquatic life

\(^{99}\) The standard is listed as “Chlorides” with an “s” in Minn. R. 7050.0223; for simplicity we will drop the “s” when referring to the chloride standard in this discussion.
and recreation) and Class 3B (industrial consumption) use classifications for waters covered under the unlisted waters provision was originally adopted into state-wide water quality standards rules in the late-1960s. Then, as now, the Class 2B and 3B uses were and are presumptive use class assignments. In other words, all surface waters of the state are presumed to be suitable for these uses unless and until water use reclassifications are proposed through a public hearing rulemaking proceeding. During this rulemaking, the Agency proposes to change the assigned industrial use classification from Class 3B to Class 3C for all the waters classified under the unlisted waters provision. For consistency, Class 3B to Class 3C changes are also proposed for 106 waters specifically listed in Minn. R. 7050.0470.

The assignment of Class 3B to most surface waters means the Class 3B chloride water quality standard of 100 mg/L is the most restrictive chloride standard (see Minn. R. 7050.0450). The Class 3 water quality standards are interpreted as 30-day average standards by the Agency for purposes of using them as the basis for an effluent limit. Should the proposed Class 3B to Class 3C amendments be adopted into rule, the Class 2A, 2B, or 2C chronic standard of 230 mg/L chloride becomes the most restrictive applicable chloride water quality standard for non-Class 7 waters. This would also apply for Class 1 waters used for domestic consumption purposes, which contain a secondary drinking water standard for chloride of 250 mg/L. The averaging duration for the Class 2 chronic standard for chloride is based on a four-day average. For Class 7 waters, the Class 3C chloride standard remains the same at 250 mg/L. As noted in Table III-25 above, the proposed Class 3B to 3C amendments would also result in a change in the industrial consumption total hardness standard for most waters from 250 mg/L to 500 mg/L (expressed as CaCO₃ equivalents). The current Class 3 pH standards will not change.

As noted above, the Class 3B to Class 3C change will affect the majority of surface waters throughout the state. The Agency is proposing that this change should not pertain to certain categories of waters. The set of waters not being proposed for the Class 3B to Class 3C changes include:

- Outstanding Resource Value Waters covered under the prohibited discharges provisions of Minn. R. 7050.0180, subp. 3. (These waters include waters within: the Voyageur’s National Park; the Boundary Waters Canoe Area Wilderness; designated Scientific and Natural Areas identified in Minn. R. 7050.0180, subp. 4; and designated Wild River segments identified in Minn. R. 7050.0180, subp.5.);
- Trout waters (Class 2A waters) identified in Minn. R. 7050.0420 and 7050.0470; and
- Wild rice waters specifically identified in Minn. R. 7050.0470.

3. Protection of Industrial Consumption [VIII.A. introduction, class 3]

The Class 3 use is intended to protect surface waters for industrial consumption uses. These industrial uses may include such things as raw product cleaning and transport at the factory sites, use of the water in the actual production of finished products, and for equipment and other process cooling purposes. Industrial water supply uses can also be categorized as consumptive or non-consumptive. An example of a non-consumptive use would be a non-recirculating (once-through) cooling water system where water is withdrawn from the supply source, utilized by the water appropriator, and returned to the waterbody where it remains available for other uses.
Consumptive use, as the name implies, utilizes the water in such a manner that it is no longer available for potential users in the immediate vicinity because it is incorporated into the product or it is lost due to evaporation, transpiration, or percolation. The water appropriated for crop irrigation is almost always considered to be a consumptive use.

4. **Summary and Possible Future Amendments** [VIII.A. introduction, class 3]

The industrial use classification amendments being proposed would change the assigned industrial use classification for unlisted waters classified under Minn. R. 7050.0430 and certain other waters specifically listed in Minn. R. 7050.0470. The reclassifications from a Class 3B water use to a Class 3C water use would affect the majority of surface waters in the state. If adopted, these changes would result in the assignment of less restrictive chloride and total hardness water quality standards for these waters.

The proposed set of Class 3B to Class 3C changes are viewed as a first step toward a more comprehensive examination of the salinity related standards in the State’s Class 2 aquatic life, Class 3 industrial consumption and Class 4 agriculture and wildlife water use classifications. Many of the standards under the Class 3 and 4 uses are based on information that was available in the mid-1960s that reflects guidelines proposed twenty or more years before that time period. The future re-examination of these salinity-related water quality standards will include input from the Minnesota Department of Agriculture, Minnesota Department of Natural Resources, and the U. S. Department of Agriculture - Agricultural Research Service’s Salinity Laboratory, as well as others from the agricultural, industrial, and environmental protection communities. Any recommended rule changes resulting from the re-examination of these standards will be addressed as part of a future revision of Minn. R. 7050.

B. **BACKGROUND INFORMATION** [VIII.B. class 3]

1. **Introduction** [VIII.B. background, class 3]

Chloride and total hardness concentrations in surface waters vary greatly from one part of the state to another. This section describes these water quality characteristics and their typical concentrations in surface waters throughout Minnesota.

2. **Chloride** [VIII.B. background, class 3]

Chloride is one of the major anions commonly found in surface and ground waters throughout Minnesota. Besides natural background concentrations, contributing sources of chloride in both surface and ground waters include municipal and industrial wastewaters, de-icing salt storage, roadway de-icing and dust suppression activities, agricultural runoff, and irrigation return waters. From an industrial water use supply standpoint, chlorides can contribute to corrosion of pipes and equipment, can add to the total dissolved solids content in recycled cooling water and boiler systems, and depending on the industry, can interfere with manufacturing processes that affects the quality of the product being produced.
To provide some perspective, water quality data contained within the EPA’s STORET data base was evaluated to characterize surface water chloride concentrations throughout the state. Data was retrieved for individual sampling stations within each of the thirteen sub-regional hydrologic unit watersheds defined for Minnesota. These thirteen sub-regional unit watersheds make up the four major regional hydrologic basins that cover the state: unit code (04) Great Lakes; unit code (07) Upper Mississippi; unit code (09) Souris-Red-Rainy; and unit code (10) Missouri. Averages of the station mean chloride concentrations for twelve of the thirteen sub-regional watersheds are listed in Table III-26. These values were derived from data contained in Exhibit UC-21.

Table III-26. Average Chloride Concentrations (mg/L) in Minnesota’s Sub-regional Watersheds.

<table>
<thead>
<tr>
<th>Sub-regional Watershed Unit</th>
<th>Mean Chloride Concentration (mg/L)</th>
<th>Sub-regional Watershed Unit</th>
<th>Mean Chloride Concentration (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0401 Lake Superior basin</td>
<td>18.3</td>
<td>0708 Cedar R. basin</td>
<td>49</td>
</tr>
<tr>
<td>0402 Lake Superior (lake samples)</td>
<td>2.1</td>
<td>0702 Des Moines R. basin</td>
<td>87</td>
</tr>
<tr>
<td>0701 Upper Mississippi R. basin</td>
<td>49</td>
<td>0902 Red River of the North basin</td>
<td>24</td>
</tr>
<tr>
<td>0702 Minnesota R. basin</td>
<td>53</td>
<td>0903 Rainy R. basin</td>
<td>9.4</td>
</tr>
<tr>
<td>0703 St. Croix R. basin</td>
<td>9.1</td>
<td>1017 Rock R. basin</td>
<td>51</td>
</tr>
<tr>
<td>0704 Lower Mississippi R. basin</td>
<td>31</td>
<td>1023 Little Sioux R. basin</td>
<td>Insufficient data</td>
</tr>
<tr>
<td>0706 Lower Mississippi R. basin</td>
<td>61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Total Hardness [VIII.B. background, class 3]

Total hardness of water refers to a physical-chemical characteristic that is commonly recognized by the increased quantity of soap needed to produce a lather or by the scale forming potential when these waters are heated. Hardness has come to be defined as the sum of the total concentration of the calcium and magnesium ions. Total hardness concentrations are expressed as calcium carbonate (CaCO₃) equivalents. For example, if a chemical analysis of a water sample shows that the concentration of total calcium is 120 mg/L and the concentration of total magnesium is 30 mg/L, the respective equivalent CaCO₃ concentrations for these two cations would be 300 mg/L as CaCO₃ and 123 mg/L CaCO₃, respectively. The summation of these two concentrations yields a total hardness value of 423 mg/L as CaCO₃. While hydrogen ions and all polyvalent metal cations (such as iron and manganese) can contribute to the soap consumptive properties of the water, they are generally in such low concentrations in water supplies that their influence is not considered to be significant and are therefore not factored into the total hardness calculation. A widely accepted descriptive classification of the hardness of water is shown in Table III-27.
Table III-27. Classification of Total Hardness Ranges.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Range in mg/L</th>
<th>Range in grains/gallon*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft</td>
<td>0 – 17.1</td>
<td>0 – 1</td>
</tr>
<tr>
<td>Slightly Hard</td>
<td>17.1 – 60</td>
<td>1 – 3.5</td>
</tr>
<tr>
<td>Moderately Hard</td>
<td>60 – 120</td>
<td>3.5 – 7.0</td>
</tr>
<tr>
<td>Hard</td>
<td>120 – 180</td>
<td>7.0 – 10.5</td>
</tr>
<tr>
<td>Very Hard</td>
<td>180 &amp; over</td>
<td>10.5 &amp; over</td>
</tr>
</tbody>
</table>

*Grains of hardness per gallon is a standard unit of measure to describe the hardness of water commonly used in the water softening industry. A conversion factor of 17.1 is used to convert hardness values expressed in grains per gallon into hardness concentrations expressed in mg/L as CaCO₃.

Water concentrations of calcium and magnesium, and the resulting hardness levels in surface and ground waters, are influenced by watershed geology and the aquifers from which these waters are obtained. Ground water hardness values within a given region of the state will often be higher than the surface water hardness values. In Minnesota, surface water hardness values vary considerably with most of the soft-to-slightly hard water conditions in the northern/northeastern part of the state. Throughout much of the rest of the region, water hardness is classified as being hard to very hard, with the highest hardness concentrations in the southwestern one-third of the state. Exhibit UC-22 is a graphical representation of surface water hardness concentrations throughout the United States, and Exhibit UC-23 is a map showing ground water total hardness concentrations from 954 domestic drinking water wells across Minnesota.

From an industrial use perspective, excessive hardness levels can be problematic since they can lead to scale formation and other deposits inside piping and on surfaces of operational and manufacturing equipment. In certain food and beverage industries, high levels of hardness can also lead to the formation of undesirable precipitants in the products made and processed. While hardness is defined as the sum of the calcium and magnesium cations, industrial water supply hardness can be further classified according to the corresponding anions associated with the calcium and magnesium. Where carbonate or bicarbonate anions are present in concentrations equivalent to or greater than the calcium and magnesium concentrations, the scale that will form upon evaporation or heating will consist primarily of calcium carbonate and magnesium hydroxide. This type of hardness is characterized as “carbonate” or “temporary” hardness since the resulting scale can be removed with acid. When carbonate and bicarbonate anion concentrations are low, sulfates and chlorides combining with the calcium and magnesium may form scale deposits that are referred to as “non-carbonate” or “permanent” hardness. These hardness related scale deposits can be more difficult to deal with since they cannot be easily removed by acid treatment. Pre-treatment water conditioning practices are commonly employed by industrial appropriators of surface waters in order to meet certain quality specifications. Solids removal, hardness removal (water softening), turbidity removal, removal of dissolved solids and dissolved gases, and pH adjustment make up the majority of water treatment processes these surface waters undergo prior to factory use.
Aside from the noted problems associated with elevated hardness concentrations, water hardness also has some beneficial properties associated with it. Total hardness plays an important role in the toxicity of certain trace metals. In general, as hardness concentrations increase, the toxicity of hardness dependent metals decreases. The hardness dependent metals standards in Minn. R. 7050 include cadmium, tri-valent chromium, copper, lead, nickel, silver (acute standards only), and zinc. Calcium is also reported to be beneficial in water as one of the factors that tend to inhibit corrosion of cast iron and steel. Waters with hardness greater than 125 mg/L can form a protective coating on lead pipes which can reduce, but not eliminate, the dissolution of lead into the water.

A data analysis was also conducted for total hardness concentrations within the thirteen sub-regional watershed units comprising the four major watersheds in Minnesota (Table III-28). Averages of the station mean total hardness concentrations were derived from the EPA STORET data presented Exhibit UC-24.

Table III-28. Average Total Hardness Concentrations (mg/L) in Minnesota’s Sub-regional Watersheds.

<table>
<thead>
<tr>
<th>Sub-regional Watershed Unit</th>
<th>Mean Total Hardness Mg/L</th>
<th>Sub-regional Watershed Unit</th>
<th>Mean Total Hardness Mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>0401 Lake Superior basin</td>
<td>108</td>
<td>0708 Cedar R. basin</td>
<td>269</td>
</tr>
<tr>
<td>0402 Lake Superior (lake samples)</td>
<td>45</td>
<td>0702 Des Moines R. basin</td>
<td>587</td>
</tr>
<tr>
<td>0701 Upper Mississippi R. basin</td>
<td>236</td>
<td>0902 Red River of the North basin</td>
<td>284</td>
</tr>
<tr>
<td>0702 Minnesota R basin</td>
<td>436</td>
<td>0903 Rainy R. basin</td>
<td>80</td>
</tr>
<tr>
<td>0703 St. Croix R. basin</td>
<td>135</td>
<td>1017 Rock R. basin</td>
<td>374</td>
</tr>
<tr>
<td>0704 Lower Mississippi R. basin</td>
<td>281</td>
<td>1023 Little Sioux R. basin</td>
<td>372</td>
</tr>
<tr>
<td>0706 Lower Mississippi R. basin</td>
<td>270</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. BASIS FOR EXISTING CLASS 3 WATER QUALITY STANDARDS [VIII. class 3]

The narrative descriptions of the Class 3 water use subcategories (Class 3A, 3B, 3C), along with the Class 3 chloride and hardness water quality standards, were first adopted by the Minnesota Water Pollution Control Commission in 1967 (precursor of the MPCA) and they have remained largely the same since that time. There are several notable differences between the 1967 Class 3 standards and those of today. In the 1967 rule, the Class 3 water use classification also included water quality standards for temperature and coliform bacteria in addition to the chloride, hardness, and pH. Another notable difference, pertinent to the proposed amendments, was that the 1967 rule included a separate ground water standard for hardness in the Class 3A and Class 3B subcategories. These hardness standards were listed as 250 mg/L and 350 mg/L, respectively. Subsequent rule amendments removed these ground water standards from the
Class 3 use classifications as well as the temperature and coliform bacteria standards. The Class 3D use classification was added to Minn. R. 7050 in 1994 along with other wetland use classifications.

A review of the public hearing testimony and the exhibits presented during the water quality rule hearings in the 1960’s and early-1970’s has provided some insights into the rational behind the adoption of the Class 3 water standards. Two documents in particular, containing information on industrial water supply uses, appear to have been the primary references used in the establishment of the chloride, hardness, and pH standards for the Class 3 water use classifications. The first document, which at the time, was a widely distributed, comprehensive resource on water pollution control information, is titled *Water Quality Criteria, Second Edition*, by Jack E. McKee and Harold W. Wolf, California State Water Resources Control Board, 1963, and is referred to in this section of the SONAR as McKee and Wolf. (Excerpted pages 92 – 106 of McKee and Wolf discussing industrial water supplies are identified as Exhibit UC-25).

The second resource is titled *Manual on Industrial Water and Industrial Waste Water* - American Society for Testing and Materials (ASTM). The first edition of this manual, titled *Manual on Industrial Water* was published in 1953. Subsequent revisions of this manual were published in 1956, 1959, and 1966. The 1959 version of the manual was the first to include the sections on industrial wastewater (Second Edition, ASTM Special Publication No. 148 – D) and was the most current version available during the initial development of the Class 3 criteria during the mid-1960s. In particular, Table II titled “Water Quality Tolerances for Industrial Applications”, which are the same in both the 1959 and 1966 manuals, is thought to have been a likely resource consulted at the time (Exhibit UC-26). Table II in Exhibit UC-26 provides a summary of the water quality criteria for a number of industries. A qualifying statement in the text describing this table indicates that “The figures in Table II are general averages and cannot be applied to individual cases without regard for local conditions.”

McKee and Wolf, and the ASTM Manual(s) along with general guidelines contained in *Guidelines for Establishing Water Quality Standards for Interstate Waters*, Federal Water Pollution Control Administration, May 1966 (Exhibit UC-27) appear to be the key resources used by staff of the Minnesota Water Pollution Control Commission to develop criteria for subsequent inclusion in the water quality rules adopted in 1967.

In 1968 the Federal Water Pollution Control Administration issued a report titled “Report of the Committee on Water Quality Criteria” Federal Water Pollution Control Administration, April 1968. This document, (commonly referred to as the “Green Book”), was completed by the National Technical Advisory Committee on Water Quality Criteria. The Secretary of the Interior first established this advisory committee in February 1967. The Green Book, which contains a section on industrial uses, was entered as an exhibit during the 1973 rule hearings on Minnesota Water Quality rules WPC 14, 15, and 23. The Green Book contains information the raw water and point-of-use (where the water is withdrawn) water quality characteristics for various industries. (Exhibit UC-28, excerpt pages 185–215).

During the 1973 rulemaking hearings on WPC 14 and 15, a position paper titled “Categorization of Surface Waters for Industrial Consumption for WPC-15”, MPCA Division of Water Quality,
Section of Industrial and Other Wastes, was introduced as an exhibit into the hearing record. This exhibit, entered into the record by George Koonce, Acting Chief of the Section of Industrial and Other Wastes, was identified at the time as PCA Exhibit 41, entry dated 5-31-73 and is identified here as Exhibit UC-29.

Exhibit UC-29 contained the following general statements in the support of the established Class 3 water quality standards:

- Industries require a consistently good quality source of water for their process and cooling needs;
- The water quality requirements vary widely depending on the industrial processes; and
- While surface waters are not considered the primary water supply source for industrial users, there is a reasonable expectation that increased industrial consumptive use of surface waters will occur in the future.

This exhibit also cited an ASTM list summarizing problems affecting industries caused by the quality of water on their products, deterioration of equipment, and reductions of efficiency or capacity. Finally, Exhibit UC-29 provided a brief discussion for the inclusion of the Class 3 chloride, hardness, pH, temperature, and bacteria standards. The limited amount of testimony pertinent to the Class 3 standards during the 1966-1967 and 1973 rule hearings centered on the inclusion of temperature standards under the industrial water use classification. The majority of people providing testimony preferred the removal of the Class 3 temperature standards in deference to the Class 2 aquatic life and recreation use temperature standards. (These recommendations were considered to be a valid alternative approach and the Class 3 temperature standards were subsequently withdrawn from the Class 3 uses categories.) The only testimony found specific to either the chloride or hardness Class 3 water quality standards offered by interested parties was in testimony presented on April 20, 1967, by the then General Manager of the Wilson and Company meat processing plant in Albert Lea, Minnesota. The statement concerned the company’s inability to meet the 100 mg/L chloride standard being proposed for the Shellrock River and Albert Lea Lake, receiving waters for the company’s wastewater discharge.

The recommended threshold concentrations for chlorides and hardness levels cited in Mr. Koonce’s exhibit appear to have been based on information presented in McKee and Wolf. Exhibit UC-29 stated that “In general the industrial consumption criteria follows the ‘Ranges of Promulgated Standards for Raw Water Sources of Domestic Water Supply’ recommended by the U. S. Public Health Service.” The basis for this statement appears to stem from an entry on page 92 of McKee and Wolf which states:

“Industries are generally willing to accept for most processes water that meets drinking water standards. Where water of higher quality is needed, e.g., for television-picture-

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100 In 1973 WPC-14 was the rule governing water quality standards for intrastate waters of Minnesota. A parallel rule, WPC-15 contained water quality standards for interstate waters. These two rules, along with their companion water use classification rules WPC-24 and 25, were ultimately merged into one rule, which was the predecessor to the current Minn. R. ch. 7050.
tube manufacture, certain food and beverage preparation, or for high pressure boilers, industry recognizes that additional treatment is the responsibility of the water user.”

Table 5-3 on page 93 of McKee and Wolf (Exhibit UC-25) which is titled “Ranges of Promulgated Standards for Raw Water Sources of Domestic Water Supply” is believed to be the reference cited by Mr. Koonce (Exhibit UC-29 at page 4). In this table, constituent ranges are given for water supply sources and these source supplies are broken down into one of three categories; Excellent, Good, and Poor. For the chloride entries, Excellent is described as 50 mg/L or less; Good is described as 50 – 250 mg/L; and Poor is described as being greater than 250 mg/L. The basis for the Class 3 chloride standards appears to parallel this three-tiered categorization of raw water supply sources. The 50 mg/L or less range under the “Excellent” category corresponds to the 50 mg/L Class 3A chloride standard, the 100 mg/L Class 3B chloride standard is close to the mid-point in the range given for the “Good” category, and the “Poor” category listing of chloride levels of “over 250” mg/L corresponds to the Class 3C chloride standard of 250 mg/L.

Table III-29 summarizes the range of recommended point of use threshold and limiting concentrations for chlorides from McKee and Wolf for the industrial sectors referenced under the chloride discussion in Exhibit UC-25.

Table III-29. Industrial Sector Recommended Chloride Criteria or Limiting Concentrations, McKee and Wolf (concentrations in mg/L).

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>McKee and Wolf Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brewing</td>
<td>60 – 100</td>
</tr>
<tr>
<td>Dairy</td>
<td>&lt; 30</td>
</tr>
<tr>
<td>Pulp and Paper</td>
<td>75 – 200</td>
</tr>
<tr>
<td>Sugar Manufacturing</td>
<td>20</td>
</tr>
</tbody>
</table>

After an examination of the rulemaking records for the 1966-67, 1970, and 1973 rule amendments on state-wide water quality standards, Agency staff has concluded that the basis for the Class 3 total hardness standards was derived from information in both McKee and Wolf and the ASTM Manual on Industrial Water and Waste Water. Why the particular Class 3 total hardness standards were chosen at the concentration levels as they were, however, remains an uncertainty. A paragraph entry in Exhibit UC-29 appears to be the extent of the direct supporting documentation on the inclusion of the Class 3 total hardness standards. This entry states:

“Excessive hardness is undesirable in water used in laundries, carbonated beverages, metal finishing, dyeing, food processing, paper and pulp mills, bottle washing, photography and leather goods processing. In vegetable and fruit canning salts of calcium and magnesium may combine with pectous substances forming insoluble pectides that toughen the product. Hardness in sugar manufacturing may form precipitates that accumulate in refined sugar.”
Table III-30 summarizes the range of recommended point of use threshold and limiting concentrations for total hardness concentrations for the industrial sectors referenced above as cited in either McKee and Wolf or the ASTM *Manual on Industrial Water and Waste Water*.

Table III-30. Industrial Sector Recommended Total Hardness Criteria or Limiting Concentrations, McKee and Wolf or ASTM (concentrations in mg/L as CaCO₃).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Laundering</td>
<td>0 – 50</td>
<td>50</td>
</tr>
<tr>
<td>Carbonated Beverages</td>
<td>200 – 250</td>
<td>250</td>
</tr>
<tr>
<td>Metal Finishing</td>
<td>not given</td>
<td>no entry</td>
</tr>
<tr>
<td>Textile</td>
<td>0 – 50</td>
<td>20</td>
</tr>
<tr>
<td>Food Processing (general)</td>
<td>10 – 250</td>
<td>Not given</td>
</tr>
<tr>
<td>Fruit and Vegetable Canning and Freezing</td>
<td>100 – 200 legumes 25 – 75</td>
<td>not given legumes 25 – 75</td>
</tr>
<tr>
<td>Paper and Pulp Mills</td>
<td>100 – 200</td>
<td>50 – 180</td>
</tr>
<tr>
<td>Bottle Washing (under Dairy Industry)</td>
<td>&lt; 180</td>
<td>No entry</td>
</tr>
<tr>
<td>Photography</td>
<td>&lt; 200</td>
<td>No entry</td>
</tr>
<tr>
<td>Leather Goods</td>
<td>50 – 513</td>
<td>50 – 135</td>
</tr>
<tr>
<td>Sugar Manufacturing</td>
<td>90</td>
<td>No entry</td>
</tr>
</tbody>
</table>

A broader perspective on the quality characteristics of the raw surface waters that have been used by the various industries is found in the 1968 Green Book (Exhibit UC-28 at page 189). Updates to the Green Book discussions on industrial water use requirements were provided in *Water Quality Criteria 1972*, National Academy of Sciences – National Academy of Engineering, March 1973 (commonly referred to as the EPA “Blue Book”, excerpt pages 368 – 396 are included as Exhibit UC-30). A brief entry on total hardness is also contained in *Quality Criteria for Water 1986*, EPA (commonly referred to as the EPA Gold Book). Exhibit UC-31 is the five page excerpt on hardness from the Gold Book, which cites to maximum hardness levels accepted by industry as a raw water source. The hardness concentrations presented in this document were taken from Blue Book Table VI-2 (Exhibit UC-30 at p. 370). The latest EPA criteria document update titled *National Recommended Water Quality Criteria: 2006*, Office of Water, Office of Science and Technology (4304T) does not contain specific criteria for industrial water use but does refer the reader back to the narrative statement in the Gold Book for the discussion on total hardness. Table VI-2 in the EPA Blue Book, titled *Summary of Specific Quality Characteristics of Surface Waters That Have Been Used as Sources for Industrial Water Supplies* is reproduced as Table III-31.

Strict adherence to the recommendations in Tables III-29 and III-30 indicates that it would seem to be necessary for a number of industrial surface water users to pre-treat raw water supply sources prior to the water’s in-plant use and product manufacture. The possible exceptions would be those facilities located in the relatively “soft” water regions in northern and northeastern Minnesota. The conclusions and recommendations offered in the Industrial Water
Supplies section of the EPA Blue Book provide a good summary and approach in dealing with industrial water use criteria. These conclusions and recommendations are listed below:

**Conclusions**

- *Industry is diversified in kind, size, and product. It incorporates many processes, including different ones to achieve the same ends. Water quality requirements for different industries, for various industrial processes within a single plant, and for the same process in different plants vary widely.*
- *Water quality requirements at point of use, as distinguished from requirements at point of intake, are established for a number of industrial processes but are inadequately defined or nonexistent for others.*
- *Modern water quality treatment technology permits water of virtually any quality to be treated to provide the characteristics desired by industry at point of use. Occasionally, this may be costly; but in general the cost of treating water for specific processes is acceptable to industry, because it is only a small part of the total production and marketing costs.*
- *Although water quality at point of use is critical for many industrial processes, industry’s intake water quality requirements are not as stringent as those for public water supplies, recreational or agricultural use, or support of aquatic life.*
- *Because of the diversity of industrial water quality requirements, it is not possible to state specific values for intake water quality characteristics for industrial use. Ordinarily these values lie between those that have been used by industries for sources of water and the quality recommended for other uses in other sections of this book.* [Table III-31, and Table VI-2 in Exhibit UC-30]

**Recommendations**

Desirable intake water quality characteristics for industrial water supplies can be meaningfully designated as a range lying between the values that have been used by industry for sources of water (Table VI-2) and the quality characteristics recommended for other water uses in other chapters of this Section. Values that exceed those in Table VI-2 would ordinarily not be acceptable to industry. [Table III-31]

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Industrial (mg/l)</th>
<th>Utility (mg/l)</th>
<th>Mine (mg/l)</th>
<th>Process Water</th>
<th>Mining Industry</th>
<th>Oil Recovery Injection Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfate (SO₄²⁻)</td>
<td>110</td>
<td>50</td>
<td>50</td>
<td>25</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Chloride (Cl⁻)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Magnesium (Mg²⁺)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Calcium (Ca²⁺)</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Sodium (Na⁺)</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>80</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Ammonium (NH₄⁺)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chloride (Cl⁻)</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>850</td>
<td>850</td>
<td></td>
</tr>
<tr>
<td>Sulfate (SO₄²⁻)</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Phosphate (PO₄³⁻)</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Dissolved Solids</td>
<td>35,000</td>
<td>35,000</td>
<td>35,000</td>
<td>35,000</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>Suspended Solids</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td></td>
</tr>
<tr>
<td>Temperature, °F</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>

* Water containing less than 1.00 mg/l dissolved solids.
* May be ≤ 1.00 mg/l for mechanical polishing operations.
* For vessels ≥ 2 mm diameter.
* 10 mg/l for pressure above 700 psi.
* 1 mg/l for finishing.
* ≤ 5 mg/l for finishing.
* Applies to blended chemical pulp and paper only.
* 10 mg/l for finishing.
* No finishing.

Book III 140
D. NEED FOR 3B TO 3C USE CLASS CHANGE [VIII. class 3]

1. Introduction [VIII.D. need, class 3]

Two reasons have been identified for the need to implement the Class 3B to Class 3C changes. The first has to do with the overly restrictive nature of the Class 3B chloride and total hardness standards; and the second relates to the comparable standards that have been adopted by states adjacent to Minnesota as well as other states in EPA Region 5.

2. Restrictive Default Classification [VIII.D. need, class 3]

The broad application of the Class 3B use classification, particularly through the “Unlisted Waters” provisions of Minn. R. 7050.0430, needs to be reconsidered due to the restrictive nature of the chloride and total hardness standards that are assigned under this water use classification. The 100 mg/L chloride standard is overly restrictive in that it becomes the controlling standard that affects discharges to watercourses that have little potential for use as industrial source water supplies due to their limited stream flow characteristics. The 250 mg/L total hardness standard is also thought to be overly restrictive given the fact that in many areas of the state, natural background total hardness concentrations exceed this standard.

The salinity related parameters of chloride, sodium, salinity, total dissolved salts (total dissolved solids), bicarbonates, specific conductance, and total hardness have become increasingly problematic standards to address in the permitting process for a number of new or expanding facilities discharging to low flow receiving waters. For certain industrial and food processing sectors, increased salinity content in their wastewater effluents can be the result of process related chemical additions, water conditioning residues resulting from the pre-treatment of their incoming water supply to achieve a high degree of purity, and/or internal water conservation measures being practiced at the facility. These factors or practices can contribute to a build-up of dissolved solids in the effluent. Many of these dissolved constituents are not removed by conventional wastewater treatment technologies and therefore require specialized treatment processes for their removal.

A provision in Minnesota’s water quality standards rule requires discharges of sewage, industrial waste, and other wastes to be controlled so that the applicable water quality standards will be maintained at all stream flows at or above the seven-day low flow with a 10-year recurrence interval (7Q_{10}; 30Q_{10} for ammonia; Minn. R. 7050.0210, subp. 7). Facilities discharging to low flow receiving waters that do not have adequate upstream dilution flows are faced with the potential of having the Class 3B standards applied as end-of-pipe effluent limits. Achievement of these limits can be costly; potentially requiring the addition of a reverse osmosis or nano-filtration types of treatment systems to remove the dissolved minerals from the waste stream. This type of treatment is also very energy intensive since the dissolved mineral constituents removed from the wastewater generally require an evaporative treatment step to concentrate the residual solids to an appropriate level that allows for landfill disposal. Given the capital and operating costs associated with these salt removal treatment technologies, there has been a notable increase in the number of variance requests from new and expanding industrial facilities faced with the assignment of effluent limits associated with these salinity related standards.
Even though the recent focus on salinity related parameters has been directed towards industrial dischargers, salinity related concentrations can also be found at elevated levels in certain municipal wastewater treatment facility effluents. The most likely source contributing to this problem comes from individual home water softening systems that discharge to these treatment plants. Most home water softening systems use an ion exchange unit. In this type of ion exchange process, the calcium and magnesium hardness cations are removed by passing the water through an ion exchange resin. When this is done, the calcium and magnesium cations are “exchanged” for the sodium ions in the resin. Periodic regeneration of the ion exchange resin is necessary in order to “strip” the resin of the accumulated calcium and magnesium ions and regenerate the sodium ion content of the resin material. This regeneration process is usually accomplished by flushing the resin material with a salt-brine (sodium chloride) solution. In municipalities, this brine solution is discharged to the sanitary sewer system, increasing the chloride load to the wastewater treatment facility.

While it is recognized that this ion exchange regeneration process can significantly increase the chloride concentration in municipal wastewater effluents, to date salinity related effluent limits have not been assigned to municipal facilities. Albeit a remote possibility at this time, the potential does exist where municipal treatment facilities could also be assigned stringent salinity related effluent limits, particularly if they are geographically located in hard water areas of the state. Should this happen, staff anticipates a dramatic increase in the number of variance applications from cities seeking relief from these limits.

From an administrative standpoint, if the Class 3B to Class 3C changes are adopted, fewer variance requests would be anticipated. Variance application, review, and processing can be time intensive and costly to both the state and the applicant. More importantly, however, is the fact that the proposed amendments will enable the Class 2 aquatic life based chloride standard to become the controlling standard for use in calculating chloride effluent limits. The Class 2 aquatic life based chloride standard has long been perceived to be a more defensible standard as compared with the Class 3B standard when processing variance applications. For those situations where the discharge is to a low flow watercourse, which due to the small flow, has limited potential for industrial uses, the Class 2 chloride standard becomes the more scientifically based and reasonable standard to protect the resource.

3. **Industrial Use Standards of Other States** [VIII.D. need, class 3]

The Class 3B to Class 3C changes would also bring Minnesota’s chloride standards closer in-line with those of our neighboring states of North and South Dakota, Iowa, Wisconsin and the other EPA Region 5 states of Michigan, Illinois, Indiana and Ohio. While ambient total hardness concentrations are needed to determine water quality standards for certain trace metals, Minnesota is unique among these states in its inclusion of total hardness as an actual water quality standard. Exhibit UC-20 provides a comparison summary of the chloride water quality standards for Minnesota and these other states.
4. **Summary** [VIII.D. need, class 3]

The proposed changes to the “default” industrial use classification from Class 3B to Class 3C will allow for the application of less restrictive chloride and total hardness standards for all waters classified under the “unlisted waters” provisions of Minn. R. 7050.0430, and for a subset of waters classified in Minn. R. 7050.0470. These proposed changes will bring the chloride standards closer in-line with neighboring states’ standards. None of the other neighboring states or other Region 5 states has a water quality standard for total hardness. A need also exists for a broader evaluation of the salinity related standards found in Minn. R. 7050 and this review may result in proposed amendments for these standards during a future rulemaking.

E. **REASONABLENESS OF CLASS 3B TO 3C CLASSIFICATION CHANGES, REQUIRED INFORMATION** [VIII. reasonableness, class 3]

1. **Introduction** [VIII.E. reasonableness, class 3]

Minnesota Stat. § 14.131 requires that this SONAR, as part of demonstrating the reasonableness of the proposed amendments, include information about affected parties, costs and other topics that are covered in the following 11 sections. The discussion in these sections pertains only to the proposed Class 3B to 3C water use classification changes.

2. **Classes of Persons Affected by the Proposed Rule Amendments, Including Those Classes that Will Bear the Costs and Those that Will Benefit** [VIII.E. reasonableness, class 3]

The persons potentially most impacted by the proposed change in the Class 3 default classification from 3B to 3C are the municipalities and industries that withdraw surface waters for drinking or for industrial uses, particularly those that take water from relatively low flow streams. These entities could see increases in the costs to treat the water they use because of possible increases in the concentrations of chloride and total hardness in the source water. Total hardness appears to be the standard most associated with potential increased costs because it is associated with water softening practices. In general, treatment costs increase as the concentrations of these constituents increase in source waters (see Sections VIII.G.3 and VIII.G.4).

For the most part the Agency’s analysis of potential increased treatment costs due to this proposed change represents the very high end of potential costs. True costs are likely to be much lower for most facilities and lower still for those facilities appropriating water from main-stem river systems with higher flow volumes.

If adopted, the proposed changes will likely provide the greatest benefit to certain industrial facilities in the food processing, ethanol, and water conditioning sectors that have an existing or future wastewater discharge to low flow receiving waters. This potential “benefit” is tempered by the fact that even with adoption of the proposed changes, the saline nature of some of these effluents indicates that additional source water or wastewater treatment will be required even to...
meet the less restrictive standards. There is a possibility that the classification changes will reduce the need for variances, which if true will save effected parties and the Agency administrative costs. The Agency has not attempted to quantify these possible cost savings, but they would likely to be small.

The citizens most likely to be impacted are those that live in the communities that appropriate surface waters for drinking water purposes from river systems that experience seasonal low flows. Additionally, more wide-spread and widely-distributed cost impacts could be felt by citizens and industry if the power generating facilities were to be impacted by the proposed Class 3 to Class 3C amendments. The potential costs incurred by municipal or industrial entities would be passed on to customers in the form of higher water usage charges or increased commodity prices.

The general public recreating on waters of the state will neither benefit or be impacted by the proposed changes. Agricultural, commercial, and other water appropriators using surface waters for irrigation purposes could be impacted by the proposed changes but these impacts are thought to be minimal since only one percent of the total surface water appropriations are for irrigation versus a 31 percent use of ground water for this purpose. Environmental groups may be concerned about potential environmental consequences of the proposed changes. These potential impacts are impossible to quantify. However, the Agency believes that any environmental harm should be negligible.

3. **Estimate of the Probable Costs to the Agency and Other Agencies of Implementing and Enforcing the Rule Amendments, and Any Anticipated Effect on State Revenues** [VIII.E. reasonableness, class 3]

The staff does not anticipate any costs to the Agency or other agencies as a result of the proposed Class 3 changes. The Agency might see modest cost savings, if the adopted changes result in fewer variance requests from permittees. Also the issuance of permits may be simplified for the affected dischargers.

4. **Determination of Whether There Are Less Costly or Less Intrusive Methods of Achieving the Rule Amendments’ Purpose** [VIII.E. reasonableness, class 3]

MPCA staff do not believe there is a less costly or less intrusive approach to solving this longstanding problem of the nearly universal applicability of unnecessarily stringent industrial use standards for chloride and total hardness.

5. **Describe Any Alternative Methods for Achieving the Purpose of the Proposed Rule Amendments that the Agency Seriously Considered and the Reasons Why They Were Rejected in Favor of the Proposed Amendments** [VIII.E. reasonableness, class 3]

A change in the default Class 3 classification applicable to most surface waters (plus 106 waters listed in Minn. R. 7050.0470) is the least costly means open to the Agency to solve the problem mentioned in the previous Section. This approach is far less costly than the alternative of researching industrial use standards and proposing alternative numeric standards. Although this
may be included as part of a future rulemaking because of the uncertain basis for the current Class 3 standards (Section VIII.C), and the fact that they have never been updated or revised since adopted in 1967. A complete review is overdue but it will be time consuming. The Agency did not seriously consider this alternative to what is being proposed because of the lack of time to include such a review in this rulemaking.

6. **Estimate of the Probable Costs of Complying with the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [VIII.E. reasonableness, class 3]

The possible costs to affected parties are discussed in Section VIII.G.

7. **Estimate of the Probable Costs of Not Adopting the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [VIII.E. reasonableness, class 3]

Not adopting the proposed Class 3 change would mean continuation of the status quo for the Agency and affected permittees. The need for certain permittees (those on low flow streams or those with high background concentrations in source water) to meet stringent standard-driven effluent limits would remain the same. Also the need for permittees to seek variances to the Class 3B standards (which they may need even with relaxed standards), and the complications associated with preparing and issuing permits for the impacted facilities would remain the same. However, not adopting the proposed change could save potentially affected parties added treatment costs as described in Sections VIII.G.3 and VIII.G.4.

8. **Differences Between the Proposed Rule and Existing Federal Regulations and the Need for and Reasonableness of Each Difference** [VIII.E. reasonableness, class 3]

The Agency is not aware of any differences in what is being proposed and federal regulations.


Minnesota Stats. §§ 14.002 and 14.131 require state agencies, whenever feasible, to develop rules and that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency’s regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals.

Classification designations and the associated numeric standards are by necessity prescriptive, and therefore we believe not inconsistent with the spirit of this statute. The general concepts of how prescriptive or flexible a water quality rule should be are discussed in SONAR Book 1, Section VIII.I.

Minnesota Stat. §§ 14.131 and 14.23 require the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made. These specific notification requirements are discussed in Section IV.C.10 and will not be repeated here. The Agency outlined its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I.

The Agency made a special effort to solicit comments and input from parties potentially impacted by the Class 3B to 3C change (Section VIII.G.5). A solicitation for comments was sent to members of the Minnesota Chamber of Commerce Environment and Water Quality Committee (Exhibit UC-34). This organization is comprised of a number of representatives in the food processing, power generation, mining, petroleum refining industries, water treatment engineering companies, municipal wastewater treatment facilities, consultants and law firms. In general, very few comments were received.

11. **Consultation with the Commissioner of Finance Regarding Fiscal Impacts on Local Governments [VIII.E. reasonableness, class 3]**

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency provided the Department of Finance with a copy of the proposed rule and SONAR at the same time as these items were sent to the Governor’s Office. This timing allows the fiscal impacts and fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with the Governor’s Office review.

12. **Agency Determination Regarding Whether Cost of Complying with Proposed Rule in the First Year After the Rule Takes Effects Will Exceed $25,000 [VIII.E. reasonableness, class 3]**

Minnesota Stat. § 14.127, subd. 1 and 2 requires the Agency to determine if the cost of complying with a proposed rule in the first year after the rule takes effect will exceed $25,000 for:

- Any one business that has less than 50 full-time employees, or
- Any one statutory or home rule charter city that has less than ten full-time employees.

The Agency outlines potential “worst-case” costs in Section VIII.G, and costs could exceed $25,000 for some parties covered by this statute. However, it seems very unlikely that there will be any costs to any party in the first year if this proposal is adopted. The reasons are:
• The costs discussed in Section VIII.G are based on the rather extreme premise that instream chloride and total hardness concentrations will increase to match the level of the standards (250 mg/L chlorides and 500 mg/L hardness) after the change is adopted.
• Even if concentrations do increase over time as a result of the change in standards (we have no evidence that they will but they may increase for reasons independent of the standards), it is very unlikely they would increase measurably in one year after enactment.
• NPDES/SDS permits are valid for five years. Even if the permit for an impacted facility expires the day after the changes were adopted (and upstream concentrations increased necessitating additional treatment), the facility would be afforded time to design and build the additional treatment facilities.

It is conceivable that an impacted facility could incur costs greater than $25,000 in the first year if, 1) ambient chloride or hardness concentrations increase enough to trigger the need for additional treatment, and 2) they have the physical facilities and plant equipment in place for additional treatment and the added costs are due to changes in the operation of the facility. The Agency views this scenario as highly unlikely.

F. REASONABLENESS OF CLASS 3B TO 3C CLASSIFICATION CHANGES [VIII. reasonableness, class 3]

1. Introduction [VIII.F. reasonableness, class 3]

The proposed Class 3B to Class 3C amendments are reasonable because they mean a more defensible set of standards (chlorides and total hardness) and potential effluent limits applicable to:
• Facilities that employ water conservation measures; and
• Facilities located in areas of the state that have waters naturally high in dissolved solids (especially in relation to the hardness standard).

Also, the proposed Class 3B to Class 3C amendments:
• May help reduce the need for variances in the future; and
• The change in the use classifications does not mean a change in the water quality of Minnesota’s surface waters.

2. Limited Water Quantity Situations and Variances [VIII.F. reasonableness, class 3]

Under the current use classification system the Class 3B 100 mg/L chloride standard has become, or has the potential of becoming, the controlling standard for many discharges to low flow receiving waters. Recently this has prompted the filing of a number of variance applications from existing and potential dischargers to these receiving waters. Even with the proposed Class 3B to Class 3C amendments which would change the applicable water quality standard for chloride from 100 mg/L to 230 mg/L, (based on the Class 2B chronic standard for
chloride), Agency staff anticipate that there will continue to be facilities who pursue variances from the more lenient chloride standard due to their source water quality and the number of times this water is recycled throughout the particular facility.

In analyzing the merits of these variance requests, it is reasonable to assess these discharges from the perspective of their potential impact on the aquatic community rather than from the perspective of a potential industrial use of these low flow receiving waters. The lack of water quantity limits these receiving waters for use as industrial, commercial, or municipal source water supplies. Assessing the potential aquatic life impacts in these instances relating to chloride and total hardness is believed to be a more defensible approach to use in variance evaluations and the process by which effluent limits are assigned.

3. High Background Concentrations [VIII.F. reasonableness, class 3]

In general, total hardness effluent limits have not been assigned to either industrial or municipal wastewater discharges. The only exception to this policy has been a mining facility in northeastern Minnesota. Over the last couple of years, however, greater scrutiny has been directed toward food processing and ethanol production facilities with effluents containing high levels of dissolved solids, including the calcium and magnesium ions which make-up total hardness. Many of these facilities are located or are being proposed in areas of the state where both surface and ground waters are high in dissolved solids. Some of these same areas of the state are places where water conservation measures are required given the scarcity of water resources to draw upon. For those facilities with wastewater discharges, the net effect is effluents high in dissolved solids being discharged to receiving waters that in many cases have little or no stream flows at 7Q10 conditions.

Historically, effluent hardness has not been considered to be a significant problem needing attention or control. Unlike the chloride standards, there is no comparable drinking water or aquatic life standard for either total hardness or the calcium and magnesium ions making up this water quality characteristic. The reasonableness of changing the Class 3B water use assignments to the Class 3C uses lies primarily with the fact that surface and ground waters in many areas of the state have background water quality that naturally exceed the Class 3B hardness water quality standard. Couple this with the water conservation provisions in Minn. R. 6115.077 that promote the wise and efficient use of water resources. It seems inconsistent and counterproductive to implement water conservation practices (in-plant recycling) on one hand and then on the other, apply stringent effluent limits on the wastewater effluents that have elevated dissolved solids due in part to water conservation practices. Rather than being credited for implementing water conservation practices, these facilities are in a sense being penalized for their water conservation efforts. This makes implementing this largely voluntary program to conserve water that much more difficult to achieve.

4. Change in Standards Does Mean Change in Water Quality [VIII.F. reasonableness, class 3]

The Class 3B standards for chloride and total hardness when first adopted in the 1960s were intended to provide industries with source waters suitable for their general use with only a
moderate degree of treatment. This remains the goal of the Agency. The proposed Class 3B to Class 3C amendments in themselves will not materially alter the quality of the raw source waters that are utilized by industrial facilities and therefore will not substantially impact the use of these surface waters for the industrial processes.

As a general rule, wet industries or power generation facilities are not likely to rely on low flow rivers or streams as their source water supplies. The Class 3B to Class 3C amendments are being proposed in order to provide some balance between the actual or potential costs of treating the water to an industry specific quality level with the actual or potential costs associated with chloride and/or total hardness removal from industrial or municipal wastewater effluents. If there are situations where chloride or total hardness effluent limits are needed to accommodate the quality requirements of a downstream water appropriator, then Agency staff believes that it is reasonable that these assignments be done on a case-by-case basis rather than through an effluent limit assignment process based on an automatic presumptive industrial use of the particular receiving water.

G. ECONOMIC IMPACT OF CLASS 3B TO 3C CLASSIFICATION CHANGES [VIII. economics, class 3]

1. Introduction [VIII. G. economics, class 3]

In this Section we assess the potential cost implications of the proposed Class 3B to Class 3C changes. Municipalities and industries that withdraw water for drinking or industrial uses may be impacted. In general, the Agency has evaluated potential added costs by making “worst-case” assumptions. In this way we can quantify “maximum” possible costs. True costs are likely to be much lower. This is because the fact that the standard changes does not mean that chloride and total hardness concentrations in rivers and streams will increase. Effluent limits and other controls on the discharge of these water quality characteristics are not changing and will still be implemented.

There is a possibility that the change will reduce the need for variances, which if true will save the effected party and the Agency administrative costs. The Agency has not attempted to quantify these possible cost savings, but they would likely to be small.

2. Water Withdrawals [VIII. G. economics, class 3]

Assessing the potential costs associated with the Class 3B to Class 3C changes first required the identification of those facilities in the state that utilize surface waters. The Minnesota Department of Natural Resources (MDNR) is the state agency responsible for the issuance of water appropriation permits and any individual, agency, corporation, or entity that appropriates water in excess of 10,000 gallons per day or 1 million gallons per year must obtain a water appropriation permit from the MDNR. MDNR provided the Agency with a listing of 642 active non-irrigation surface water permits. This list contains the name of the water appropriator, the water name and location of the water withdrawal, a descriptive water use code, the permitted pumping rate and yearly maximum water appropriation, and five years of reported water
withdrawal records (Exhibit UC-32). Additional information was obtained from the MDNR water appropriations permit program’s Web site that has a compilation of Minnesota water use data by major water use categories for 2005.

In Minnesota an estimated 1,428 billion gallons of surface and ground water was used by water appropriation permit holders in 2005. The major water use categories, water use percentage estimates, and a category description are listed as follows.

Power Generation – 63%. The water is used to cool power generating plant equipment. This is historically the largest volume of use and relies almost entirely on surface water sources. Power generation use is primarily non-consumptive, in that most of the water withdrawn is returned to its original source.

Public Supply – 15%. Water is distributed by community suppliers for domestic, commercial, industrial, and public users. The category relies on both surface and ground water sources.

Industrial Processing – 11%. Water under this category is used in mining activities, paper mill operations, and food processing. Three-fourths or more of withdrawals are from surface water sources.

Irrigation – 6%. Water is withdrawn from both surface water and ground water sources for major crop and noncrop uses. Nearly all irrigation is considered to be a consumptive use.

Other – 5%. This category refers to waters that are used for activities such as air conditioning, construction dewatering, water level maintenance, and pollution abatement.

Of the 642 active non-irrigation permits noted on Exhibit UC-32, approximately 500 permits (78%) have been issued for activities that include: sand and gravel washing operations (code 244); construction dewatering activities (code 252); lake level, mine, quarry, and sand/gravel pit dewatering activities (codes 261, 262, 263, and 264); aquaculture uses (code 272); snow and ice making (code 273); and wild rice operations (code 296). The proposed Class 3B to Class 3C amendments will have little to no impact on these activities.

The remaining water appropriation permits have been issued primarily for municipal waterworks (code 211); cooling water use for power generation facilities (codes 222, 223, 225, 226, 229); commercial cooling (code 231); agricultural food and livestock processing (code 241); pulp and paper processing (code 242); and mine processing (code 243). In this latter grouping, the municipal water treatment plants located in “hard” water areas of the state show the greatest potential for increased cost of treatment if the proposed Class 3B to Class 3C amendments were to be adopted and if there is an increase in the total hardness concentrations of the source water supplies.

3. Municipal Water Treatment Facilities [VIII. G. economics, class 3]

In order to quantify possible additional costs, data was obtained from the Minnesota Department of Health, which identified 22 community water systems that utilize surface waters, either
wholly or in part, as their source water supplies. Seven of these communities withdraw water from Lake Superior, the Rainy River, or Burntside Lake. These waterbodies will retain their current Class 3A or Class 3B use classifications. Fifteen of these community water systems are on waters that would be affected by the proposed Class 3B to Class 3C changes. Of this list of fifteen, eight municipalities include water softening as part of their water treatment processes (Table III-32). The remaining seven of the fifteen are located in the soft water areas in the northeastern part of the state.

Table III-32. Municipalities Potentially Impacted by the Proposed Class 3B to 3C Classification Change.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Surface Water Source</th>
<th>Avg. Daily Rate, gallons per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minneapolis</td>
<td>Mississippi River</td>
<td>70,000,000</td>
</tr>
<tr>
<td>St. Paul Regional Water Services</td>
<td>Mississippi River/ Chain of Lakes</td>
<td>45,000,000</td>
</tr>
<tr>
<td>St. Cloud</td>
<td>Mississippi River</td>
<td>7,473,521</td>
</tr>
<tr>
<td>Moorhead</td>
<td>Red River of the North</td>
<td>4,400,000</td>
</tr>
<tr>
<td>Fergus Falls</td>
<td>Otter Tail River via Hoot and Wright Lakes</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Fairmont</td>
<td>Budd Lake</td>
<td>1,485,000</td>
</tr>
<tr>
<td>Thief River Falls</td>
<td>Red Lake River</td>
<td>1,180,000</td>
</tr>
<tr>
<td>East Grand Forks</td>
<td>Red Lake River</td>
<td>1,120,000</td>
</tr>
</tbody>
</table>

Drinking water sold to users from community water systems is based on a charge per unit of measure represented by either 1,000 gallons or 100 cubic feet. One-hundred cubic feet of water is equivalent to about 750 gallons. A 1995 reference published by the American Water Works Association indicated that in the United States the typical cost for drinking water was about $2.00 for 1,000 gallons. This same reference indicated that 1,000 gallons of water would serve one consumer for about 20 days. Of the amount charged for 1,000 gallons of tap water, about $0.30 - $0.40 goes to water treatment, the rest is for operation and maintenance of the plant, storage and distribution systems, and employee wages. Water softening costs would be a subset of this $0.30 - $0.40 per 1,000 gallon range in treatment costs.

In order to assess projected water softening costs for the community supply systems using surface waters identified above, Agency staff, working with the Minnesota Section of the American Water Works Association, sent an informal inquiry to these communities asking for estimated water softening treatment costs if the total hardness standard were to changed from 250 to 500 mg/L CaCO₃. Summaries of the responses are provided below. Potential chloride increases were not evaluated since the secondary drinking water standard for chloride is 250 mg/L, which is the same as the Class 3C chloride standard.

The following cost estimates assume the total hardness of the source water increases from existing ambient levels to the level of the Class 3C standard, 500 mg/L as CaCO₃. Thus the potential increased costs discussed below are considered worst case scenarios. As previously
stated, the fact of changing the standard does not mean that concentrations in rivers and streams around the state will increase to the level of the standard or increase at all.

Minneapolis, St. Paul Regional Water Services, and St. Cloud. Representatives from these three water treatment plants indicated that the proposed Class 3B to Class 3C amendments would not be an issue of concern to their on-going water softening operations. This view in part was based, 1) on the high volume flow rate of the Mississippi River (the 7Q10 of the Mississippi River at Anoka is 1,300 cubic feet per second or approximately 840 million gallons per day), and 2) the remote likelihood that the total hardness of the river would ever have a sustained concentration anywhere near 500 mg/L CaCO3. The total hardness of the Mississippi River in the north metropolitan area generally averages around 180 mg/L as CaCO3.

Moorhead. A detailed response was provided by the city of Moorhead on hardness removal costs based on their 2006 chemical bid prices of $137.50 per ton for lime and $233 per ton of soda ash and an on-average cost for lime sludge disposal of $40 per million gallons of water treated. A range of projected costs were calculated for different types of hardness resulting from the variations of anions associated with the calcium and magnesium cations in the river water. Monitoring data from the Red River of the North in the Moorhead area shows an average total hardness of around 250 mg/L CaCO3. The additional removal costs to treat for calcium and magnesium carbonate and bicarbonate hardness ranged from $130 - $220 per million gallons of water treated. The calcium and magnesium non-carbonate removal costs, hardness dominated by the presence of calcium and magnesium sulfates or chlorides, ranged from $300 - $480 per million gallons of water treated. Using the lower ($130) and upper ($480) projected cost estimates and an average of 1.337 billion gallons per year withdrawn from the Red River of the North results in a range of additional treatment costs for softening of raw water with a total hardness around 500 mg/L CaCO3 from $174,000 - $642,000 per year. This translates to an average increase to a four-person residential household of $11.40 – $42.05 per year. This would represent a 4 – 15 percent increase in the yearly water-volume usage charge to the four-person household. (Four-person household cost increase estimates based on a 60 gallon per day per person water usage, a water volume charge of about $3.20 per 1,000 gallons at the tap, and average current total hardness concentration of 250 mg/L CaCO3 for the Red River of the North at Moorhead, Minnesota.)

Fergus Falls. The total hardness of the water appropriated from Wright Lake by the Fergus Falls water treatment plant is generally in the range of 180 – 200 mg/L CaCO3. In 2005 Fergus Falls used 482 tons of lime to soften 559,837,000 gallons of water to produce a finished water with a total hardness of around 84 mg/L CaCO3. The total cost for the lime used in 2005 was $66,900. The 2005 cost of the lime chemical alone was approximately $120 per million gallons of water treated. This represents $10.50 per year for a four-person household to cover the softening cost of the lime used. If instead of treating raw water with a hardness of around 190 mg/L CaCO3 the incoming water raises to a concentration of 500 mg/L, the estimated annual softening charge becomes $30 per four-person household. This estimate factors in a lime sludge disposal cost of $40 per million gallons of water treated.

Fairmont. The City of Fairmont uses a lime/soda ash chemical precipitation softening process to treat lake water from Budd Lake to a level between 85 - 100 mg/L hardness. At the time of the
survey response, the lake water was running about 208 mg/L total hardness as CaCO₃ and the average daily production was 2.3 million gallons. The Fairmont Water/Wastewater Superintendent provided a breakdown on the individual costs for lime and soda ash to treat the raw water on an incremental basis over a total hardness range between 200 to 500 mg/L CaCO₃. Based on these calculations, it costs $125 per million gallons to soften incoming raw water at 200 mg/L hardness versus $316 per million gallons for incoming water at a total hardness of 500 mg/L CaCO₃. Chemical costs for water softening would increase from $105,100 to $265,400 per year to treat incoming water with a total hardness of 500 mg/L CaCO₃. After adding in an estimated lime sludge disposal cost comparable to that cited above, it would change the yearly softening proportion of the water bill for a household of four-persons from $14.45 to about $31 per year.

**Thief River Falls.** Total hardness of the Red Lake River in the Thief River Falls area ranges between 180 – 200 mg/L as CaCO₃. The city uses lime to soften the finished water to a total hardness of about 120 mg/L. In 2005 the city treated 433,654,000 gallons of water with a lime cost totaling $28,700. A proportional estimate to treat incoming raw water at a 500 mg/L hardness would result in a lime usage cost of approximately $75,500 per year. An additional $17,000 per year is estimated to cover the cost for spent lime sludge disposal.

**East Grand Forks.** The East Grand Forks water treatment plant’s water intake on the Red Lake River is upstream of a low-head dam just upstream of the Red Lake River’s confluence with the Red River of the North. Information received from the city indicated that they estimate that the combined costs for pretreatment and water softening chemicals to be approximately $0.40 per thousand gallons. Minnesota Department of Health data indicates that water plant uses cationic polyelectrolyte chemicals in the coagulation phase of their pretreatment process as well as lime and soda ash for their chemical precipitation water softening. Based on an average yearly water appropriation of 419 million gallons, and assuming about one third of the $0.40 per thousand gallons goes for water softening chemicals, the city currently spends about $55,300 per year on chemicals to soften the water for their customers. Treatment cost estimates for additional chemicals specific to treating incoming raw water with hardness levels at 500 mg/L would bring this yearly allocation to approximately $131,700.

The preceding cost estimates are offered as examples of potential costs associated with treating source waters with total hardness increases to 500 mg/L CaCO₃. These estimates do not however, factor in other indirect costs related to higher solids removal requirements which could reduce the overall production capacities at these water treatment plants. On average, if source waters used by the above listed facilities increase to the Class 3C hardness standard, yearly softening costs might be expected to double or triple above the dollar amounts currently being spent for this water treatment process.

4. **Power Generating Facilities [VIII. G. economics, class 3]**

As noted above, power generation facilities as a category are the largest volume users of surface waters in the state; an estimated 902 billion gallons in 2005. Most of the water used at these facilities is once-through, non-contact cooling purposes although some of the surface water may also be used for boiler and other make-up water needs. These make-up waters, in particular
water used in high pressure boilers, undergo extensive corrosion inhibition, scale control treatment, and water conditioning prior to use. The once-through, non-contact cooling water on the other hand is generally used untreated except for intermittent feed additions of biocidal chemicals normally during the summer months to kill or inhibit biological growth. In Exhibit UC-30 Table VI-2 at p. 370 and Table VI-5 at p. 377 characterize the chloride and total hardness water quality concentrations of cooling waters that have been used and considered acceptable source waters. Under the freshwater subcategory, the maximum chloride concentrations listed for once-through cooling waters is 600 mg/L and 500 mg/L for make-up recycle waters. Under this same freshwater subcategory, the total hardness concentration for the once-through cooling is 850 mg/L as CaCO₃ and make-up recycle waters ranging from 650 - 850 mg/L as CaCO₃.

For power generation facilities with closed-cycle, recirculating cooling water systems, less surface water appropriation is needed when compared to once-through cooling water systems, but water conditioning chemical additives are generally required to prevent corrosion, scale build-up, and biological fouling of the condensers, cooling towers, and water distribution lines. Water from these evaporative closed-cycle cooling systems is lost through evaporation, drift, or blowdown. Drift is defined as the mechanical entrainment of the water droplets in the rising air exhausted from the top of the cooling tower. In order to restore the water lost through evaporation and drift, a continuous quantity of make-up water must be added to the recirculating water system. As water evaporates from a closed-cycle cooling system, dissolved and suspended substances gradually build-up and remain in the recirculating cooling water. In order to control this build-up to reasonable levels, a quantity of the recirculating cooling water is purposely discharged on a continuous basis. The cooling water discharged is called blowdown, and it must be replenished by make-up water to maintain the water balance.

An example of a facility using a recirculating cooling system is the Xcel Energy Sherburne County Generating Plant (Sherco) at Becker, Minnesota. Sherco is Minnesota’s largest electric generating plant with three coal-fired units producing a total of 2,400 megawatts of electricity. This plant withdraws water from the Mississippi River for cooling water purposes. Water is also obtained from on-site wells and from the City of Becker’s water treatment plant for in-plant water uses and drinking water. Currently the MDNR allows this facility to appropriate 10,750 million gallons per year from the Mississippi River. The reported 2005 surface water withdrawal by Sherco was 6,885.8 million gallons, plus an additional 374.8 million gallons of ground water from wells on the site. Sherco intermittently discharges cooling tower blowdown as an effluent to the Mississippi River. In 2005, Sherco reportedly discharged 1,070.92 million gallons of cooling tower blowdown water.

Information presented in Sherco’s 2005 annual report indicates that the recirculating cooling water systems concentrate the solids and chemical constituents of ambient river water until the specific conductance of the cooling water reaches approximately 1900 – 2000 microsiemens per centimeter. When this level of specific conductance is reached, most chemical constituents and suspended and dissolved solids are concentrated approximately six to ten times higher than levels in the ambient river water. Upstream ambient monitoring of the Mississippi River over the last 22 years shows yearly average total hardness of 153.8 mg/L CaCO₃ (range 130 – 178 mg/L) and an average chloride concentration of 7.8 mg/L (range 5 – 12 mg/L). Cooling tower blowdown water that does not get recycled-back for in-plant use is the only effluent discharge
from the facility. The excess blowdown is discharged to the Mississippi River via a holding pond.

Many recirculating cooling water systems operate at a slightly scale-producing condition. The objective of this type of operation is to develop a calcium carbonate film on the metal surfaces to prevent, or retard, corrosion. An operational challenge to this method of corrosion control is to maintain coverage of the carbonate film yet manage the system so the film does not become so thick that it significantly reduces heat transfer or clogs the condenser tubes. Minimization of excessive amounts of calcium carbonate (CaCO₃) scale in large evaporative cooling water systems is commonly done through the addition of sulfuric acid to reduce alkalinity of the source water. This acid addition form of treatment converts calcium bicarbonate dissolved in the incoming make-up water to volatile carbon dioxide and calcium sulfate. Calcium sulfate is more soluble than calcium carbonate and is managed at acceptable operating levels through periodic blowdown of the cooling water system. While sulfuric acid addition is considered to be less expensive than complete softening, it requires the installation of automatic controls to adjust the acid feed rate and maintain pH conditions so as to not cause excessive corrosion.

The typical quantity of sulfuric acid used for cooling tower pH and alkalinity control at the Sherco facility is reported to be about 500,000 gallons of 92 percent H₂SO₄ per year. Based on an estimated cost for sulfuric acid at $200 per ton, annual acid addition chemical costs for the closed-cycle cooling tower system is on the order of $746,000 per year. This estimated cost is in addition to the costs associated with the bromine and chlorine based additives to control biological growth and the molybdenum-based corrosion inhibiting salt also being used in the cooling water system. If under a hypothetical situation the hardness of the make-up water were to increase from 150 mg/L to 500 mg/L CaCO₃, this annual chemical cost would more than triple, assuming a linear relationship between the increases in total hardness and required acid addition volumes.

An incremental cost comparison such as this could be considered a conservative estimate based in part on the anionic chemical constituency of the hypothetical source water with a total hardness of 500 mg/L CaCO₃. If for instance this hypothetical source water was dominated by noncarbonate hardness compounds with high concentrations of the sulfate anion, the calcium sulfate CaSO₄ solubility product may be exceeded in the recirculating water which can then lead to precipitation and CaSO₄ scale development in the system. The CaSO₄ concentrations could then become the limiting factor for this acid addition type of water conditioning for scale prevention. Should such a scenario develop, other more costly cooling water treatment methods such as cold lime-soda softening of the make-up water or sidestream filtration and warm lime-soda softening of a portion of the recirculating water could become viable alternatives (Exhibit UC-33 at p. 241). Another option in the operation of the facility which would accommodate the use of source waters with higher total hardness levels could be a reduction in the number of times the water is recycled in the cooling system through an increase in the blowdown rate. This operational management approach is best suited in situations where available source water quantities are plentiful.

5. Comments from Industries and Impacts on the Paper Industry [VIII. G. economics, class 3]
As noted earlier in the discussion on the municipal water treatment facilities located on the Mississippi River, significant increases in the total hardness or chloride concentrations on the major river systems where most of the major power plants and other large surface water users are located seems to be very remote. While there is value in estimating potential costs impacts to these facilities that theoretically could result from the Class 3B to Class 3C amendments, as a practical matter total hardness or chloride concentrations along these river systems are expected to remain close to their current concentrations irrespective of the proposed classification changes. Early on when the Class 3B to Class 3C changes were being considered by Agency staff, a solicitation for comment was sent to members of the Minnesota Chamber of Commerce Environment and Water Quality Committee (Exhibit UC-34). This organization is comprised of a number of representatives in the food processing, power generation, mining, petroleum refining industries, water treatment engineering companies, municipal wastewater treatment facilities, consultants and law firms. This solicitation requested input from an industrial user’s perspective on the proposed change in the applicable chloride and total hardness standards for surface waters of the state that serve as source water supplies for many of these industries. One response was received to the solicitation from an individual representing Sappi Fine Paper North America, Sappi Paper Cloquet LLC (Sappi Paper) located in Cloquet, Minnesota. Sappi Paper’s comments concerned three issues: 1) increased corrosion in their carbon steel lines; 2) recovery boiler tube corrosion and lower dust melting temperature; and 3) increased hardness/chloride concentrations resulting from increased closure in the system. As noted in the Agency’s response, Exhibit UC-35, the source water supply for the Sappi Paper facility comes from Lake Superior, which is classified as a Class 3A water. No change in industrial use classification of Lake Superior is being proposed. Very few other comments were received.

While Sappi Paper will not be affected by the proposed Class 3B to Class 3C amendments, a discussion of the issues raised in their solicitation response follows. The Sappi Paper facility at Cloquet and the Boise Cascade mill along the Rainy River in International Falls are the two kraft paper mills in Minnesota. Wood pulp manufactured by the kraft pulping process basically separates the cellulose fibers from the lignins that bind these fibers together through a “cooking” process at high temperatures and pressure in an alkaline pulping liquor that contains sodium hydroxide and sodium sulfide. After separation producing this pulp, the spent pulping liquor is evaporated to a high concentration and then burned in a recovery boiler to recover energy to produce steam. The resulting inorganic chemical ash that remains after this combustion process is then used to re-constitute fresh pulping liquor. Some of these inorganic chemicals are also recovered in the electrostatic air emission control systems on the recovery furnaces.

As kraft mills increase their degree of internal recycling, non-process elements also accumulate within the system. Chloride and potassium are two non-process elements that can accumulate to high levels in highly closed pulp mills. High levels of chloride and potassium in the liquor can lead to operational problems in the recovery boilers by accelerating the plugging of the flue gas passages and increasing the rate of corrosion of the boilers by lowering the melting temperature of the ash generated during the firing process. This lowering of the melting point can result in a build-up of sticky deposits which can result in unscheduled maintenance downtime in order to go in and water wash these deposits from the boiler. A number of articles published in the Technical Association of the Pulp and Paper Industry Journal indicate that chloride and...
Total hardness concerns related to the build-up of scale in the mill’s water supply are similar to those faced by other industries with scale build-up in piping and boiler systems that can diminish heat transfer capabilities and increase pumping requirements. A reference in Exhibit UC-30 at page 383 indicates that elevated levels of total hardness in paper mills can also interfere with washing operations and can cause fouling in the resin sizing (paper surface finishing) and the digestion processes. Recent published mineral scale management case studies of several paper mills show that specific types of mineral scale build-up in various mill processes can be minimized through improved process control and minor process changes. (Exhibit UC-39 and Exhibit UC-40).

As a practical matter, no significant increases in either the chloride or total hardness concentrations are expected in the source supply waters for the above mentioned mills, the paper mills in Duluth, or along the Mississippi River in Grand Rapids, Brainerd, and Sartell, Minnesota areas. To illustrate the basis for this expectation, the following hypothetical example is offered to demonstrate the quality and quantity from an upstream discharge flow required to raise the instream chloride concentration to 75 mg/L, the recommended chloride value which appears for groundwood papers and soda and sulfite pulp production in Exhibit UC-30, Table VI-15 at p.384. Chloride was chosen for the example since it is considered a conservative constituent.

Hypothetical Example Assumptions:

- Receiving Water – Mississippi River in the Grand Rapids, Minnesota area.
- Mississippi River Q₉₀ flow value* – 374 cubic feet per second (242 million gallons per day), [USGS flow gaging station 05211000 in Grand Rapids].
- Background instream chloride concentration based on monitoring data collected between July 1967 and March 1991 from a sampling station on the Mississippi River eight miles southwest of Cohasset, Minnesota (upstream of Grand Rapids) – average value 4.2 mg/L chloride.
- Maximum instream source water target concentration – 75 mg/L chloride.
- Maximum allowable effluent chloride concentration based on Final Acute Value (FAV) end-of-pipe concentration – 1,720 mg/L chloride.

*In Minnesota, the MDNR has the ability to suspend consumptive water appropriation permits from main stem rivers, (Mississippi, Minnesota, Rainy, Red River of the North, and the St. Croix River) when the first designated main stem river gage downstream of the site of appropriation drops below the annual Q₉₀ exceedance flow value (Minn. Stat. 103G.285, subd. 2). The Q₉₀ flow is a statistical flow value that represents the river flow that is exceeded 90 percent of the time during the period of record analyzed. The annual Q₉₀ flow values are significantly higher than the 7Q₁₀ low flow down to which the chloride standards would apply for a given watercourse. In this case, the Minnesota Department of Natural Resources (MDNR) may authorize chlorination of the water supply to meet the chloride standard.
instance, the 7Q\textsubscript{10} low flow for the Mississippi River at Grand Rapids, Minnesota is 111 cubic feet per second.

Based on the assumptions listed above, an upstream discharge of 10.4 million gallons per day with an effluent chloride concentration of 1,720 mg/L would be needed to raise the instream chloride concentration of the Mississippi River to 75 mg/L at the Q\textsubscript{90} flow. Again, when the Q\textsubscript{90} flow is reached it triggers the suspension of consumptive water appropriations in the area. Thus, it would take a very sizable upstream discharge at the maximum allowable chloride concentration (the Class 2 chloride FAV), at the minimum allowable flow (Q\textsubscript{90}) for the chloride concentration to reach the source water target concentration.

To provide a context for the size of this hypothetical effluent flow, the average annual design flow for the current Grand Rapids WWTP is 14.35 million gallons per day. This facility treats domestic wastewaters from the city (2000 census population 7,764) as well as the domestic and industrial wastewaters from the UPM Kymmene (formerly Blandin) paper mill in town. Annual average design flow for the current WWTP at Brainerd (population 13,178) is 3.07 million gallons per day and for the St. Cloud WWTP (population 59,107) the average annual design flow is 13 million gallons per day.

6. **Summary of Potential Economic Impact** [VIII. G. economics, class 3]

On average, if source waters used by the municipal facilities listed in Table III-32 increase to the Class 3C hardness standard, yearly softening costs might be expected to double or triple above the dollar amounts currently being spent for this water treatment process. Potential cost increases to certain industries that are associated with scale prevention techniques to treat the incoming water could triple if water treatment and conditioning were the primary techniques employed. These estimates, however, are offered as examples of possible costs if the total hardness of the source water increases from what it is now to 500 mg/L CaCO\textsubscript{3}. The Agency has no evidence to suggest that chloride and total hardness concentrations will increase to such levels due to the change in classification from 3B to 3C.

H. **SUMMARY** [VIII. class 3]

The proposed Class 3B to Class 3C amendments are reasonable in that they are intended to strike a balance between the protection of the water quality needs of industrial users and the need to allow for the establishment of defensible effluent limits for discharges to low flow receiving waters that have limited potential for use as either industrial or municipal source water supplies. The fundamental assumption that all surface waters of the state can be used for industrial consumptive purposes does not realistically match the lack of water quantity associated with many of these waterbodies. The preferred method of insuring acceptable industrial source water quality is to assess the potential downstream impacts from current and future discharges that have the potential of impacting a specific industrial source water supply and to assign appropriate effluent limits designed to safeguard these uses. This site specific approach preserves the underlying intent to provide industrial users with suitable water sources. Effluent limits and the protection levels that they afford should be appropriate for the known and attainable uses of a given waterbody.
These proposed amendments address these issues through a use classification change that will be applicable to the majority of surface waters throughout the state. These amendments have been described as a first step towards a broader, more comprehensive analysis of the salinity related water quality standards contained in the State’s Class 2, Class 3, and Class 4 water use classifications. Preliminary analysis indicates that such an effort will likely result in additional proposed amendments during a future rulemaking.

If adopted into rule, changes to the chloride and total hardness standards resulting from the Class 3B to Class 3C amendments will likely provide the greatest benefit to certain industrial facilities in the food processing, ethanol, and water conditioning sectors that have an existing or future wastewater discharge to low flow receiving waters. This potential “benefit” is tempered by the fact that even with adoption of the proposed changes, the saline nature of some of these effluents indicates that additional source water or wastewater treatment will be required even to meet the less restrictive standards.

Those entities that would most likely be affected by these proposed changes are those municipalities and small volume industrial water appropriators on relatively low flow streams and rivers that rely on these waters as source water supplies for either domestic or industrial consumption purposes. In these situations, total hardness appears to be the standard that would potentially cause the most concern relative to the increased costs associated with water softening practices.
IX. UPDATES, ADDITIONS AND CORRECTIONS TO USE CLASSIFICATION LANGUAGE, MINN. R. 7050.0400 TO 7050.0470

A. INTRODUCTION AND USE CLASSIFICATION SYSTEM

This Section of the SONAR contains proposed changes to the parts of Minn. R. 7050 that deal with the beneficial use classifications, Minn. R. 7050.0400 to 7050.0470. The next two major sections will deal with the update of the list of trout waters (Class 2A), the proposed new limited resource value waters, and two other classification issues. All the changes discussed in this Section are non-substantive; i.e., the meaning and intent of the rule will not be changed as a result of the proposed revision.

The Agency recently adopted Minn. R. 7050.0405 as part of requirements of Minn. Laws 2003 ch. 128 § 156 (see SONAR Book I, Section I.B and Exhibit A-4). No changes are being proposed to Minn. R. 7050.0405 as part of this rulemaking, but this part will appear as new to most readers.

It may be helpful to briefly review Minnesota’s beneficial use classification system for surface waters as outlined in SONAR Book I, Section II.B.1. Minnesota has identified seven beneficial uses associated with surface waters, designated as Class 1 through Class 7 (Minn. R. 7050.0140). The use classes are listed below. The numbers 1 – 7 do not imply a priority rank to the use classes.

<table>
<thead>
<tr>
<th>Use Class</th>
<th>Beneficial Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Drinking water</td>
</tr>
<tr>
<td>Class 2</td>
<td>Aquatic life and recreation</td>
</tr>
<tr>
<td>Class 3</td>
<td>Industrial use and cooling</td>
</tr>
<tr>
<td>Class 4A</td>
<td>Agricultural use, irrigation</td>
</tr>
<tr>
<td>Class 4B</td>
<td>Agricultural use, livestock and wildlife watering</td>
</tr>
<tr>
<td>Class 5</td>
<td>Aesthetics and navigation</td>
</tr>
<tr>
<td>Class 6</td>
<td>Other uses</td>
</tr>
<tr>
<td>Class 7</td>
<td>Limited resource value waters (not fully protected for aquatic life due to lack of water, lack of habitat or extensive physical alterations)</td>
</tr>
</tbody>
</table>

While all surface waters are protected for multiple beneficial uses, it is useful to think of all surface waters as falling into one of two categories: a) those protected for aquatic life and recreation (Class 2), and b) those designated as limited resource value waters (Class 7). The vast majority of Minnesota surface waters are Class 2, fully protected for aquatic life and recreation. All Class 7 waters started out as Class 2 but each has been individually assessed and reclassified through rulemaking as a limited resource value water. Class 7 waters support a very limited aquatic community and offer limited opportunities for water-related recreation. As noted, all surface waters are assigned multiple uses. Both Class 2 and 7 waters (i.e., all surface waters of the state) are also designated as Class 3, 4A, 4B, 5 and 6, and are protected for the associated beneficial uses listed above.
Minnesota R. 7050.0470 is the section of the rule that specifically lists certain surface waters of the state under one of nine major surface water drainage basins. The waters specifically listed in Minn. R. 7050.0470, while numerous, makeup only a fraction of the total number of waters in Minnesota. Examples of waters that are specifically listed include trout waters, surface waters protected for drinking, outstanding resource value waters, and limited resource value waters. Most surface waters in the state are classified under the “unlisted waters” provisions of the rule, Minn. R. 7050.0425 and 7050.0430. All waters not listed in Minn. R. 7050.0470 are protected for aquatic life and recreation (Class 2), plus Classes 3, 4A, 4B, 5 and 6.

B. NEED FOR AND REASONABLENESS OF NON-SUBSTANTIVE CHANGES TO USE CLASSIFICATION LANGUAGE [IX. use class]

1. Minn. R. 7050.0400, Change in Heading and References [IX.B. need and reasonableness, use class]

Minnesota R. 7050.0400 introduces the parts of the rule that deal with the beneficial use classifications. The Agency proposes to add a more descriptive heading to Minn. R. 7050.0400 to make it more informative. Also, two citations to other rule parts are being changed. The first removes Minn. R. 7050.0400 from the range of parts cited because it is unnecessary to cite the part of the rule one is in. This change will make it consistent with how ranges of rule parts are cited in other introductory parts of Minn. R. ch. 7050. The second citation change is to the consolidated descriptions of the use classes in the revised Minn. R. ch. 7050.

7050.0400. PURPOSE. BENEFICIAL USE CLASSIFICATIONS FOR SURFACE WATERS; SCOPE.

Parts 7050.0400 7050.0410 to 7050.0470 classify all surface waters within or bordering Minnesota and designate appropriate beneficial uses for these waters. The use classifications are defined in part 7050.0200 7050.0140.

2. Minn. R. 7050.0420, Removal of Class 3C [IX.B. need and reasonableness, use class]

The Agency is proposing to remove the references to Class 3C waters in Minn. R. 7050.0420. This part of the rule specifies the use classifications applicable to trout waters. The current rule says that: “All [trout] waters listed in part 7050.0470 as Class 1B, 2A and 3B are also classified as Class 3C, 4A, 4B, 5 and 6 waters.” (emphasis added). The reference to Class 3C is not needed since these waters are already classified as 3B. The 3B classification, being a “higher” class, supersedes the Class 3C classification and standards. This change is being proposed as an off-shoot of the Agency’s proposal to change the “default” industrial use classification from 3B to 3C, but it is independent of this more substantive change (Section VIII). The Agency is not proposing to change the current 3B classification that all trout waters currently have, as listed in Minn. R. 7050.0470. A search of Minn. R. 7050.0470 found no Class 2A (trout) waters that were not also specifically classified as 3B.
The proposal, to remove “3C” from Minn. R. 7050.0420 is needed because it is redundant and superfluous. This change will have no impact on the protection of trout waters. It is independent of the larger proposed change to the industrial use classifications.

3. Minn. R. 7050.0450, Clarification of Multi-classifications [IX.B. need and reasonableness, use class]

The Agency is proposing to reword the first sentence in Minn. R. 7050.0450 that deals with multi-classifications. The need is to make it clear that it is not “if” a surface water is classified in more than one use class, but to clearly state that, in fact, all surface waters of the state are classified in more than one class. The concept of multiple classifications is commonly misunderstood, and this change will replace wording that tends to reinforce the misunderstanding with wording that is clear on this point. Minnesota R. 7050.0450 is quoted below showing the proposed change.

7050.0450 MULTICLASSIFICATIONS.

If a water All surface waters of the state are classified in more than one class, and all the water quality standards for each of the classes apply. If the water quality standards for particular parameters for the various classes are different, the more restrictive of the standards apply.

4. Minn. R. 7050.0460, Clarification of the List of Waters Specifically Classified and the Abbreviations Used [IX.B. need and reasonableness, use class]

The Agency is proposing several changes to Minn. R. 7050.0460. The first is the addition of “in part 7050.0470” to the heading of this part and the division of the part into three subparts (see wording below). These changes help define the content of the part and separate the different provisions for ease of citation.

The second proposed change is the addition of a sentence reminding people that most waters are not specifically listed in Minn. R. 7050.0470, and that they need to look at Minn. R. 7050.0425 and 7050.0430 for the beneficial uses assigned to waters not listed. This addition should reduce the number of people that become confused about applicable uses when they cannot find their waterbody of interest in Minn. R. 7050.0470. Confusion about the use classes assigned to unlisted waters is one of the most common pitfalls associated with the current rule.

The third proposed change is to change “waterbody” to “water body”. While the Agency prefers one word in its written documents, two words for this term is the convention throughout Minn. R. ch. 7050.

The fourth proposed change is a new listing of all the abbreviations and symbols used in Minn. R. 7050.0470 to a more “bullet-like” format, and to have them all in one place and easier to read. The abbreviations for township, range and section” are being moved as part of this change so they are listed with the others in the proposed new listing of all the abbreviations used in Minn. R. 7050.0470. Also, as part of this proposed change, some of the existing paragraphs
are moved within Minn. R. 7050.0460. No new abbreviations are proposed to be added and no existing ones are proposed for removal. All the proposed changes in Minn. R. 7050.0460 are shown below.

7050.0460. WATERS SPECIFICALLY CLASSIFIED IN PART 7050.0470.

Subpart 1. Explanation of listings. The waters of the state listed in part 7050.0470 are classified as specified. The specific stretch of watercourse or the location of a waterbody is described by township, range, and section, abbreviated as T., R., S., respectively. Any community listed in part 7050.0470 is the community nearest the water classified, and is included solely to assist in identifying the water. Most waters of the state are not specifically listed in part 7050.0470. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed.

Outstanding resource value waters are listed in part 7050.0470 and are denoted by an asterisk (*) preceding the name of the water resource. Following the name is the effective date the water resource was designated as an outstanding resource value water and a letter code that corresponds to the applicable discharge restrictions in part 7050.0180, subpart 3 or 6. The letter code P corresponds to the prohibited discharges provision in part 7050.0180, subpart 3. The letter code R corresponds to the restricted discharges provision in part 7050.0180, subpart 6.

Subp. 2. Outstanding international waters. The waters listed in part 7050.0470, subpart 1, that are not designated as outstanding resource value waters or classified as Class 7 waters are designated as outstanding international resource waters under part 7052.0300, subpart 3. Unlisted waters classified in part 7050.0430 and unlisted wetlands classified in part 7050.0425 that are located in the Lake Superior Basin are also designated as outstanding international resource waters under part 7052.0300, subpart 3.

Waters listed in part 7050.0470 that are classified as Class 2Bd are Class 2B waters also classified for domestic consumption purposes. Applicable standards for Class 2Bd waters are listed in part 7050.0222, subpart 3.

Waters designated as wild rice waters in part 7050.0470, subpart 1, are identified by the letters WR appearing in brackets following the name of the water.

Subp. 3. Abbreviations and symbols. The listings in part 7050.0470 include the following abbreviations and symbols:

T., R., S. means township, range and section, respectively.
An asterisk (*) preceding the name of the water body means the water body is an outstanding resource value water.

[month/day/year/letter code] following the name of the outstanding resource value water in brackets is the effective date the water resource was designated as an outstanding resource value water. The letter code (P or R) indicates the applicable discharge restrictions in part 7050.0180, subpart 3 or 6. The letter code P corresponds
to the prohibited discharges provision in part 7050.0180, subpart 3. The letter code R corresponds to the restricted discharges provision in part 7050.0180, subpart 6.

[WR] following the name of the water body means the water body is designated as a wild rice water in part 7050.0470, subpart 1.

Class 2Bd waters are Class 2B waters also protected for domestic consumption purposes (Class 1). Applicable standards for Class 2Bd waters are listed in part 7050.0222, subparts 3 and 3a.

5. Minn. R. 7050.0470, subp. 1 to 9, Additions to the Introductory Paragraphs [IX.B. need and reasonableness, use class]

The Agency proposes to reword the heading for Minn. R. 7050.0470, and to add a sentence to the introductory paragraphs in each of the nine subparts in Minn. R. 7050.0470. The heading needs to be reworded to clarify the language and make it more straightforward. The proposed new sentence to be added to each subpart reminds readers again to look at Minn. R. 7050.0425 and 7050.0430 for applicable use classes, if they cannot find the waterbody of interest in Minn. R. 7005.0470. The addition to Minn. R. 7050.0470, subp.1 is shown below as an example.

7050.0470 CLASSIFICATIONS FOR SURFACE WATERS IN MAJOR SURFACE WATER DRAINAGE BASINS.

Subpart 1. Lake Superior Basin. The water use classifications for the listed waters in the Lake Superior Basin are as identified in items A to B, and D. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed.

6. Minn. R. 7050.0470, subp. 1 to 9, Corrections and Housekeeping Changes [IX.B. need, and reasonableness, use class]

Since the original adoption of the water use classification system, formerly codified in rules WPC 24 and WPC 25, there have been occasional corrections or modifications of names and legal description listings of various waters specifically listed in what is now Minn. R. 7050.0470, subparts 1 through 9. As part of the effort to clarify and correct errors in the rule, this rulemaking includes a substantial number of proposed modifications and changes to the listings in Minn. R. 7050.0470. For the most part, the scope of these changes can best be described as “housekeeping.” Included among these changes are:

1. Assignment of unique lake identification numbers to lakes specifically listed in the rule;
2. Additions of alternate names for certain listed waterbodies; and
3. Additions/deletions to certain legal descriptions identifying the locations of the listed waters.

The Agency is proposing to add the Minnesota Department of Natural Resources lake identification numbers to the listings for all lakes listed in Minn. R. 7050.0470. The lake ID numbers are unique numbers assigned to each lake or reservoir in Minnesota by the MDNR. They were published in 1968 as part of an inventory of all lakes in Minnesota larger than 10
acres (15,291 in 1968). The ID numbers have a broad range of applications, both in and outside the Agency. For example the Agency uses them to identify the lakes monitored for transparency in the Citizens Lake Monitoring Program. The MDNR uses them to identify specific lakes in their “lake finder” Web page that provides fisheries, water quality and other information to the public on Minnesota’s lake resources (http://www.dnr.state.mn.us/lakefind/index.html).

Many lakes have the same or similar names. Some lakes have more than one name or there may be variations in spelling. The lake ID numbers will eliminate any question as to which lake it is.

The majority of the proposed changes to waterbody names and locations appearing in Minn. R. 7050.0470 (nos. 2 and 3 in list above) are a byproduct of the Agency’s contributions to EPA’s efforts to develop a national water quality standards database. The goal of this database is to improve public access to information about the nation’s surface waters. In Minnesota there has been an ongoing effort to produce computerized mappings of the assigned water use classifications for the surface waters of the state. These in-house generated mapping products are then sent off to be incorporated into the National Hydrography Database, a component of the national WQS data base. When completed, this database will allow access to maps and data for the approximately two million surface waters across the nation.

In the mid-1960s, state of Minnesota county highway maps (½ inch to a mile, 1:126,720 scale) were generally the primary references used in naming and locating information for the waters originally listed in what is now Minn. R. 7050.0470. In proofing the mapping products to be incorporated into the National Hydrography Database, the base reference maps being used are U.S. Geological Survey 7.5 minute topographical quadrangle maps (1:24,000 scale). In comparison to the county highway maps, these topographical maps provide a much greater level of detail on the locations of these waters. The use of the USGS map resources, coupled with ready-access to aerial photographs for most areas of the state, has resulted in a number of changes and corrections to the legal descriptions for the waters specifically listed in Minn. R. 7050.0470. The additions and corrections to these waters are shown by either underscored (new) or over-struck (deleted) entries in Minn. R. 7050.0470 (Exhibit A-15a). These changes are in addition to the more substantive changes associated with the trout water listing updates described in Section X.C.

Included in the third category of changes are four lakes in the Lake Superior Basin that are situated along the border of the Boundary Waters Canoe Area Wilderness (BWCAW). These lakes include, Ptarmigan Lake (lake ID no.16-0183-00), Unnamed Lake (16-0237-00), Pellet Lake (16-0592-00), and another Unnamed Lake (16-0598-00). These lakes are split by the border defining the BWCAW; i.e., portions of these lakes are within the BWCAW and portions of these lakes are outside the current border. For these four lakes, all individually less than 15 acres in size, it was concluded that the majority of the surface areas of all four are within the BWCAW. As a result of this evaluation, the Agency proposes to list:

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• Ptarmigan Lake and Unnamed Lake (16-0237-00) in Minn. R. 7050.0470, subp. 1, item B, and
• Pellet Lake and Unnamed Lake 16-0598-00 in Minn. R. 7050.0470, subp. 2, item B.

These waters will be classified as Class 1B, 2Bd, 3B, 4A, 4B, 5, and 6 waters. Also, they will be flagged with an asterisk (*) designating them as outstanding resource value waters (ORVW) in the “prohibited discharge category.” The assigned listing date will be November 5, 1984, [11/5/84P] to coincide with the original listing date of all of the other waters within the BWCAW.

Also included in the third category cited above are modifications to the legal descriptions for three lakes in the Lake of the Woods Basin, as noted below.

• Kabetogama Lake (69-0845-00), add range 19;
• Knife Lake (38-0404-00), add range 6; and
• Sand Point Lake (69-0617-00), add township 67.

These legal description modifications were identified from lake maps and USGS quadrangle map evaluations showing that portions of these lakes extend into sections not previously covered by the township and range public land survey listings for these three lakes in Minn. R. 7050.0470, subp. 2, item B. Kabetogama, Knife, and Sand Point Lakes are presently listed as ORVWs.

The four individual lake listings in the rule, and the modifications to the legal descriptions of the other three lakes referenced above, are considered “housekeeping” changes since the proposed amendments are intended to clarify the assigned use classifications for these waters. Their status as ORVWs, where applicable, will not change as a result of these additions, and no new ORVWs are being proposed.

7 Conclusions [IX.B. need and reasonableness, use class]

The proposed non-substantive changes are both needed and reasonable. They will make the rule clearer, easier to use and;

• Help prevent a common error users make in identifying all the multiple beneficial uses assigned to waters of the state;
• Remove a redundant use class listing (3C from Minn. R. 7050.0420);
• Help identify lakes and reservoirs with the addition of the MDNR lake ID numbers; and
• Correct or make more accurate the names and locations of certain waterbodies.
C. REASONABLENESS OF PROPOSED CHANGES TO USE CLASSIFICATION LANGUAGE, REQUIRED INFORMATION [IX. use class]

1. Introduction [IX.C. reasonableness, use class]

Minnesota Stat. § 14.131 requires that this SONAR, as part of demonstrating the reasonableness of the proposed amendments, include information about affected parties, costs and other topics that are covered in the following 11 sections. The discussion in these sections pertains only to the proposed changes to Minn. R. 7050.0400 to 7050.0470 covered in Section IX.

2. Classes of Persons Affected by the Proposed Rule Amendments, Including those Classes that Will Bear the Costs and Those that Will Benefit [IX.C. reasonableness, use class]

The proposed changes to Minn. R. 7050.0400 to 7050.0470 are non-substantive and serve only to make the rule clearer, more accurate and easier to read. It is the Agency’s intent that the only effect of these changes on the public will be an improved understanding of rule content. There will be no costs associated with these changes (see Section IX.D).

3. Estimate of the Probable Costs to the Agency and Other Agencies of Implementing and Enforcing the Rule Amendments, and Any Anticipated Effect on State Revenues [IX.C. reasonableness, use class]

There are no anticipated added costs to the Agency or any other Agency as a result of these proposed changes. For example, the cooperative work between the Agency and EPA on the national water quality standards database and the National Hydrography Database is ongoing independent of these proposed amendments.

4. Determination of Whether There Are Less Costly or Less Intrusive Methods of Achieving the Rule Amendments’ Purpose [IX.C. reasonableness, use class]

The proposed changes are not intrusive. The Agency’s proposed clarifications represent a reasonable approach to the goal of improving the rule language.

5. Describe Any Alternative Methods for Achieving the Purpose of the Proposed Rule Amendments that the Agency Seriously Considered and the Reasons Why They Were Rejected in Favor of the Proposed Amendments [IX.C. reasonableness, use class]

The Agency has not considered alternatives to what is being proposed.

6. Estimate of the Probable Costs of Complying with the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties [IX.C. reasonableness, use class]

There are no added costs to any party as a result of these proposed changes.
7. **Estimate of the Probable Costs of Not Adopting the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [IX.C. reasonableness, use class]

There will be no added costs to any party if the proposed changes are not adopted.

8. **Differences Between the Proposed Rule and Existing Federal Regulations and the Need for and Reasonableness of Each Difference** [IX.C. reasonableness, use class]

To our knowledge, the proposed changes are entirely consistent with any relevant federal regulations.


Minnesota Stats. §§ 14.002 and 14.131 require state agencies, whenever feasible, to develop rules and that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency’s regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals.

Clarification of the rule language would seem to be consistent with the spirit of this statute. The general concepts of how prescriptive or flexible a water quality rule should be are are discussed in SONAR Book I, Section VIII.I.

10. **Additional Notification of the Public Under Minn. Stat. §§ 14.131 and 14.23** [IX.C. reasonableness, use class]

Minnesota Stat. §§ 14.131 and 14.23 require the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made.

These specific notification requirements are discussed in Section IV.C.10 and will not be repeated here. The Agency outlined its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I.

11. **Consultation with the Commissioner of Finance Regarding Fiscal Impacts on Local Governments** [IX.C. reasonableness, use class]

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency provided the Department of Finance with a copy of the proposed rule and SONAR at the same time as these items were sent to the Governor’s Office. This timing allows the fiscal impacts and fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with the Governor’s Office review.
12. **Agency Determination Regarding Whether Cost of Complying with Proposed Rule in the First Year after the Rule Takes Effect will Exceed $25,000** [IX.C. reasonableness, use class]

Minnesota Stat. § 14.127, subd. 1 and 2 requires the Agency to determine if the cost of complying with a proposed rule in the first year after the rule takes effect will exceed $25,000 for:

- Any one business that has less than 50 full-time employees, or
- Any one statutory or home rule charter city that has less than ten full-time employees

The Agency has determined that there will be no added costs to the parties covered by this Statute.

D. **ECONOMIC IMPACT OF PROPOSED NON-SUBSTNATIVE CLASSIFICATION CHANGES, MINN. R. 7050.0400 TO 7050.0470** [IX. economics, use class]

The proposed changes discussed in Section IX are considered non-substantive and administrative in nature in the context of this rulemaking, but are nonetheless important to the overall work effort to provide a clear and understandable rule and the most accurate set of use classification listings in Minn. R. 7050.0470 as possible for the state and national databases. The Agency believes there will be no added costs to any party associated with the adoption of these amendments. Any unforeseen costs would be minimal.
X. ADDITION OF NEW CLASS 1 WATERS AND UPDATE LIST OF CLASS 2A TROUT WATERS

A. INTRODUCTION [X.B. introduction, class 1 and 2A]

The Class 1 use classification is assigned to waters of the state that serve as source water for drinking, culinary or food processing or other domestic purposes. All ground waters are Class 1; ground waters are not part of the changes discussed in this Section. Unlike ground waters, the relatively small subset of surface waters that are protected for drinking (Class 1 and Class 2Bd) are all individually listed in Minn. R. 7050.0470. However, the six waterbodies shown in Table III-33 are either directly or indirectly used as source waters for public water systems but they are not specifically listed and have not been assigned the domestic consumption use classification. The Agency proposes to add the Class 1C Domestic Consumption use classification to these waters. If adopted into rule, these six waters will be assigned the following use classifications: Class 1C, 2Bd, 3C, 4A, 4B, 5, and 6.

The Agency also proposes to change the drinking water use classification for a seventh waterbody from Class 1B to 1C. The waterbody is St. James Mine Pit Lake in St. Louis County, which is currently classified as a Class 1B, 2A, 3B, 3C, 4A, 4B, 5, and 6 water by virtue of its existing listing in the rule as a trout water. Based on changes to the Minnesota Department of Natural Resources (MDNR) designated stream trout lake listings, St. James Mine Pit Lake is no longer a designated trout lake and is being proposed for reclassification to the cool and warm water use classification. Given the fact that this lake is still used by the city of Aurora as a source of water for its public water system, St. James Mine Pit Lake is proposed to be reclassified as a Class 1C, 2Bd, 3C, 4A, 4B, 5, and 6 water. This change will have no impact on the quality of Aurora’s drinking water supply.

The Class 2A use classification is a subgroup of the Class 2 aquatic life and recreational use assigned to some waters of the state so as to “permit the propagation and maintenance of a healthy community of cold water sport and commercial fish and associated aquatic life and their habitats” (Minn. R. 7050.0222, subp. 2). Class 2A waters are managed to support a trout or salmon sport fishery. The Agency relies on the MDNR to determine which streams and lakes are suitable for the management of coldwater fisheries. The Class 2A waters referenced in Minn. R. 7050.0420 are based on the latest list adopted into rule by the MDNR (Minn. R. 6264.0050). The Agency proposes to update the reference in Minn. R. 7050.0420 and to make the necessary changes to the individual listings in Minn. R. 7050.0470 needed to bring the list up to date.

Ten lake trout lakes within the Boundary Waters Canoe Area Wilderness (BWCAW) that do not appear in Minn. R. 6264.0050 as designated trout waters are also being proposed for Class 2A water use classification. These lakes will be specifically listed in Minn. R. 7050.0470 and will be identified as Outstanding Resource Value Waters (ORVW), consistent with the provisions of Minn. R. 7050.0180, subp. 3.
These changes will not impact the protection Minn. R. ch. 7050 provides to Class 1 surface waters and to Class 2A trout waters; nor will the addition of the 10 lake trout lakes to Minn. R. 7050.0470 impact their protection because they are already located within the BWCAW and are considered ORVWs.

It is worth noting here that all trout waters are protected for domestic consumption (Class 1) regardless of whether or not they are actually used as a community drinking water supply. Thus, the EPA drinking water standards apply to all Class 2A waters (Minn. R. 7050.0420 and 7050.0470) even if the waterbody is not used for drinking. Generally, the Agency believes the beneficial uses assigned to a waterbody should reflect the actual or potential uses made of that waterbody. The Agency is considering removing the Class 1 use designation for those trout waters not actually used as a drinking water supply in a future rulemaking.

B. NEED AND REASONABLENESS OF DRINKING WATER RECLASSIFICATIONS CLASS 1 WATERS [X.B. introduction, class 1]

The list of waterbodies for which the drinking water use classification is proposed is shown in Table III-33.

Table III-33. Waterbodies Proposed to be Classified for Domestic Consumption, Class 1C.

<table>
<thead>
<tr>
<th>Waterbody</th>
<th>Basin</th>
<th>County</th>
<th>Lake ID No.</th>
<th>Minn. R. 7050.0470,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Community Water Systems</td>
<td></td>
<td></td>
<td>Subp. 3</td>
</tr>
<tr>
<td>Wright Lake</td>
<td>Red River</td>
<td>Otter Tail</td>
<td>56-0783-00</td>
<td>Subp. 3</td>
</tr>
<tr>
<td>Hoot Lake</td>
<td>Red River</td>
<td>Otter Tail</td>
<td>56-0782-00</td>
<td>Subp. 3</td>
</tr>
<tr>
<td>Ottertail River Diversion Channel</td>
<td>Red River</td>
<td>Otter Tail</td>
<td>Na</td>
<td>Subp. 3</td>
</tr>
<tr>
<td>St. James Mine Pit Lake</td>
<td>Lake Superior</td>
<td>St. Louis</td>
<td>69-0428-00</td>
<td>Subp. 1</td>
</tr>
<tr>
<td></td>
<td>Non-community Water Systems</td>
<td></td>
<td></td>
<td>Subp. 1</td>
</tr>
<tr>
<td>Bow Lake</td>
<td>Lake Superior</td>
<td>Cook</td>
<td>16-0211-00</td>
<td>Subp. 1</td>
</tr>
<tr>
<td>Gull Lake</td>
<td>Rainy River</td>
<td>Cook</td>
<td>16-0632-00</td>
<td>Subp. 2</td>
</tr>
<tr>
<td>Fenske Lake</td>
<td>Rainy River</td>
<td>St. Louis</td>
<td>69-0085-00</td>
<td>Subp. 2</td>
</tr>
</tbody>
</table>

The definition of public (drinking) water systems, as specified in 40 CFR 141.2 and incorporated by reference in Minn. R. 4720.5100, is as follows:

*Public water system means a system for the provision to the public of water for human consumption through pipes or, after August 5, 1998, other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes: any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system; and any collection or pretreatment storage facilities not under such control which are used.*
Thus a community water system is one that serves at least 15 service connections or regularly serves an average of 25 or more individuals on a daily basis for at least 60 days out of the year. A non-community water system is either a “transient non-community water system” or a “non-transient non-community water system,” which are described as:

- Transient non-community water system means a system that does not regularly serve at least 25 of the same persons over six months per year; and
- Non-transient non-community water system means a system that regularly serves at least 25 of the same persons over 6 months per year.

The Fergus Falls and Aurora, Minnesota water supply sources are part of community water systems whereas Bow Lake, Gull Lake, and Fenske Lake are source supplies for transient non-community water systems.

The need to reclassify the seven waterbodies listed in Table III-33 as Class 1C waters is demonstrated by their current use as public water system supply sources. The use classification should reflect the actual use being made of the waterbody. The Agency proposes to list these specific waterbodies with the Class 1C domestic consumption use classification in Minn. R. 7050.0470. Specific information regarding each of the proposed Class 1C reclassifications is provided below.

**Wright Lake, Hoot Lake, and the Otter Tail River Diversion Channel.** The primary source of water used for domestic consumption purposes at Fergus Falls, Minnesota comes from a withdrawal point on the west end of Wright Lake. Wright Lake is connected to Hoot Lake which in turn is connected to the Otter Tail River via a constructed diversion channel and aqueduct approximately two miles north, northeast of the Fergus Falls water treatment plant intake. A diversion dam on the Otter Tail River at this location diverts a portion of the Otter Tail River through the diversion channel down through these two lakes in order to meet the appropriation demands of the city as well as to maintain lake water elevation levels. Exhibit UC-18 is a 2003 aerial photograph of this area showing the waterbodies proposed for Class 1C classification.

The Otter Tail River is classified Class 1C from the outlet of Height-of-Land Lake in Becker County to its confluence with the Bois de Sioux River in Breckenridge, Minnesota. Historically, Agency staff has treated the diversion channel, Hoot Lake and Wright Lake as being “part of the Otter Tail River system” and have considered these waters as having the same domestic consumption water use as the Otter Tail River. In order to be clear that this has been and continues to be staff’s intent, it is reasonable to specifically list these three waterbodies in the rule and classify them as Class 1C waters to reflect their actual use as community water system supply sources.

**Bow Lake, Fenske Lake, and Gull Lake.** Bow Lake, Fenske Lake, and Gull Lake are transient non-community water systems that supply drinking water to three separate camping/resort type
facilities on the outskirts of the Boundary Waters Canoe Area Wilderness in northern Minnesota. These commercial facilities were identified as surface water users in updated information provided by the Minnesota Department of Health on non-community water systems. The incorporation of these three lakes as Class 1C waters into Minn. R. 7050.0470 is reasonable in order to reflect their use for drinking water and other domestic consumption purposes.

St. James Mine Pit Lake. St. James Mine Pit Lake in St. Louis County is a water supply source for the city of Aurora. Revisions to Minn R. 6264.0050, subp. 2 (the MDNR listing of designated trout lakes) have resulted in the “de-listing” of this mine pit lake from the list of designated stream trout lakes. As such, it is reasonable to remove the Class 1B, 2A, 3B classifications assigned to trout waters and replace them with the uses assigned to non-trout waters used as a source of drinking water, Class 1C, 2Bd, 3C, 4A, 4B, 5, and 6. The Agency proposes to make this change in Minn. R. 7050.0470, subp. 1, item B, subitem (110) to reflect this trout listing change and to acknowledge the continued use of this mine pit lake for domestic consumption purposes. Again, this change does not impact Aurora’s water supply.

C. NEED FOR AND REASONABLENESS OF UPDATING THE TROUT WATER LIST
[X. need and reasonableness, 2A]

The MDNR periodically revises the official list of designated trout waters (Minn. R. 6264.0050, subparts 2 and 4) through a rulemaking process that incorporates information obtained from MDNR fisheries surveys, fishery management goals and objectives, public comments, and riparian land owner comments solicited in accordance with the provisions of Minn. Stat. § 97C.005. The current list of trout waters cited in Minn. R. 7050.0420 is dated September 14, 1999. The most recent amended version of Minn. R. 6264.0050 was adopted by the MDNR on June 14, 2004. The Agency typically updates the list of trout waters (Class 2A waters) in Minn. R. 7050.0470 as needed at each triennial review. In the rule as proposed, the Class 2A waters listed in Minn. R. 7050.0470 have been updated to reflect the additions and deletions of the trout water listings contained in the June 14, 2004, version of Minn. R. 6264.0050. The Agency has used this list of trout waters as the basis to make the necessary changes to Minn. R. 7050.0470 with the intent that the two lists are in agreement. Therefore it is reasonable to update the list of Class 2A trout waters in Minn. R. 7050.0470 based on the latest list from the MDNR.

In addition to the stream trout lakes designated in Minn. R. 6264.0050, there are other lakes where lake trout are the primary species of management interest. Stream trout lakes are managed for one or more stream trout species (brook trout, brown trout, rainbow trout, and/or splake). While some designated stream trout lakes will have a combination of stream trout species and lake trout present, the majority of lake trout lakes are not specifically listed in Minn. R. 6264.0050. However, most of the existing and potential lake trout lakes are listed in Minn. R. 7050 as Class 2A waters as a result of past revisions of Minn. R. ch. 7050 based on information provided by MDNR. The proposed listing of the additional ten lake trout lakes within the BWCAW during this rulemaking proceeding will update the Minn. R. 7050 listings to coincide with MDNR’s ongoing management objectives for these lakes.
All the proposed trout water listing changes in Minn. R. 7050.0470 are summarized below:

1. Eight new trout stream listings are being added in the following counties – Cass (1), Chisago (2), Fillmore (3), Lake (1), Pine (1);
2. One new stream trout lake listing in Lake County is being added;
3. Ten lake trout lakes within the Boundary Waters Canoe Area Wilderness are being added to the list – Cook County (7), Lake County (2), St. Louis County (1);
4. Three trout streams currently on the list are being removed – Fillmore County (2), Houston County (1);
5. Two St. Louis County mine pit lakes currently on the list are being removed;
6. The designated trout portion of 13 streams are being extended in the following counties – Cass (4), Dakota (1), Fillmore (3), Houston (2), Lake (1), Morrison (1), Pine (1);
7. The designated trout segments of 21 trout streams are being shortened in the following counties, Blue Earth (1), Carlton (2), Cass (3), Cook (4), Houston (1), Itasca (3), Lake (3), Morrison (1), Pine (2), Roseau (1); and
8. Modifications to the names of eleven trout streams are being made.

As with other waters specifically listed in Minn. R. 7050.0470, the legal descriptions detailing the geographic locations of trout waters were proof-checked using 7.5 minute USGS topographic quadrangle maps and aerial photographs as part of a mapping effort to digitize the locations of all the waters specifically listed in Minn. R. 7050.0470 (see Section IX.B.6). This work effort has yielded a number of recommended changes to the legal descriptions of waters specifically listed in Minn. R. 7050.0470, including some that are also listed in Minn. R. 6264.0050, subparts 2 and 4. These suggested listing changes have been forwarded to MDNR staff for their consideration and potential incorporation into the next revision of Minn. R. 6264.0050. Following the adoption of the revised MDNR rule, the Agency will propose the adopted legal description changes into Minn. R. 7050.0470 during a future triennial review of Minn. R. ch. 7050.

In conclusion, the proposed cold water fishery classification changes are needed and reasonable to appropriately assign the Class 2A water use to waters designated by the MDNR as trout waters. These changes will bring Minn. R. ch. 7050 into agreement with the latest list of trout waters from the MDNR.

D. REASONABLENESS OF ADDITION OF NEW CLASS 1 WATERS AND UPDATE OF TROUT WATER LIST, REQUIRED INFORMATION [X. reasonableness, class 1 and 2A waters]

1. Introduction [X.D. reasonableness, class 1 and 2A]

Minnesota Stat. § 14.131 requires that this SONAR, as part of demonstrating the reasonableness of the proposed amendments, include information about affected parties, costs and other topics that are covered in the following 11 sections. The discussion in these sections pertains only to
the proposed Class 1 classification changes and to the updating of the list of trout (Class 2A) waters.

2. **Classes of Persons Affected by the Proposed Rule Amendments, Including Those Classes that Will Bear the Costs and Those that Will Benefit** [X.D. reasonableness, class 1 and 2A]

The proposed addition of new Class 1 surface waters will bring the rule into line with the actual uses provided by these waters (Table III-33). The additions will go largely unnoticed because it does not change the fact that these waters are already used as a drinking water supply, nor do they alter the protection provided these waterbodies as sources of drinking water. No party will incur added costs due these changes (see Section X.E.1).

It is unlikely, but conceivable that some party might incur added costs due the updating of the trout waters list in Minn. R. 7050.0470. Streams and lakes designated as trout waters do not have to be named in Minn. R. 7050.0470 to be protected by the MDNR. Potential economic impacts are discussed in Section X.E.2.

3. **Estimate of the Probable Costs to the Agency and Other Agencies of Implementing and Enforcing the Rule Amendments, and Any Anticipated Effect on State Revenues** [X.D. reasonableness, class 1 and 2A]

Any costs to the Agency as a result of the Class 1 and Class 2A amendments, which are not likely, would be very small. Any added costs will be absorbed into current staffing levels and budgets. There should be no costs at all to other agencies.

4. **Determination of Whether There Are Less Costly or Less Intrusive Methods of Achieving the Rule Amendments’ Purpose** [X.D. reasonableness, class 1 and 2A]

These proposed amendments are not intrusive.

5. **Describe Any Alternative Methods for Achieving the Purpose of the Proposed Rule Amendments that the Agency Seriously Considered and the Reasons Why They Were Rejected in Favor of the Proposed Amendments** [X.D. reasonableness, class 1 and 2A]

The Agency has not considered alternatives to what is being proposed.

6. **Estimate of the Probable Costs of Complying with the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [X.D. reasonableness, class 1 and 2A]

The Agency does not anticipate added costs for any party as a result of these proposed changes, however, there is some possibility of cost due the updating of the trout water list (see Section X.E.2).
7. **Estimate of the Probable Costs of Not Adopting the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [X.D. reasonableness, class 1 and 2A]

There will be no added costs to any party if the proposed changes are not adopted.

8. **Differences Between the Proposed Rule and Existing Federal Regulations and the Need for and Reasonableness of Each Difference** [IX.D. reasonableness, class 1 and 2A]

The proposed addition of the Class 1 designation to six waterbodies is independent of the federal drinking water standards, which are incorporated by reference in Minn. R. 7050.0221; there is nothing inconsistent with this action and federal regulations. Updating of the trout waters list is consistent with federal regulations that say beneficial uses assigned to waters should reflect the actual uses attained.


Minnesota Stats. §§ 14.002 and 14.131 require state agencies, whenever feasible, to develop rules and that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency’s regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals.

The proposed Class 1 and Class 2A amendments are by necessity prescriptive; it is the nature of specific classification listings. The Agency does not believe that this fact makes the proposed changes inconsistent with the intent of this statute. The general concepts of how prescriptive or flexible a water quality rule should be are discussed in SONAR Book I, Section VIII.I.


Minnesota Stat. §§ 14.131 and 14.23 require the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made.

These specific notification requirements are discussed in Section IV.C.10 and will not be repeated here. The Agency outlined its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I.

11. **Consultation with the Commissioner of Finance Regarding Fiscal Impacts on Local Governments** [IX.D. reasonableness, class 1 and 2A]

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency provided the Department of Finance with a copy of the proposed rule and SONAR at the same
time as these items were sent to the Governor’s Office. This timing allows the fiscal impacts and fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with the Governor’s Office review.

12. **Agency Determination Regarding Whether Cost of Complying with Proposed Rule in the First Year after the Rule Takes Effects will Exceed $25,000** [IX.D. reasonableness, class 1 and 2A waters]

Minnesota Stat. § 14.127, subd. 1 and 2 requires the Agency to determine if the cost of complying with a proposed rule in the first year after the rule takes effect will exceed $25,000 for:

- Any one business that has less than 50 full-time employees, or
- Any one statutory or home rule charter city that has less than ten full-time employees

The Agency has determined that there will be no added costs to the parties covered by this Statute.

**E. ECONOMIC IMPACT OF ADDING NEW CLASS 1 WATERS AND UPDATING LIST OF TROUT WATERS** [X. economics, class 1 and 2A]

1. **New Class 1 Waters** [X.E. economics, class 1]

The proposal to classify the waterbodies listed in Table III-33 as Class 1C waters will not result in additional treatment costs for any current NPDES/SDS permit holders. A Voluntary Investigation Cleanup program site is located south of Wright Lake adjacent to the banks of the Otter Tail River in Fergus Falls, Minnesota. As noted earlier, the Otter Tail River is currently classified as a Class 1C water. On-going remediation activities at this site are managing several coal ash disposal areas at the Otter Tail Power Company’s Hoot Lake Plant location. Surface water impacts from these areas are to the Otter Tail River downstream of the Fergus Falls water works intake point in Wright Lake. Additional costs to this program’s remediation activities are not anticipated as a result of the proposed Class 1C water use classifications of Hoot and Wright Lakes and the Otter Tail Diversion Channel.
2. **Update of Trout Water List** [X.E. economics, class 2A]

A review of the proposed new trout water listings indicates that one municipal wastewater treatment plant (WWTP) is affected by the proposed update of the trout stream list in Minn. R. 7050.0470. This facility, the Empire WWTP in Dakota County, is operated by Metropolitan Council Environmental Services (MCES) and it currently discharges to a segment of the Vermillion River that was designated by MDNR as a trout stream in 2002. Subsequently the MDNR extended the portions of the Vermillion River and its tributaries designated as trout waters. Based on the current listing in Minn. R. 6264.0050, subp. 4, item Q, subitem (7), the trout waters reach of the Vermillion River extends from just west of Cedar Avenue on the south side of the city of Lakeville, to a point just east of U. S. Highway 52. The segment of the Vermillion River and its tributaries east of the city of Farmington is proposed to be added during this rulemaking to Minn. R. 7050.0470 as a Class 1B, 2A, 3B, 4A, 4B, 5 and 6 water. The Empire WWTP is located within this reach, about two miles east of the city of Farmington.

An expansion underway at the Empire WWTP will ultimately double the permitted wastewater discharge from this facility from its current 14 million gallons per day average wet weather design flow to 28.61 million gallons per day. During the planning phase of evaluating how wastewater services would be delivered to this rapidly growing south-metro area, issues were raised regarding the potential impacts this discharge would have on both the quality and quantity of stream flows on the Vermillion River. Among the concerns were the impacts on the trout fishery resulting from potential stream bank erosion and flooding resulting from a flow increase of this magnitude. These issues, coupled with the instream thermal impacts from the WWTP discharge, were factors that led the MCES and its stakeholder groups to the decision to divert the treated wastewater effluent from the Vermillion River and pipe it directly to the main channel area of the Mississippi River near river mile 823.2. The expansion and upgrades underway at the Empire WWTP are intended to provide wastewater services to the area through the year 2050. Construction costs associated with the overall project are estimated to be in excess of $84.4 million. Of this, $69.6 million are associated with the project costs for the construction of the 12.5 mile-long outfall line. The planned removal of the Empire WWTP effluent from the Vermillion River is a proactive attempt to help insure the continued maintenance and protection of this metropolitan area trout stream resource.

Aside from the costs associated with the Empire WWTP, no significant additional costs are anticipated as a result of the proposed listing of additional water segments as Class 2A waters in Minn. R. 7050.0470 associated with the update of the trout water list. Trout lakes and trout streams designated in Minn. R. 6264.0050 are among the list of special waters under the Agency’s storm water rules requiring additional best management practices and enhanced runoff controls for discharges to these waters (Minn. R. 7090.1010 and Exhibit UC-19). As such, future additional costs associated with the implementation of storm water best management practices may be incurred by the state, local units of government, and private land developers that have storm water runoff discharging to waters that have been assigned this “special waters” designation. By virtue of the fact that they are designated trout waters in Minn. R. 6264.0050, additional best management practices and enhanced runoff controls are currently required for
discharges to these waters. The application of these requirements, however, is independent of whether or not the proposed Class 2A use classification is assigned to these waters.

In the case of the ten lake trout lakes proposed for specific listing in Minn. R. 7050.0470, even though they are not “designated” in Minn. R. 6264.0050, no additional costs are anticipated due to the assignment of the Class 2A use classification. They are already protected under the “prohibited discharge” category of ORVW waters due to the fact they are within the boundaries of the BWCAW (Minn. R. 7050.0180, subp. 3).
XI. CLASSIFICATION CHANGES, PROPOSED LIMITED RESOURCE VALUE WATERS (CLASS 7)

A. INTRODUCTION [XI. introduction, class 7]

Section XI of this SONAR discusses the:

1. Proposed reclassification of twelve surface water reaches from Class 2 to Class 7 limited resource value waters;
2. Proposed reclassification of the lower reaches of an existing Class 7 water in Renville County back to a Class 2B use classification; and
3. Recommendation that the Class 2B use classification is retained for a watercourse in Isanti County originally assessed for potential Class 7 reclassification.

As noted elsewhere in this SONAR (see Section IX.A. above and SONAR Book I, Section II.B.1), waterbodies or specific reaches of waterbodies in Minnesota, are assigned certain water uses either by being specifically listed in Minn. R. 7050.0470, “listed waters,” or by being assigned use classifications under the “unlisted waters” provisions in Minn. R. 7050.0430 and 7050.0425. The vast majority of waters in Minnesota are assigned use classifications by the latter. In essence, watercourses in the unlisted waters category are designated as Class 2B aquatic life and recreation waters and are presumed to be “fishable/swimmable” waters until such time that their attainable uses are evaluated on an individual basis. Since all surface waters are assigned multiple uses, water quality standards specific to each of the assigned use classes apply. If more than one use class has standards for the same pollutant, the most stringent standard is used.

Class 7 waters are protected so as to allow secondary body contact, to preserve the groundwater for use as a potable water supply, and to protect the aesthetic qualities of the water. Aquatic life and recreational uses in and on Class 7 waters are limited due to instream channelization and/or the lack of instream flows. As part of the multiple use classification system, Class 7 waters are also protected for industrial consumption use (Class 3C), agriculture and livestock uses (Class 4A and 4B), aesthetic enjoyment and navigation (Class 5) and Class 6, other uses.

Effluent limits assigned to discharges to Class 7 waters are often less restrictive than those assigned to a Class 2 water of comparable size. To protect the Class 7 uses, advanced secondary treatment limits are normally assigned to continuous discharges to these waters. There are instances where either the wastewater discharge flow rates are high and/or the length of the Class 7 watercourse segment is so short that more restrictive limits are needed in order to be protective of the downstream Class 2 water uses (Minn. R. 7053.0245, subp. 3). In other words, while Class 2 chronic water quality standards are not applied to Class 7 reaches, these standards must be met in the downstream Class 2 water, and the discharge of toxic pollutants to a Class 7 reach cannot be in concentrations acutely toxic to aquatic life. This holds true regardless of the size of the discharge and the length of the Class 7 water reach.
The watercourses assessed for potential reclassification, the existing or proposed discharger to these waters, and the Agency staff recommended use classification changes are shown in Table III-34.

Table III-34. Waterbodies Assessed for Potential Class 7 Designation and Agency Recommended Action.

<table>
<thead>
<tr>
<th>No.</th>
<th>Assessed Watercourse</th>
<th>Existing or Potential Discharger</th>
<th>Present Use Class</th>
<th>Proposed Use Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>County Ditch No. 45 (Branch Lateral 3)</td>
<td>Golden Oval Eggs at Renville, MN Renville County</td>
<td>Class 2B</td>
<td>Class 7</td>
</tr>
<tr>
<td>2</td>
<td>County Ditch No. 45</td>
<td>Southern Minnesota Beet Sugar Cooperative at Renville, MN Renville County</td>
<td>Class 2B</td>
<td>Class 7</td>
</tr>
<tr>
<td>3</td>
<td>Lateral Judicial Ditch No. 29</td>
<td>Evan, MN Brown County</td>
<td>Class 2B</td>
<td>Class 7</td>
</tr>
<tr>
<td>4</td>
<td>Judicial Ditch No. 29</td>
<td>Isanti Estates (mobile home park) Isanti County</td>
<td>Class 2B</td>
<td>Class 2B (no change)</td>
</tr>
<tr>
<td>5</td>
<td>Judicial Ditch No. 4</td>
<td>Lac Qui Parle Oil at Dawson, MN Lac Qui Parle County</td>
<td>Class 2B</td>
<td>Class 7</td>
</tr>
<tr>
<td>6</td>
<td>Unnamed Ditch to Sater’s Creek</td>
<td>Agri-Energy at Luverne, MN Rock County</td>
<td>Class 2B</td>
<td>Class 7</td>
</tr>
<tr>
<td>7</td>
<td>Unnamed Ditch to County Ditch No. 42</td>
<td>Winthrop, MN Sibley County</td>
<td>Class 2B</td>
<td>Class 7</td>
</tr>
<tr>
<td>9</td>
<td>Unnamed Ditch to Deer Creek (Co. Ditch No. 71)</td>
<td>Myrtle, MN Freeborn County</td>
<td>Class 2B</td>
<td>Class 7</td>
</tr>
<tr>
<td>10</td>
<td>Unnamed Ditch to Deer Creek (Co. Ditch No. 71)</td>
<td>Manchester, MN Freeborn County</td>
<td>Class 2B</td>
<td>Class 7</td>
</tr>
<tr>
<td>11</td>
<td>County Ditch No. 11</td>
<td>Renville, MN Renville County</td>
<td>Class 7</td>
<td>Class 2B</td>
</tr>
</tbody>
</table>

B. NEED FOR CLASS 7 AND CLASS 2B RECLASSIFICATIONS [XI. need, class 7]

The need to address the potential Class 7 reclassifications of ten of the above listed waters is based on the Agency’s need to respond to petition requests from existing or potential dischargers who have requested an individual evaluation of the water uses assigned to these selected watercourse. Two additional proposed Class 7 waters listed above (the unnamed lateral ditch to Sibley County Ditch No. 42 and an easterly lateral segment of County Ditch No. 45) were independently assessed by the Agency to address a re-location of the wastewater treatment facility at Winthrop, Minnesota and to address an Agency recommended re-location of the Southern Minnesota Beet Sugar Cooperative’s process and non-contact cooling water discharge. The need for the proposed Class 2B reclassification of the lower reaches of Renville County Ditch No. 45, south of the city of Renville was prompted by new information gathered on this...
segment of watercourse during the assessment of the other segments of the County Ditch No. 45 system mentioned above. Lastly, the unnamed creek tributary to Cedar Creek in Isanti County was assessed for potential Class 7 reclassification in response to a petition, but the Agency is recommending that this creek retain its current Class 2B use classification.

In addition to the need associated with outside petition requests outlined above, Minn. Stat. § 115.44 establishes a need to appropriately classify waters of the state in order to reflect their existing or potential water uses. Over the last 29 years an assessment process has been in place which has been used to determine whether or not the Class 2 aquatic life and recreational uses are attainable. For those assessed waters where these uses are considered un-attainable, Agency staff has proposed reclassification of these water segments as Class 7 limited resource value waters.

C. REASONABLENESS OF CLASS 7 AND CLASS 2 CLASSIFICATION CHANGES, REQUIRED INFORMATION [XI. reasonableness, class 7 and 2]

1. Introduction [XI.C. reasonableness, class 7 and 2]

Minnesota Stat. § 14.131 requires that this SONAR, as part of demonstrating the reasonableness of the proposed amendments, include information about affected parties, costs and other topics that are covered in the following 11 sections. The discussion in these sections pertains only to the proposed reclassification of 12 waterbodies from Class 2 to Class 7 (limited resource value waters) and the single proposed change from Class 7 back to Class 2 changes covered in Section XI.

2. Classes of Persons Affected by the Proposed Rule Amendments, Including those Classes that Will Bear the Costs and Those that Will Benefit [XI.C. reasonableness, class 7 and 2]

The persons most directly impacted by the proposed new Class 7 and Class 2 classifications are the five municipalities and the four industries listed in Table III-34. The proposed Class 7 reclassifications, if adopted, potentially could save the four industries and three municipalities wastewater treatment costs. This is because more lenient point source effluent limits are applicable to discharges to Class 7 receiving waters (Minn. R. 7053.0245). Savings could extend beyond just savings in treatment costs if the reclassifications allow the impacted discharges to obtain NPDES/SDS permits without having to request a variance, and other administrative cost saving may follow as well. Clearly these seven dischargers stand to gain the most economically if the proposed reclassifications are adopted.

No cost saving are attributed to the proposed Class 7 at Winthrop, Minnesota, if adopted, because they operate a stabilization pond wastewater treatment facility (see Section XI.F). The effluent limits for a pond discharge are essentially the same regardless of the classification of the receiving stream.
The reclassification of the lower reaches of Renville County Ditch No. 45 from Class 7 to Class 2B is not likely to result in additional treatment costs to the parties potentially impacted by this change.

Other potentially impacted parties are the citizens that live in these communities or others that have an interest in the area. For example, some might benefit if the changes are adopted and the changes contribute to the economic vitality of the industries so they remain sources of employment and tax revenues. Others may be concerned about environmental consequences of the proposed changes. These impacts are impossible to quantify. However, the Agency believes that the on-site use attainability analysis is a reliable indicator of existing and attainable uses and that the use classification changes are not a threat to the environment. Any environmental harm should be negligible.

3. **Estimate of the Probable Costs to the Agency and Other Agencies of Implementing and Enforcing the Rule Amendments, and Any Anticipated Effect on State Revenues** [XI.C. reasonableness, class 7 and 2]

For the most part the costs to the Agency as a result of the proposed Class 7 and Class 2A changes have already been incurred. We estimate that the costs for staff time alone for the use attainability survey and preparation time for rulemaking for each proposed Class 7 waterbody is approximately $1,500. This does not include other expenses associated with rulemaking (e.g., Attorney General’s time, Administrative Law Judge, court reporter, etc.). Thus 12 use attainability analyses would cost approximately $18,000. These costs to the Agency are part of current staffing levels, workloads and budgets. In the future, the Agency could potentially see cost savings, if the changes are adopted, because staff may not need to evaluate and process as many variance requests, and permit issuance for the affected dischargers may be streamlined.

There should be no costs to other agencies.

4. **Determination of Whether There Are Less Costly or Less Intrusive Methods of Achieving the Rule Amendments’ Purpose** [XI.C. reasonableness, class 7 and 2]

The Agency believes that there are no practical or realistic less costly or intrusive methods to achieve the same result.

5. **Describe Any Alternative Methods for Achieving the Purpose of the Proposed Rule Amendments that the Agency Seriously Considered and the Reasons Why They Were Rejected in Favor of the Proposed Amendments** [XI.C. reasonableness, class 1 and 2]

The Agency has not considered alternatives to what is being proposed.
6. **Estimate of the Probable Costs of Complying with the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [XI.C. reasonableness, class 7 and 2]

These costs and the affected parties are discussed in Sections XI.C.2 and 3 above, and in Section XI.F.

7. **Estimate of the Probable Costs of Not Adopting the Proposed Rule Amendments, Including Costs Borne by Categories of Affected Parties** [XI.C. reasonableness, class 7 and 2]

The possibility that there will be added costs to the parties listed in Table III-34 if the proposed changes are not adopted is real. For example, the projected savings in capital costs alone for one party (the city of Evan, Minnesota) associated with the Class 7 reclassification of the proposed receiving waters is approximately $100,000 (Section XI.F).

8. **Differences Between the Proposed Rule and Existing Federal Regulations and the Need for and Reasonableness of Each Difference** [XI.C. reasonableness, class 7 and 2]

The UAA process and the adoption of waterbody-specific use classification, based on the results of the UAA, that recognizes a very limited aquatic community and very limited opportunities for recreation is consistent with federal regulations (40 CFR 131.3, see Section XI.D.1 below).


Minnesota Stats. §§ 14.002 and 14.131 require state agencies, whenever feasible, to develop rules and that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency’s regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals.

As noted previously, classification designations are by necessity prescriptive. This holds true for changes to a limited resource value water. The general concepts of how prescriptive or flexible a water quality rule should be are discussed in SONAR Book I, Section VIII.I.

10. **Additional Notification of the Public Under Minn. Stat. §§ 14.131 and 14.23** [XI.C. reasonableness, class 7 and 2]

Minnesota Stat. §§ 14.131 and 14.23 require the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made.

These specific notification requirements are discussed in Section IV.C.10 and will not be repeated here. The Agency outlined its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I.
11. Consultation with the Commissioner of Finance Regarding Fiscal Impacts on Local Governments [XI.C. reasonableness, class 7 and 2]

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency provided the Department of Finance with a copy of the proposed rule and SONAR at the same time as these items were sent to the Governor’s Office. This timing allows the fiscal impacts and fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with the Governor’s Office review.

12. Agency Determination Regarding Whether Cost of Complying with Proposed Rule in the First Year after the Rule Takes Effects will Exceed $25,000 [XI.C. reasonableness, class 7 and 2]

Minnesota Stat. § 14.127, subd. 1 and 2 requires the Agency to determine if the cost of complying with a proposed rule in the first year after the rule takes effect will exceed $25,000 for:

- Any one business that has less than 50 full-time employees, or
- Any one statutory or home rule charter city that has less than ten full-time employees

There will be no added costs to the parties named in this statute as a result of these proposed changes.

D. REASONABLENESS OF PROPOSED CLASS 7 AND CLASS 2B RECLASSIFICATIONS [XI. reasonableness, class 7]

1. Use Attainability Analysis [XI.D. reasonableness, class 7]

When Minnesota first adopted water quality standards in the late-1960s all surface waters were classified for multiple uses including Class 2, fisheries and recreation. This use was assigned to all surface waters whether or not these uses were actually attainable. As time progressed, it became apparent that there were certain waters of the State that could not meet the national “fishable/swimmable” goal of the Clean Water Act. In recognition of the disparities between the designated uses and the attainable uses for certain waters, in the late-1970s the Agency developed an assessment procedure that evaluated whether the designated uses were consistent with the uses that appeared to be attainable for a given waterbody. This use assessment procedure (now called a use attainability analysis or UAA), was developed using EPA guidance. It was used to individually evaluate the attainable uses of the assessed waters. The concept of the limited resource value use classification is consistent with Section 101(a)(2) of the Clean Water Act and with the EPA guidance used to develop the assessment procedure. Therefore, the Agency maintains that the assignment of a use classification that reflects a water’s existing or attainable uses is a reasonable approach in the establishment of water quality standards.
As noted, waters classified under the “unlisted waters” provisions of the rule are presumed to be suitable for aquatic life and recreational uses. These waters retain the Class 2 classification unless and until:

- A UAA has been performed which demonstrates that the water qualifies for Class 7 limited resource value water reclassification;
- The proposed Class 7 reclassification is adopted as a rule amendment in accordance with Minnesota’s rulemaking procedures; and
- The Class 7 water use reclassification is approved by the EPA.

A “use attainability analysis” is the name applied to the assessment process that evaluates whether or not a given waterbody supports certain beneficial water uses. In a regulatory sense, a UAA is defined in the federal Water Quality Standards Regulation (40 CFR 131.3) as:

“...a structured scientific assessment of the factors affecting the attainment of a use which may include physical, chemical, biological and economic factors as described in section 131.10(g).”

Title 40 of CFR § 131.10(g) specifies that:

“States may remove a designated use which is not an existing use, as defined in Sec. 131.3, or establish sub-categories of a use if the State can demonstrate that attaining the designated use is not feasible because:

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

Historically, Agency has considered factors outlined in 40 CFR 131.10(g)(1) through (5) as being part of the use attainability analysis. The economic and social issues referenced in section 131.10(g)(6) are generally addressed as part of the Minnesota’s variance provisions specified in Minn. R. 7050.0190 and 7000.7000.
Parallel state criteria comparable to the factors, outlined in (1) through (5) above, are contained in existing Minn. R. 7050.0200, subp.8. This rule states that use attainability analysis information shall be used to:

“... determine the extent to which the waters of the state demonstrate:
   A. the existing and potential faunal and flora communities are severely limited by
      natural conditions as exhibited by poor water quality characteristics, lack of habitat, or
      lack of water; or
   B. the quality of the resource has been significantly altered by human activity and
      the effect is essentially irreversible; and
   C. there are limited recreational opportunities (such as fishing, swimming, wading,
      or boating) in and on the water resource.”

The conditions in items A and C or B and C must be established by the use attainability analysis before the waters can be classified as limited resource value waters.” Another provision in Minn. R. 7050.0200, subp. 8 specifies that the flows of Class 7 waters must be intermittent in nature or less than one cubic foot per second at the once in ten year, seven-day low flow (7Q_{10}).

Over the past 29 years, Agency personnel have used a stream assessment survey procedure to conduct UAAs of waters proposed for potential Class 7 reclassification. These stream surveys gather data on the physical, chemical, and biological factors affecting the capacity of these waters to sustain Class 2 uses or meet the “fishable/swimmable” goal. While the detail and complexity of the surveys may vary depending on the type of waterbody assessed, each survey serves to document whether or not the Class 7 criteria listed above have been met. The evaluation of the information gathered through the UAA, taken as a whole, allows one to conclude whether or not the designated use class is appropriate for that particular waterbody. Therefore, the basis for whether or not it is reasonable to reclassify a given waterbody as Class 7 rests with the physical, chemical, and biological factors exhibited by the waterbody being evaluated.

In the sections that follow, the reasons supporting each of the recommended reclassifications for the proposed Class 7 waters is summarized. Survey information, photographs of the assessed waters, and site maps are part of the assessment surveys and are contained in the cited exhibits for the individual water courses proposed for Class 7 reclassification.

1. County Ditch No. 45 (Branch Lateral 3), Renville County, Golden Oval Eggs [XI.D. reasonableness, class 7]

The June 2003 reclassification request for County Ditch No. 45, Branch Lateral 3 was made by a consultant representing Golden Oval Eggs Cooperative (Exhibit UC-1). Golden Oval Eggs is an egg laying and breaking facility located on the eastern side of the city of Renville. Golden Oval has a sequencing batch reactor wastewater treatment facility on their property that currently serves to pre-treat the wastewater prior to it being sent to the city of Renville’s mechanical WWTP. Golden Oval is considered a significant industrial user, which means they contribute
wastewater to the Renville WWTP under an agreement covered by the city’s NPDES/SDS permit (no. MN0020737).

In 2004 Golden Oval took over operation and maintenance of the batch reactor treatment facility, and facility upgrades were added for the intended purpose of independently treating their process wastewaters and discharging the effluent to Branch Lateral 3 of County Ditch No. 45. If this proposal ultimately happens, Golden Oval would no longer be a significant industrial user discharging to the Renville municipal WWTP. The Golden Oval proposed point of discharge to Branch Lateral 3 would be approximately 1.6 miles upstream of the existing Renville WWTP outfall to this same ditch.

The main stem County Ditch No. 45 was originally adopted as a Class 7 water in 1981. If Branch Lateral 3 of County Ditch No. 45 is reclassified as Class 7, it would be an upstream extension of an existing Class 7 water segment. In a related action, in 2004 Southern Minnesota Beet Sugar Cooperative attempted to obtain ditch access permission to relocate their effluent and non-contact cooling water discharges to this same branch lateral ditch segment. Ditch access permission was denied for the Branch Lateral 3 discharge relocation, but access permission was obtained by So. MN Beet Sugar for a new discharge location to an alternate County Ditch No. 45 segment located south and east of the Branch Later 3 reach. The proposed reclassification of the receiving water for So. MN Beet Sugar’s discharge is discussed in the next Section.

Branch Lateral 3 County Ditch No. 45 is proposed for Class 7 reclassification due to the amount of channelization and the lack of water in this ditch system. The proposed Golden Oval effluent outfall location is near the headwater of Branch Lateral 3 and there is less than one square mile of contributing watershed above this point. The estimated 7Q10 low flow for this ditch segment is zero cubic feet per second (cfs). The aquatic life and recreational use potential of this ditch is severely limited by the lack of water and lack of suitable habitat due to the degree of channelization. Therefore both Class 7 criteria conditions A and C, and B and C are documented for this ditch segment (Exhibit UC-2).

3. County Ditch No. 45, Renville County, Southern Minnesota Beet Sugar Cooperative
[X.I.D. reasonableness, class 7]

Southern Minnesota Beet Sugar Cooperative is a major industrial facility on the eastern side of the city of Renville. Southern MN Beet Sugar processes sugar beets into refined, white granulated sugar, molasses, dried beet pulp, as well as several other sugar beet related byproducts. Prior to the end of December 2004, So. MN Beet Sugar had a seasonal discharge of both treated process and non-contact cooling wastewaters discharging to Renville County Ditch No. 37, a tributary to West Branch Beaver Creek. At the recommendation of the Agency, So. MN Beet Sugar initially attempted to relocate their discharge to Branch Lateral 3 of County Ditch No. 45 at a point less than one-half mile upstream of the proposed Golden Oval outfall location discussed above. In the summer of 2004, So. MN Beet Sugar failed to obtain ditch access authorization from the Renville County Commissioners to relocate their discharge outfall to Branch Lateral 3. Again, at the recommendation of Agency staff, So. MN Beet Sugar pursued and successfully obtained ditch access permission to relocate to an alternate lateral ditch segment.
of County Ditch No. 45. This ditch segment joins with the main stem County Ditch No. 45 approximately two miles downstream of the Renville municipal WWTP outfall.

In December 2004 a permit was issued to So. MN Beet Sugar allowing for a seasonal discharge (September through March) to County Ditch No. 45 at a point directly south and across Highway 212 from their factory location. This permit contains variances from water quality standards for certain salinity related parameters and also contains references to certain county imposed conditions relating to quality and quantity aspects of the relocated discharge. Agency staff believe that there are limited aquatic and recreational uses along this ditch segment and that a Class 7 reclassification of this segment of County Ditch No. 45 is justified given the degree of channelization and lack of water along this watercourse. Class 7 criteria conditions A and C, and B and C are documented for this ditch segment (Exhibit UC-3).

4. Judicial Ditch No. 29, Brown County at Evan, Minnesota

Evan, Minnesota, population 91 (2000 census), is located in northwestern Brown County approximately 20 miles west of New Ulm, Minnesota. In August 2001, a consulting engineering firm, acting on behalf of the city of Evan, submitted a dual request to the Agency: first for a variance from certain water quality standards relating to a proposed new recirculating sand filter WWTP for the city, and second, for a Class 7 reclassification for the proposed receiving waters, a lateral ditch and the main stem of Judicial Ditch No. 29 (Exhibit UC-4). Judicial Ditch No. 29 in part forms the headwaters of Hindeman Creek (Spring Creek), which contains a designated trout stream reach, upstream of its confluence with the Minnesota River.

The Agency conducted a UAA of these watercourses in October 2002. Conclusions drawn from this assessment led staff to recommend potential Class 7 reclassification for a reach extending approximately nine miles downstream of the proposed Evan outfall. This was based on the amount of channelization along the lateral and main stem judicial ditches and the lack of water (zero cfs) at the projected 7Q10 low flow conditions. The downstream end point of the proposed Class 7 reach is approximately one mile upstream of the beginning of the designated trout stream segment. Class 7 criteria conditions A and C, and B and C are documented for Judicial Ditch No. 29 and its lateral ditch (Exhibit UC-5).

A NPDES/SDS permit with variances to instream water quality standards for dissolved oxygen and un-ionized ammonia nitrogen was approved and issued by the Agency Board in April 2003 (Exhibit UC-6). Since that time, representatives with the city of Evan considered the possibility of entering into agreements with two nearby cities, Cobden or Morgan for wastewater treatment services. Neither of these communities is able to allow for this option so Evan appears to be back to the original recirculating sand filter WWTP proposed treatment alternative.
5. Judicial Ditch No. 4, Lac Qui Parle County, Lac Qui Parle Oil at Dawson, MN [XI.D. reasonableness, class 7]

The request for possible Class 7 reclassification of Judicial Ditch No. 4 was received in April 2003 from a consultant on behalf of the Lac Qui Parle Oil Coop (also formerly known as Dawson Ag Services). This facility is located along U.S. Highway 212 on the northwestern side of Dawson, Minnesota (Exhibit UC-7).

Past spills or leaks of agricultural fertilizers and petroleum products have resulted in soil and groundwater contamination in the area of the former Dawson Ag Services facility (Agency Site ID No. Leak 00012622). Groundwater monitoring studies jointly required by the Agency and the Minnesota Department of Agriculture have shown contaminated groundwater plumes extending to Judicial Ditch No. 4 which flows through the facility. Excavation of contaminated soils from the area of impact has occurred. Based on the data and information provided in the monitoring reports, Lac Qui Parle Oil Coop has been instructed to proceed with the preparation and submission of a corrective action design in order to remediate the groundwater to surface water quality standards.

Less than 1,000 feet downstream of the Lac Qui Parle Oil Coop facility, Judicial Ditch No. 4 enters into a storm sewer system that conveys the flows underground through the city of Dawson in an east/southeasterly direction. The storm sewer then discharges to an open channel on the eastern side of Dawson near the city park and the city’s wastewater treatment plant. Water within this open channel ultimately flows to the West Branch Lac Qui Parle River.

The proposed Class 7 reclassification of Judicial Ditch No. 4 is somewhat unique. Agency is proposing to reclassify the upper portion of Judicial Ditch No. 4 as a Class 7 water due to the degree of channelization and limited watershed area above the Lac Qui Parle Oil Coop facility (Exhibit UC-8). In other words, Class 7 criteria conditions A and C, and B and C are met along the headwaters of Judicial Ditch No. 4 down to the point where the ditch enters into the Dawson storm water system, just south of Highway 212. Agency staff recommends, however, that the open channel on the eastern side of Dawson down to the West Branch Lac Qui Parle retain its Class 2B water use classification based on observations of numerous fish in the open water channel during the 2004 stream assessment survey. Also, a reported fish kill of northern pike in this channel, which was the result of an apparent sodium hydroxide release from another industrial facility in Dawson in mid-April, 1992, indicates the presence of game fish (Exhibit UC-9).

6. Unnamed Ditch and Sater’s Creek, Rock County, Agri-Energy LLC at Luverne, Minnesota [XI.D. reasonableness, class 7]

Agri-Energy LLC is an ethanol production facility utilizing a dry mill corn processing, fermentation, and distillation process to produce nearly 22 million gallons of ethanol per year. The Class 7 assessment was conducted on the unnamed ditch and Sater’s Creek in response to a chloride variance request application submitted by the facility in February 2002 (Exhibit UC-10).
The water supplied to Agri-Energy LLC for its operations is potable water from the city of Luverne. Depending on the demands for water in the city, water supplied to Agri-Energy comes from one of two, or a combination of both, city-run water treatment plants for potable water. Chloride concentrations in the city water vary depending on the wells being used at any given time. The chloride concentrations in the water from Water Plant No. 1 generally run around 40 mg/L. The chloride levels in the well water from Water Plant No. 2 are about twice this concentration. Agri-Energy treats the city water through a reverse osmosis system at a flow rate of 226 gallons per minute. Of this amount, 61 gallons per minute becomes reverse osmosis reject water with chloride concentrations running on the order of 170 – 300 mg/L. Up to 90,000 gallons per day of reverse osmosis reject water is discharged to the unnamed ditch which flows to Sater’s Creek, a tributary of the Rock River.

The upper portions of the unnamed ditch north of the Agri-Energy facility are largely undefined in the sense that the ditch is no more than a swale through an agricultural field. In the vicinity of the Agri-Energy facility the unnamed ditch, and the reverse osmosis reject water, flow underground for about a quarter mile before out-letting just north of U.S. Interstate Highway 90. The ditch then flows to the east and crosses underneath I-90 before joining with Sater’s Creek which flows along the south side of I-90. Sater’s Creek in-turn flows through a commercial area before it passes under Highway 75 on its way to its confluence with the Rock River.

Those surface portions of the unnamed ditch south of the Agri-Energy facility as well as Sater’s Creek are 100 percent channelized with thick, emergent vegetative growth through-out the reaches. At the time of the UAA, the unnamed ditch channel upstream of the facility was dry. Downstream of the outfall discharge, and in the upper reaches of Sater’s Creek, only stagnant water conditions were present. At the last downstream station on Sater’s Creek, stream flow was estimated to be about 0.1 cubic foot per second. Instream channelization and the lack of water are the factors supporting the Class 7 reclassification of these two watercourses (see Exhibit UC-11).

7. Unnamed Ditch to County Ditch No. 42, Sibley County at Winthrop, Minnesota [XI.D. reasonableness, class 7]

County Ditch No. 42 was originally classified as a Class 7 water in 1981. At that time, the city of Winthrop operated a mechanical WWTP with an outfall discharge directly to County Ditch No. 42. In the mid-1980’s the city constructed a waste stabilization pond system on the eastern side of town, which resulted in the re-location of their effluent discharge outfall to an unnamed ditch that runs parallel to the south side of the stabilization ponds and joins with County Ditch No. 42 a short distance downstream of the city’s former WWTP.

The pond discharges on a seasonal basis to the head-end of the unnamed ditch. At the time of the UAA, the only flowing water in the ditch was the treated effluent being discharged from the pond’s secondary treatment cell. The overall lack of water, coupled with the high degree of channelization along this reach, are the bases for proposing a Class 7 reclassification of this unnamed ditch (Exhibit UC-41).
Two Unnamed Ditches and Deer Creek (County Ditch No. 71), Freeborn County at Myrtle, Minnesota [XI.D. reasonableness, class 7]

The city of Myrtle, population 63 (2002), is located in southeastern Freeborn County about four miles north of the Minnesota/Iowa border. The reclassification request was submitted to the Agency in the form of a December 2003 dual request for both a Class 7 reclassification and a variance request from standards (Exhibit UC-12). Individual on-site wastewater septic systems in Myrtle reportedly discharge to a field tile drainage system that conveys the partially treated wastewaters to the ditches that drain to Deer Creek. Deer Creek is also known as County Ditch No. 71.

At the time of the reclassification request, the city was exploring a re-circulating sand filter wastewater treatment system with a surface water discharge to the assessed unnamed ditches. At the time of this writing (October 2006), the city is in the process of re-examining wastewater treatment alternatives, some of which would still have a surface discharge to the unnamed ditches.

The Class 7 criteria conditions A and C, and B and C are documented in Exhibit UC-13 for the unnamed ditches and portions of Deer Creek. Habitat limitations due to the lack of water and extensive channelization indicate that these segments would more appropriately be classified as Class 7 limited resource value waters. The downstream end for the proposed Class 7 reach on Deer Creek (Co. Dt. 71) is at the confluence of the creek and a lateral ditch system flowing in from the west. While Deer Creek at, and downstream of, the confluence of these two ditch systems is still highly channelized, there is a marked change in the channel substrate, from the mud/sand mix noted at upstream stations to a stony mix with sand and silt downstream. There also appears to be some opportunities for fishing and recreational use in this area. At the next accessed stream station downstream (Observation point C), fishing and recreational use potentials were judged to be even greater (Exhibit UC-13).

County Ditch No. 11, Freeborn County at Manchester, Minnesota [XI.D. reasonableness, class 7]

Manchester, Minnesota (population 81), located about five miles northwest of Albert Lea, is another unsewered community in Freeborn County. Manchester currently has no sewage collection system or centralized wastewater treatment plant. On-site septic systems reportedly discharge to a series of drain tiles in the area.

County Ditch No. 11 originates just north of town and flows in a south/southeasterly direction for about six miles before entering the northwest end of Fountain Lake. Like the city of Myrtle, a dual request for Class 7 reclassification and a variance from standards was received in December 2003 (Exhibit UC-14). Also like the city of Myrtle, a re-circulating sand filter facility was the wastewater treatment system being proposed at the time. If constructed, this proposed facility will have an effluent discharge of approximately 15,000 gallons per day.
County Ditch No. 11 flows primarily through agricultural lands. Numerous field tile line outfalls were noted and all were discharging water to the ditch at the time of the UAA survey. This ditch is 100 percent channelized throughout most of its upper reaches. It begins to take-on more of a natural channel characteristic downstream of the U.S. Interstate Highway 90 overpass on the north side of School Section Lake. Fisheries and recreational uses in the proposed Class 7 reach of County Ditch No. 11 are considered to be very limited due to the lack of habitat caused by the extensive channelization and the lack of sustaining stream flows due to the ditch’s limited watershed size. Therefore Class 7 criteria conditions A and C, and B and C are cited in support of the proposed reclassification of the upper 5.7 miles of County Ditch No. 11 (Exhibit UC-15).

10. Conclusion [XI.D. reasonableness, class 7]

The beneficial uses assigned to certain waters of the state, including Class 7 waters, are specifically listed in Minn. R. 7050.0470. However, most waters of the state are not listed and are classified under the “unlisted waters” provisions of Minn. R. 7050.0425 and 7050.0430. All watercourses in the “unlisted waters” category are designated as Class 2B waters and are assumed to be fishable/swimmable until it can be demonstrated otherwise. If a use attainability analysis of a waterbody shows that aquatic life and recreation uses are severely limited, then a reclassification of a specific reach may be appropriate. Reclassification is usually initiated by a request from an existing or potential discharger. Each use classification change requires amending Minn. R. ch. 7050.

Such is the case with the twelve watercourses being proposed for Class 7 reclassification in this rulemaking. Each of the waters has been individually assessed using the stream assessment survey worksheets. These survey findings are included in Exhibits UC-1 through UC-16 and UC-41 along with related correspondence. The proposed Class 7 reclassifications are needed and reasonable.

E. REASONABLENESS OF PROPOSED RECLASSIFICATION OF CLASS 7 WATER TO CLASS 2B, AND RETENTION OF EXISTING CLASS 2B USE CLASSIFICATION [XI. reasonableness, class 2]

1. Reclassification of Class 7 to Class 2, Lower Reaches of County Ditch No. 45, Renville County, downstream of Renville, Minnesota [XI.E. reasonableness, class 2]

Stream assessment surveys conducted in 1977 and 1978 on County Ditch No. 45 downstream of the city of Renville were used to recommend the 1981 Class 7 reclassification of County Ditch No. 45 from the city of Renville downstream to a point where the ditch flows into Sacred Heart Creek, approximately three-quarters of a mile upstream of the Minnesota River. In 2004 the County Ditch No. 45 ditch system was re-assessed in part to address the recommended re-location of the Southern Minnesota Beet Sugar Cooperative’s wastewater and non-contact cooling water discharges and in part to address the potential independent discharge into Branch Lateral 3 of County Ditch No. 45 from the Golden Oval Eggs Cooperative.
The portion of County Ditch No. 45 that is proposed for reclassification back to a Class 2B water use classification extends from the ditch’s confluence with Sacred Heart Creek upstream to 770th Ave. (a Flora Township section line road between Sections 6 and 7, T.114N, R.36W). This is a distance of just under three river miles. At the 770th Ave. culvert crossing and continuing downstream, County Ditch No. 45 is a high gradient natural stream channel with a predominant stony, sand/silt stream bottom. At this location, the watercourse flows primarily through riparian wooded areas as it makes its way from higher elevations towards the Minnesota River valley below (Exhibit UC-16).

Biological sampling of both County Ditch No. 45 and Sacred Heart Creek was included as a condition in the So. MN Beet Sugar Cooperative NPDES/SDS permit in order to gather baseline data prior to the re-location and commencement of their discharge into the County Ditch No. 45 watershed and as a follow up to assess the discharge’s possible impact. The sampling results indicate that there is a diverse assemblage of aquatic organisms in the lower portions of County Ditch No. 45. These data are reflected in the results obtained from sample station CD45ALT in the March 2006 Biological Monitoring Report for CD45 and Sacred Heart Creek (Exhibit UC-17). While actual fishing and recreational use of this segment of County Ditch No. 45 may be limited, the limitations are driven more by the inaccessibility to this watercourse than by any inherent or human-induced physical or chemical limitations of this segment of watercourse. Therefore it is reasonable to reclassify this lower portion of this watercourse as a Class 2B aquatic life and recreational use water.

2. Retention of Class 2 designation for Unnamed Creek at Isanti Estates Mobile Home Park, Isanti County, Minnesota [XI.E. reasonableness, class 2]

Isanti Estates is a mobile home community located on U. S. Highway 65 approximately two miles south of the city of Isanti. Wastewater from Isanti Estates is treated on-site with an extended aeration package plant that is designed to treat an average wet weather flow of 23,000 gallons per day. The effluent from this facility is discharged to an unnamed creek that runs along the north side of the property. This unnamed creek flows from a 160 acre wetland complex on the west side of Highway 65, situated within the Athens State Wildlife Management Area, and flows in an east/southeasterly direction approximately two river miles to its confluence with Cedar Creek. Cedar Creek is a tributary of the Rum River.

Except for a midpoint segment where the unnamed creek is channelized through a wetland area, the creek retains much of its natural channel characteristics as it flows through wooded and other largely undeveloped rural lands. While low stream flow events can be expected along this watercourse given the limited upstream watershed size (about 2.5 square miles), the fact that the creek is fed by outflows from the wetland in the wildlife management area would tend to moderate instream water levels more than what would normally be expected if the headwaters area were simply an upstream extension of the stream channel. Spring-time flow inundations of the surrounding riparian lands adjacent to this creek also appear to make these areas well suited for northern pike spawning.

An equally important consideration in the assessment of existing or potential uses of this watercourse is the fact that the unnamed creek flows through a portion of the northern
boundaries of the Cedar Creek Natural History Area near its confluence with Cedar Creek. The Cedar Creek Natural History Area is a 5,400 acre ecological research site owned by the University of Minnesota. This natural history area is uniquely situated in an area where the North American continent’s three major ecosystems overlap. This convergence of 1) the northern conifer forest, 2) the eastern deciduous forest, and 3) the western tallgrass prairies makes the area an ideal site for a diverse mix of long-term ecological studies.

Based on the information gathered during the use attainability stream assessment survey (Exhibit UC-42) the Agency believes that it is reasonable to recommend that the unnamed creek at Isanti Estates retain its current Class 2B water use classification.

3. Conclusions [XI.E. reasonableness, class 2]

The Agency is proposing to reclassify the lower reach of Renville County Ditch No. 45 from Class 7 back to Class 2. New survey information led the Agency to conclude that this reach has a fisheries and recreational potential and would more appropriately be classified as a Class 2B water.

Based on the results of the stream assessment survey conducted on the unnamed creek at Isanti Estates, along with the comments obtained from the local MDNR fisheries office, the Agency recommends the current Class 2B water use classification be retained for this watercourse.

F. ECONOMIC IMPACT OF PROPOSED CLASS 7 AND CLASS 2B RECLASSIFICATIONS [XI.F. economics, class 7 and 2]

1. Class 7 Reclassifications [XI.F. economics, class 7]

Wastewater treatment plant discharges to Class 7 limited resource value waters, in general, are assigned less stringent effluent limits than would otherwise be assigned if the receiving water remained classified for Class 2 aquatic life and recreational water use. This is generally the case, but factors such as: 1) the size of the discharge, 2) the length of the Class 7 receiving water, and 3) the use classification of the downstream waterbody, come into play in the effluent setting process. The result may be the assignment of effluent limits that closely match limits assigned to discharges to a Class 2 waterbody irrespective of the use classification of the immediate receiving water.

If the proposed Class 7 reclassifications are adopted into rule, cost savings relating to capital expenditures and/or yearly operation and maintenance costs may be realized by the four industrial facilities and three of the four municipalities listed in Table III-34. The proposed reclassification at Winthrop, Minnesota is considered to be cost neutral since this community operates a stabilization pond wastewater treatment facility and any cost savings as a result of the proposed reclassification are thought to be minimal.

For the remaining three municipalities (Evan, Manchester, and Myrtle, Minnesota), cost savings that may result from a Class 7 reclassification will vary depending on the type of facilities that
are ultimately chosen to treat the communities’ wastewater. Shown below is an example of the potential cost savings resulting from the assignment of less restrictive effluent limits for the city of Evan should the proposed receiving waters be reclassified as a Class 7 waters. These cost estimates were taken from a 2000 preliminary engineering report developed for the city which examined three wastewater alternatives. These cost projections do not include the estimated $315,000 cost to re-build the sanitary sewer collection system.

The first alternative explored was a regional consolidation with a near-by community’s proposed wastewater treatment facility. The projected capital cost of this proposal was approximately $724,000. This alternative was later rejected in part due to the costs associated with pumping the sewage the four-mile distance between the two towns. The second alternative considered the construction of a sequencing batch reactor WWTP at Evan with a projected cost of $283,900. This treatment facility could reportedly meet the Class 2B effluent receiving water discharge limits. The third alternative was a recirculating sand filter treatment facility, which was projected to cost $183,400. The recirculating sand filter would produce an effluent quality that would meet the Class 7 discharge limits but would not consistently produce an effluent quality needed to meet Class 2B receiving water requirements.

The projected capital cost savings associated with the Class 7 reclassification of the proposed receiving waters at Evan would therefore be approximately $100,000. A $6,000 reduction in the annual operation and maintenance costs ($20,000 vs. $26,000) would also be realized if these waters were reclassified as Class 7 waters. An NPDES/SDS discharge permit has been issued for the city of Evan which contains variances to the dissolved oxygen and instream ammonia water quality standards. The resulting effluent limits assigned in this permit parallel those that would be assigned for a Class 7 discharge receiving water.

While the preceding discussion speaks to the issue of potential cost savings associated with the proposed Class 7 reclassifications there is another important factor that deserves recognition. With populations of less than 100 people, debt retirement for any type of centralized WWTP and collection system for these towns will be costly. As such, Agency staff anticipates both Myrtle and Manchester to pursue their variance requests, in accordance with the provisions contained in Minn. R. 7000.7000 and 7050.0190, if adoptions of the proposed Class 7 reclassifications fail to make their way through this rulemaking process, and if these communities choose a wastewater system designed with a continuous surface water discharge.

2. Class 7 to Class 2B Reclassification [XI.F. economics, class 2]

If adopted, the proposed reclassification of the lower reaches of Renville County Ditch No. 45 from its existing Class 7 to Class 2B use will effectively shorten the Class 7 reach of this watercourse by 2.7 river miles. The downstream end of the Class 7 reach would then be 7.6 river miles below the city of Renville’s WWTP outfall. In addition to the domestic wastewaters from the residents in town, the Renville WWTP currently treats wastewater from three industrial facilities: Golden Oval Eggs, MinAqua Fisheries (an aquaculture facility in Renville), and the domestic wastewaters generated at the Southern Minnesota Beet Sugar Cooperative facility. Golden Oval and MinAqua both have pre-treatment systems that pre-treat their wastewaters before discharging the effluent to the Renville WWTP. Past discussions have indicated that one
or both of these operations may in the future decide to withdraw from the city’s WWTP and discharge on their own into the upstream portions of County Ditch No. 45 if ditch access permission is granted by Renville County and necessary NPDES/SDS permits can be obtained. This potential new point of discharge would be approximately 1.5 river miles above the Renville WWTP outfall.

Based on the current and potential discharge scenarios outlined above, coupled with the seasonal (September through March) discharge to another lateral ditch of County Ditch No. 45 from the So. MN Beet Sugar facility, additional treatment costs to the city are not anticipated at this time as a result of the proposed Class 2B reclassification of the lower 2.7 miles of County Ditch No. 45. Ammonia nitrogen levels in the treated effluent from Golden Oval and MinAqua will be evaluated if and when these facilities seek a discharge permit for independent discharges to Branch Lateral 3 of County Ditch No. 45 and appropriate ammonia effluent limits will be established as necessary.

3. Summary [XI.F. economics, class 7 and class 2]

In conclusion, the proposed Class 7 reclassifications, if adopted, potentially could save the four industrial facilities and three of the four municipalities wastewater treatment costs (see Table III-34) due to the generally more lenient point source effluent limits applicable to Class 7 receiving waters (Minn. R. 7053.0245). The proposed reclassification at Winthrop, Minnesota is considered to be cost neutral because they operate a stabilization pond wastewater treatment facility. For Evan, Manchester and Myrtle, cost savings that may result from a Class 7 reclassification will vary depending on the type of facilities that are ultimately chosen to treat the communities’ wastewater.

The reclassification of the lower reaches of Renville County Ditch No. 45 from Class 7 to Class 2B is not likely to result in additional treatment costs to the parties potentially impacted by this change.
XII. IMPACT ON AGRICULTURE

Minnesota Stat. § 14.111 requires agencies to send a copy of any proposed rule that affect farming operations to the Commissioner of Agriculture no latter than 30 days prior to publication of the proposed rule in the State Register.

The Agency believes that the proposed addition of Class 2 numeric standards for acetochlor and metolachlor to Minn. R. ch. 7050 could impact farming operations. These standards were developed at the request of the Department of Agriculture. The potential for these standards to impact farming operations is discussed detail in Sections V.C and V.L.

The Agency believes that the other proposed amendments discussed in Book III of the SONAR should not have a direct impact on farming operations.

On April 18, 2007, the Agency sent a letter, together with a draft copy of the proposed rule amendments, to the Commissioner of Agriculture well in advance of the targeted State Register publication date. The letter, which highlighted the proposed water quality standards for acetochlor and metolachlor discussed in Section V, will be introduced as an exhibit at the beginning of the public hearings. Copies of this letter were also sent to the Minnesota Departments of Health and Natural Resources.
XIII. NOTICE TO THE COMMISSIONER OF TRANSPORTATION

Minnesota Stat. § 174.05, subd. 1 requires the Agency to inform the Commissioner of Transportation of all activities which relate to the adoption, revision or repeal of any standard or rule concerning transportation. A representative of the Minnesota Department of Transportation (MDOT) is on the Agency’s interested party mailing list and received all the mailings discussed in Section III of SONAR Book I. The Agency believes that the proposed revisions discussed in this Book may indirectly impact the Department of Transportation, but we do not anticipate any direct impact or direct cost implications.

The change discussed in this Book of the SONAR with the most potential to impact Department of Transportation activities in controlling construction site runoff is the proposal to change the default industrial use classification from 3B to 3C. In a related exchange of letters, the Agency informed MDOT that we would not be revising the Class 2 standard for chloride as they had requested (see Section III.F in SONAR Book I, and Exhibits A-14j and A-22).

On April 18, 2007, the MPCA sent a letter, together with a draft copy of the proposed rule amendments, to the Commissioner of MDOT. The letter will be introduced as an exhibit at the beginning of the public hearings.
XIV. LIST OF WITNESSES AND EXHIBITS

A. WITNESSES

The Agency plans to have the following staff available to testify at the public hearings on issues relevant to Book III of the SONAR.

David Maschwitz – Proposed amendments in general, history of their development, preparation of the proposed rule and author of portions of SONAR Book III. Proposed chronic standards for acetochlor and metolachlor, and proposed mercury and *E. coli* standards.

Mark Tomasek – Supervisor of Standards Unit.

Gerald Blaha – Proposed rule language. Proposed Class 3B to 3C change in default classification, update list of trout waters (Class 2A), addition of new Class 1 waters, changes to language associated with use classifications, and proposed new limited resource value waters (Class7) and author of portions of SONAR Book III.

Angela Preimesberger – Proposed standards for mercury, acetochlor, metolachlor, benzene, and naphthalene and author of portions of SONAR Book III. Preparation of exhibit list.

Dann White - Proposed acute standards for acetochlor, metolachlor.

Joseph Zachmann, Minnesota Department of Agriculture (MDA) - Proposed standards for acetochlor and metolachlor, implementation of best management practices and costs.

Dan Stoddard, Minnesota Department of Agriculture - Proposed standards for acetochlor and metolachlor. MDA pesticide programs.

B. EXHIBITS

The list of all exhibits is attached.
XV. CONCLUSION

Based on the foregoing, the proposed rule amendments described in SONAR Books III are both needed and reasonable.

Dated: 7/16/07

Brad Moore
Commissioner
Exhibit List: Statement of Need and Reasonability, Books I-III

A-1 Statement of Need and Reasonableness, Book I of III, In the Matter of Proposed Revisions of Minnesota Rules Chapter 7050, Relating to the Classification and Standards for Waters of the State; the Proposed Addition of a New Rule, Minnesota Rules Chapter 7053, Relating to Point and Nonpoint Source Treatment Requirements; and the Repeal of Minn. R. Chapters 7056 and 7065
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document  MPCA St. Paul
July 2007  Book I of III

A-2 Statement of Need and Reasonableness, Book II of III, In the Matter of Proposed Revisions of Minnesota Rules Chapter 7050, Relating to the Classification and Standards for Waters of the State; the Proposed Addition of a New Rule, Minnesota Rules Chapter 7053, Relating to Point and Nonpoint Source Treatment Requirements; and the Repeal of Minn. R. Chapters 7056 and 7065
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document  MPCA St. Paul
July 2007  Book II of III

A-3 Statement of Need and Reasonableness, Book III of III, In the Matter of Proposed Revisions of Minnesota Rules Chapter 7050, Relating to the Classification and Standards for Waters of the State; the Proposed Addition of a New Rule, Minnesota Rules Chapter 7053, Relating to Point and Nonpoint Source Treatment Requirements; and the Repeal of Minn. R. Chapters 7056 and 7065
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document  MPCA St. Paul
Book III of III

A-4 Statement of Need and Reasonableness (SONAR): In the Matter of Proposed Additions To Minnesota Rules Chapter 7050, Relating to the Classification and Standards for Waters of the State; Proposed Additions Required By Minnesota Session Law 2003, Chapter 128, Article 1, Section 156 As Amended By Minnesota Session Law 2005, First Special Session, Chapter 1, Article 2, Section 156
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document  MPCA St. Paul
May 2006  http://www.pca.state.mn.us

A-5 Exhibit List for Statement of Need and Reasonableness, Books I-III
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document  MPCA St. Paul
July 2007

A-6 2006 303(d) List. (Final 2004 MPCA Clean Water Act Section 2004 303(d) Total Maximum Daily Load (TMDL) List of Impaired Waters)
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Publication  MPCA St. Paul
June 1, 2006  http://www.pca.state.mn.us
The List identifies impaired streams and lakes in ten major River Basins.

A-7 Guidance Manual For Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment 305(b) Report and 303(d) List
Author: Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Guidance  MPCA St. Paul
October 2005  pp1-106 & Appendices  http://www.pca.state.mn.us/water/tmdl/index
URL: See first document under "publications"

A-8a Subject: Triennial Review -Revised
From Larry C. Salmela, Department Manager - Environmental, United States Steel Corporation (USS)
Comment Letter  Mount Iron
September 22, 2003
To Mr. Marvin Hora, Environmental Outcomes Division, MPCA
A-8b
From Bruce A. Nelson, Executive Director, Alexandria Lake Area Sanitary District, Minnesota Environmental Science and Economic Review Board (MESERB)

Comment Letter

October 31, 2003
To David Maschwitz and Greg Gross, Environmental Outcomes Division, MPCA

Follow-up to Meeting on October 24, 2003 in New Ulm, Minnesota

A-9

Request for Comments on Possible Amendments to Rules Governing State Water Quality Standards, Minnesota Rules Chapters 7050 and 7052

Author: Minnesota Pollution Control Agency (MPCA)

Public Notice State Register (SR)


A-10

From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

Letter MPCA

November 6, 2003 St. Paul http://www.pca.state.mn.us

To Interested Parties for 7050, 7052 and 7055 Water Quality Rules

1st Notice to mailing list. MPCA Cover Letter with State Register Notice to Interested Parties for 7050, 7052 and 7055.

A-11a

Subject: State Register of November 10, 2003 - Possible Amendments to Rules Governing State Water Quality Standards

From Larry C. Salmela, Department Manager - Environmental, United States Steel Corporation (USS)

Comment Letter Mount Iron

December 12, 2003
To David E. Maschwitz, Environmental Outcomes Division, MPCA

Comment Letter from 1st Notice.

A-11b

Subject: Possible Amendments to Rules Governing State Water Quality Standards, Minnesota Rules Chapters 7050 and 7052

From Bruce A. Nelson, Executive Director, Alexandria Lake Area Sanitary District, Minnesota Environmental Science and Economic Review Board (MESERB), Christopher M. Hood, Flaherty & Hood, P.A.

Comment Letter

December 31, 2003
To David Maschwitz, Environmental Outcomes Division, MPCA

Comment Letter from 1st Notice.

A-11c

Subject: Request for Comments on Possible Amendments to Rules Governing State Water Quality Standards, Minnesota Rules Chapters 7050 and 7052

From Rebecca J. Flood, Manager - Environmental Compliance Section, Environmental Services Division, Metropolitan Council

Comment Letter St. Paul

December 31, 2003
To David Maschwitz, Environmental Outcomes Division, MPCA

Comment Letter from 1st Notice.

A-11d

Subject: Proposed Water Quality Standards Rules Revision Invitation to Comment

From Janette K. Brimmer, Kris Sigford of the Minnesota Center for Environmental Advocacy (MCEA)

Comment Letter St. Paul

January 9, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA

Comment Letter from 1st Notice.

A-11e

Subject: Request for Comments on Possible Amendments to Rules Governing State Water Quality Standards, Minnesota Rules Chapters 7050 and 7052

From Keith E. Hanson, Minnesota Chamber of Commerce Water Quality Subcommittee - Chair

Comment Letter St. Paul

December 31, 2003
To David E. Maschwitz, Environmental Outcomes Division, MPCA

Comment Letter from 1st Notice.
A-11f  Subject: Possible Amendments to Rules Governing State Water Quality Standards, Minnesota Rules Chapters 7050 and 7052
From Steven Colvin, Environmental Management Unit Supervisor, Division of Ecological Services, Minnesota Department of Natural Resources (MDNR)
Comment Letter  
December 31, 2003
To David E. Maschwitz, Environmental Outcomes Division, MPCA
Comment Letter from 1st Notice.

A-11g  Subject: Syngenta Comments & Input to MPCA WQ Standards Rule Revision Process… (Importance: High)
From David Flakne, State Government Relations Manager, Syngenta Crop Protection
e-mail  
September 29, 2003
To David E. Maschwitz, Environmental Outcomes Division, MPCA

A-11h  Subject: RE: MPCA WQ Standards Rule Revision…
From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
e-mail  
September 29, 2003
To David Flakne, Syngenta
Comment Letter from 1st Notice.

A-11i  Subject: Syngenta Comments & Input to MPCA WQ Standards Rule Revision Process… (Importance: High)
From David Flakne, State Government Relations Manager, Syngenta Crop Protection
e-mail  
December 19, 2003
To David E. Maschwitz, Environmental Outcomes Division, MPCA
Comment Letter from 1st Notice. 3 Attachments:
EPA DWLOC Values iRED.ppt; EPA LOC CASM Screening Values…; US EPA Atrazine Aquatic Life Water Quality (see Exhibit H-59)

A-11j  Subject: RE: Syngenta Comments & Input to MPCA WQ Standards Rule Revision Process…
From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
e-mail  
December 22, 2003
To David Flakne, Syngenta
Comment Letter from 1st Notice. Attachment: Atrazine U.S. EPA.doc

A-11k  Subject: Syngenta Comments/Questions on MPCA Proposed Revisions to WQ Standards 7050 and 7052… (Importance: High)
From David Flakne, State Government Relations Manager, Syngenta Crop Protection
e-mail  
May 25, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA
Comment Letter from 1st Notice. Comment Letter from 1st Notice. 3 Attachments:
EPA DWLOC Values iRED.ppt; EPA LOC CASM Screening Values…; US EPA Atrazine Aquatic Life Water Quality

A-11l  Subject: RE: Syngenta Comments/Questions on MPCA Proposed Revisions to WQ Standards 7050 and 7052…
From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
e-mail  
May 25, 2004
To David Flakne, State Government Relations Manager, Syngenta Crop Protection
Comment Letter from 1st Notice.

A-12  Request for Comments on Possible Amendments to Rules Governing State Water Quality Standards, Minnesota Rules Chapters 7050 and 7052
Minnesota Pollution Control Agency (MPCA)
Public Notice  
State Register (SR)  
May 17, 2004  Vol 28(46); pp.1464-7
Notice to solicit in SR, May 17, 2004
From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

Letter

May 11, 2004
To Interested Party

Cover Letter & Mailing List - 2nd Notice

A-14a Subject: Water Quality Rule Revisions
From Paula West, Executive Director, Minnesota Lakes Association (MLA)

e-mail

May 13, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA

A-14b Subject: Proposed Extension of 1 mg/L Phosphorous Effluent Limit to New or Expanding Discharges
From Steven Colvin, Environmental Management Unit Supervisor, Division of Ecological Services, Minnesota Department of Natural Resources (MDNR)

Letter

May 14, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA

A-14c Subject: RE: Syngenta Comments/Questions on MPCA Proposed Revision to WQ Standards Chapter 7050 and 7052...
(Importance: High)
From David Flakne, State Government Relations Manager, Syngenta Crop Protection

e-mail

May 25, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA

A-14d

From Crosby-Ironton Presbyterian Church

Letter

June 11, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA

Re: Upholding Strict Standards to Protect Water Quality in Our State

A-14e Subject: Clean Water/Public Input
From Tine Thevenin, Author/Speaker

e-mail

June 18, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA

A-14f Subject: Request for Development of Water Quality Standards
From Dan Stoddard, Manager, Agricultural Chemical Environmental Section, Minnesota Department of Agriculture (MDA)

Letter

June 23, 2004
To Greg Gross, Environmental Outcomes Division, MPCA

A-14g Subject: Mercury Comments
From Donald Barron

Comment Letter

Received June 24, 2004
To Environmental Protection Agency Administrator, Ariel Rios Building (Washington, D.C.)

Copy Mailed To: David E. Maschwitz, Environmental Outcomes Division, MPCA, St. Paul, MN

A-14h Subject: Comments - Proposed Changes to MS Ch. 7050
From Terry Noonan, Project Manager - Water Resources, Ramsey County Public Works

e-mail

June 25, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA
A-14i  Subject: Comments on Possible Amendments to Rules Governing State Water Quality Standards, Minnesota Rules Chapters 7050 and 7052
From Al Christopherson, President, Minnesota Farm Bureau Federation (MFBF)
Comment Letter
June 28, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA
with Cover Letter (e-mail from Jackie Gauger sent on June 29, 2004)

A-14j  Subject: Mn/DOT Comments on Water Quality Standards Revision
From Richard Elasky, Chief Environmental Officer, Minnesota Department of Transportation (MNDot)
Comment Letter
June 29, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA
3 Attachments: Derivation of Acute and Chronic Toxicity Criteria for Chloride (January, 2000) prepared by Jim Schmidt - WDNR; Chronic Data - Chlorides spread sheet provided by Jim Schmidt - WDNR; Ambient Aquatic Life Criteria For Chloride - Chloride Issue Paper (2003) provided by Connie Due - Iowa DNR, Environmental Services Division, Water Quality Bureau

A-14k  Subject: MESERB/CGMC Data Practices Act Request Relative to Proposed Amendments to the Phosphorus Rule, Minn. R. 7050.0211, subp. 1a
From Christopher M. Hood, Flaherty & Hood, P.A.
Letter
June 30, 2004
To Commissioner Sheryl Corrigan
Included an Attached Memo (Exhibit A-14l)

A-14l  Subject: Supplemental Data Practices Act Request
From Christopher M. Hood, Flaherty & Hood, P.A. for Coalition of Greater Minnesota Cities (CGMC)
Letter
July 16, 2004
To Sheryl A. Corrigan, Commissioner, Minnesota Pollution Control Agency (MPCA)

A-14m  Subject: Proposed Water Quality Standards Rule Revision Invitation to Comment
From Sol Simon, President - Mississippi River Revival (MRR)
Comment Letter
June 30, 2004
To David E. Maschwitz, Environmental Outcomes Division, MPCA

A-15a  Proposed Amendments to Minnesota Rules Chapter 7050 [RULES AS PROPOSED]
Author: Minnesota Pollution Control Agency (MPCA)
Rule
July 16, 2007

A-15b  Proposed New Minnesota Rules Chapter 7053 [RULES AS PROPOSED]
Author: Minnesota Pollution Control Agency (MPCA)
Rule
July 16, 2007

A-16  NEWS RELEASE: MPCA Seeks Input on Proposed Changes to State Water-Quality Standards
Author: Minnesota Pollution Control Agency (MPCA)
Publication
For Release: June 4, 2004
http://www.pca.state.mn.us
News Release for the public meetings
A-17 **Subject: Plans for Additions and Revisions to Water Quality Standards in Minn. R. chs. 7050 and 7052**
From David E. Maschwitz, Greg Gross - Supervisor, and Marvin E. Hora, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Memo**
September 23, 2003
To MPCA's Citizens' Board
with cover letter to interested parties from David Maschwitz dated September 12, 2003, and list of 59 interested parties that received a copy of the memo to the Agency Board. (Agency Board meeting was on September 23, 2003)

A-18 **Triennial Review of Water Quality Standards, Minn. R. ch. 7050 & 7052**
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Presentation**
September 23, 2003
For MPCA's Citizens' Board

PowerPoint presentation

A-19 **Subject: Update on Proposed Revisions and Additions to Minnesota Water Quality Standards**
From David E. Maschwitz, Greg Gross - Supervisor, and Marvin E. Hora, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Memo**
August 13, 2004
To MPCA's Citizens' Board
with cover letter to interested parties dated August 16, 2004, and list of 72 interested parties that received a copy of the memo to the Agency Board. (Agency Board meeting was on August 24, 2004)

A-20 **Update of Plans to Revise MN Water Quality Standards**
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Presentation**
August 24, 2004
To MPCA's Citizens' Board

PowerPoint presentation

A-21 **Health Risk Limits for Groundwater Water Intake and Cancer Potency Adjustment Factors**
Author: Helen Goeden, Ph.D., Minnesota Department of Health (MDH)

**Presentation**
August 24, 2004
To MPCA's Citizens' Board

PowerPoint presentation - New MDH Slides

A-22 **Subject: Request for Change to the Class 2 Standard for Chloride**
From Marvin E. Hora, Manager, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Letter**
September 24, 2004
To Mr. Richard Elasky, Chief Environmental Officer, Minnesota Department of Transportation (MNDOT)

A-23 **Subject: Update on Proposed Revisions and Additions to Minnesota Water Quality Standards**
From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Memo**
September 21, 2004
To MPCA's Citizens' Board
Cover letter to interested parties; 2 Attachments: Agency Board Meeting was on September 28, 2004.

A-24 **Update of Plans to Revise MN Water Quality Standards**
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Presentation**
September 28, 2004
To MPCA's Citizens' Board

PowerPoint presentation
2003 Administrative Rule Preliminary Proposal Form
Author: David E. Maschwitz, Environmental Outcomes Division, MPCA
Form MPCA October 27, 2003
with cover memorandum To: Scott Wiggins, Legislative Coordinator; From: Kevin Molloy, Water Quality Rule Coordinator; 1st of three forms to the Governor’s Office

2007 Administrative Rule Proposed Rule and SONAR form:
Minnesota's Water Quality Standards, Proposed Revision of Minnesota Rules Chapter (Minn. R. Ch.) 7050, Proposed Addition of a New Rule, Minn. R. Ch. 7053, Proposed Repeal of Out-dated Rules, Minn. R. Ch. 7056 and 7065
Author: David E. Maschwitz (Rule/SONAR Content) and Kevin Molloy (Rulemaking Coordinator), Minnesota Pollution Control Agency (MPCA)
Form MPCA April 9, 2007 Adm. Rule Tracking #: AR081(B)
Attached to Memo: Letters to Commissioner Tom Hanson, Department of Finance, Commissioner Gene Hugoson, Minnesota Department of Agriculture, and Commissioner Carol Molnau, Minnesota Department of Transportation

No Exhibit

Petition for Rulemaking to the Minnesota Pollution Control Agency -Pursuant to Minnesota Statutes § 14.09 et seq.
From Chistopher M. Hood, Flaherty & Hood, P.A.
Petition December 15, 2003
To Commissioner Sheryl Corrigan, Minnesota Pollution Control Agency (MPCA)
Includes cover letter to Commissioner Sheryl Corrigan Re: Petition to amend Minn. R. 7050.0211, subp. 1a (the “phosphorus rule”)

Subject: Response to Petition to Amend Minn. R. 7050.0211, subp. 1a (the "phosphorus rule")
From Commissioner Sheryl Corrigan, Minnesota Pollution Control Agency (MPCA)
Letter January 13, 2004
To Christopher M. Hood, Flaherty & Hood, P.A.

Phosphorus Rulemaking Petition
From Janette K. Brimmer, Kris Sigford of the Minnesota Center for Environmental Advocacy
Petition Minnesota Center for Environmental Advocacy (MCEA) July 27, 2004
To Commissioner Sheryl Corrigan, Minnesota Pollution Control Agency (MPCA)
Includes cover letter (Re: Petition to Amend Minn. R. 7050.0211)

Subject: Petition to Amend Minn. R. 7050.0211
From Commissioner Sheryl Corrigan, Minnesota Pollution Control Agency (MPCA)
Letter August 18, 2004
To Janette K. Brimmer, Kris Sigford of the Minnesota Center for Environmental Advocacy (Response to MCEA's July 27, 2004 Petition)

Subject: MPCA Proposed Phosphorous Rule and Phosphorous Strategy Amendments
From Christopher M. Hood, Flaherty & Hood, P.A.
Letter June 30, 2004
To Sheryl A. Corrigan, Commissioner, Minnesota Pollution Control Agency (MPCA)
Attached Technical Memo from MESERB (see Exhibit A-32b)
Subject: MPCA Approach to Phosphorus Effluent Limits in NPDES Permitting
From Bruce A. Nelson, Executive Director, Alexandria Lake Area Sanitary District, Minnesota Environmental Science and Economic Review Board (MESERB)

Memo
June 30, 2004
To Commissioner Sheryl Corrigan
Attachment to Exhibit A-14k

A-33

From Sheryl A. Corrigan, Commissioner, Minnesota Pollution Control Agency (MPCA)

Letter
August 5, 2004
To Christopher M. Hood, Flaherty & Hood, P.A.

A-34

Subject: Amendments to Phosphorus Rule, Minn. R. 7050.0211, subp. 1a
From Bruce A. Nelson, Executive Director, Alexandria Lake Area Sanitary District, Minnesota Environmental Science and Economic Review Board (MESERB)

Comment Letter
February 11, 2005
To David E. Maschwitz, Environmental Outcomes Division, MPCA
Additional Contact: Steve Nyhus, Flaherty & Hood, P.A.

A-35

Subject: MPCA Proposed Water Quality Assessment Rules Revisions and Ecoregion-Based Eutrophication Standards
From Bruce A. Nelson, Executive Director, Alexandria Lake Area Sanitary District, Minnesota Environmental Science and Economic Review Board (MESERB)

Comment Letter
March 18, 2005
To David E. Maschwitz, Environmental Outcomes Division, MPCA
Additional Contact: Steve Nyhus, Flaherty & Hood, P.A.

A-36

Subject: Response to MESERB February 11, 2005 Letter, Comments on Amendments to Phosphorus Rule; and March 18, 2005 Letter, Comments on Proposed Eutrophication Standards
From Greg Gross, Supervisor, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

Letter
May 12, 2005
To Bruce A. Nelson, Executive Director, Alexandria Lake Area Sanitary District, Minnesota Environmental Science and Economic Review Board (MESERB)
Attachment: Draft Amendments to Minnesota Rules Chapter 7050; Excerpt of Planned Revision of Water Quality Standards

A-37a

Minn. Session Law 2003, ch. 128, art. 1, § 156, subdivisions 1 and 2 Water Quality Assessment Process

Law
2003
Minnesota Office of Revisor of Statutes
St. Paul
(Original Law)
http://www.revisor.leg.State.mn.us

A-37b

Minn. Special Session Law 2005 ch. 1, art. 2, § 151, subdivisions 1, 2 and 3 Water Quality Assessment Process

Law
2005
(Minn. Special Session Law 2003, ch. 128, art. 1, § 156, subdivisions 1 and 2)
http://www.revisor.leg.State.mn.us

A-38

No Exhibit

A-39

No Exhibit
A-40a Subject: Critical Concerns Regarding Draft Nutrient Standards and Phosphorous Rule
From Bruce A. Nelson, Executive Director, Alexandria Lake Area Sanitary District, Minnesota Environmental Science and Economic Review Board (MESERB)
Comment Letter Alexandria
June 16, 2005 pp.1-4
To Sheryl A. Corrigan, Commissioner, Minnesota Pollution Control Agency (MPCA)

Author: Walt Poole, Ph.D., America's Clean Water Foundation (ACWF)
Report ACWF
March 2005 pp.6-31
In Cooperation with the Association of State and Interstate Water Pollution Control Administrators (ASIWPACA)

A-41 Subject: MESERB's Concerns Regarding Nutrient Standards and Phosphorous Rule
From Sheryl A. Corrigan, Commissioner, Minnesota Pollution Control Agency (MPCA)
Letter St. Paul
June 29, 2005 pp.1-3
To Bruce A. Nelson, Executive Director, Alexandria Lake Area Sanitary District, Minnesota Environmental Science and Economic Review Board (MESERB)

A-42a Changes to Proposed Amendments to Minn. Rules, ch. 7050
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document St. Paul
March 9, 1990 pp.1-6

A-42b Revised Changes to Proposed Amendments to Minn. Rules pts. 7050.0218, subp. 2 and 7050.0220, subp. 4
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document St. Paul
March 16, 1990

A-43 No Exhibit

A-44a Sensitivity of Mussels to Ammonia Toxicity, Implications for a Revised Minnesota Ammonia Standard Considering the Biology and Distribution of Mussels in Minnesota
Author: Minnesota Pollution Control Agency (MPCA)
Agenda St. Paul
March 25, 2004
Contact List on back

A-44b Subject: Meeting at MPCA, 1:00-4:30p.m., March 25, 2004
Sensitivity of Mussels to Ammonia Toxicity, Implications for a Revised Minnesota Ammonia Standard Considering the Biology and Distributions of Mussels in Minnesota
From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Letter St. Paul
March 15, 2004
To Ammonia Toxicity Experts (see exhibit A-44c for list)

A-44c Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document St. Paul
2004
List of Attendees (for March 25, 2004 Mtg.: exhibit A-44b)

A-45 Notice of Intent To Re-Evaluate the Aquatic Life Ambient Water Quality Criteria for Ammonia
Author: Geoffrey H. Grubbs, Director, Office of Science and Technology, Environmental Protection Agency (EPA)
Public Notice Washington, D.C.
July 8, 2004 Vol 69(130); pp.41262-4 http://www.gpoaccess.gov/fr/index.html
A-46a Proposed Water Quality Standards Rule Revisions (Update)
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Website MPCA St. Paul
December 3, 2004 http://www.pca.state.mn.us
Included excerpts from Minn. Rule ch 7050 revisions (See Exhibit A-46b).

A-46b Excerpts of Planned Revision of Water Quality Standards: Preliminary Draft Amendments to Minn. R. 7050.0150 and 7050.0222 - Relevant Definitions and Eutrophication Standards for Lakes, Reservoirs and Shallow Lakes [DRAFT]
Author: Minnesota Pollution Control Agency (MPCA)
Rule Minnesota Office of Revisor of Statutes St. Paul
November 1, 2004 http://www.pca.state.mn.us
Attachment to December 3, 2004 website, "Proposed Water Quality Standards Rule Revisions".

A-47 Proposed Water Quality Standards Rule Revisions
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Website MPCA St. Paul
Revised: June 16, 2005 http://www.pca.state.mn.us

A-48a Proposed Water Quality Standards Rule Revisions
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Website MPCA St. Paul
Revised: August 9, 2005 http://www.pca.state.mn.us
Includes complete versions of Minn. Rules ch 7050 & 7055 [Drafts]. (See Exhibit A-48b & A-48c)

A-48b Proposed Amendments to Minnesota Rules Chapter 7050 [DRAFT]
Author: Minnesota Pollution Control Agency (MPCA)
Rule MPCA St. Paul
July 28, 2005 http://www.pca.state.mn.us

A-48c Proposed Amendments to Minnesota Rules Chapter 7055 [DRAFT]
Author: Minnesota Pollution Control Agency (MPCA)
Rule Office of Revisor of Statutes, State of Minnesota St. Paul
July 28, 2005
Attached to August 9, 2005 Rule Revision Website

A-49a Proposed Water Quality Standards Rule Revisions
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Website MPCA St. Paul
Revised: January 26, 2006 http://www.pca.state.mn.us
Includes complete versions of Minn. Rules ch 7050 & 7055 [Drafts] (Updated January 1, 2006; See Exhibit A-49b & A-49c) and Derivation of acetochlor and metolachlor standards (See Exhibit A-49d)

A-49b Proposed Amendments to Minnesota Rules Chapter 7050 [DRAFT]
Author: Minnesota Pollution Control Agency (MPCA)
Rule MPCA St. Paul
Revised January 1, 2006 http://www.pca.state.mn.us

A-49c Proposed New Minnesota Rule Chapter 7055 [DRAFT]
Author: Minnesota Pollution Control Agency (MPCA)
Rule MPCA St. Paul
Revised January 1, 2006 http://www.pca.state.mn.us

A-49d Outline of Basis for Draft Proposed Acetochlor and Metolachlor Class 2 Water Quality Standards
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
MPCA Document MPCA St. Paul
January 17, 2006 http://www.pca.state.mn.us
5.3 Variances From Water Quality Standards

A-50 Water Quality Standards Handbook: 2nd Ed.
Author: Office of Water, Environmental Protection Agency (EPA)
Guide EPA
August 1994 EPA-823-B-94-005a; pp.5-11, 5-12
Washington
http://www.epa.gov

A-51 National Recommended Water Quality Criteria: 2002
Author: Office of Water and Office of Science and Technology, Environmental Protection Agency (EPA)
EPA Report
November 2002 Washington, D.C.
http://www.epa.gov

A-52 Announcement: Health Risk Limits Expert Advisory Panel
From Patricia Bloomgren, Director, Division of Environmental Health, Minnesota Department of Health (MDH)
Letter
2005 St. Paul
http://www.health.state.mn.us

A-53 Subject: Exclusions/Inclusions for DWS in 7050
From Richard D. Clark
e-mail
May 20, 2005 St. Paul
To David E. Maschwitz, Environmental Outcomes Division, MPCA
Includes Attachment: SONAR excerpt on Drinking Water Standards

A-54 40 CFR parts 141 and 143
Author: Environmental Protection Agency (EPA) -From the US Gov. Print. Office via GPO Access
Rule Code of Federal Regulations (CFR)
Revised July 1, 2004 Vol 21 Washington, D.C
http://www.gpoaccess.gov/fr/index.html

Title 40 "Protection of Environment": Part 141 "National Primary Drinking Water Regulations" and Part 143 "National Secondary Drinking Water Regulations"

A-55a Statement of Need and Reasonableness [Excerpt]
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document
1979; 1980 Rule Revision PCA-004-80-AK, pp.1, 37-8
Excerpt on Proposed Amendments for WPC 14 C.9. and 15 C.9.- 5 mg/L TSS Limit & Pretreatment

St. Paul

Hearing Examiner
Report State of Minnesota Office of Hearing Examiners
1980 PCA-80-004-AK, pp.1, 78-81
Excerpt related to Proposed Amendments for WPC 14 C.9. and 15 C.9.- 5 mg/L TSS Limit & Pretreatment

St. Paul

A-55c Proposed Findings of Fact and Conclusions [Excerpt]
Minnesota Pollution Control Agency (MPCA)
MPCA Document
October 28, 1980 Cover sheet, pp.20
Cover Sheet: Agenda Item Control Sheet; Excerpt on Proposed Amendments for WPC 14 C.9. and 15 C.9.- 5 mg/L TSS Limit & Pretreatment

St. Paul

A-55d Order Adopting Rules
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document
1980 PCA-80-004-AK, p. 3, no. 4
In the Matter of the Proposed Amendments to MPCA Rules WPC 14, 15, 24 and 25 and the Proposed Repeal of WPC 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 23, 26, 29, 31 and 32.
A-56  **Minn. R. ch. 7056**  
**Rule**  
November 3, 1998  
Author: Minnesota Pollution Control Agency (MPCA)  
Minnesota Office of Revisor of Statutes  
St. Paul  
http://www.revisor.leg.state.mn.us/  
*Mississippi River and Tributaries*

A-57  **Minn. R. ch. 7065**  
**Rule**  
November 3, 1998  
Author: Minnesota Pollution Control Agency (MPCA)  
Minnesota Office of Revisor of Statutes  
St. Paul  
http://www.revisor.leg.state.mn.us/  
*Effluent Standards for Disposal Systems*

A-58  No Exhibit

A-59  No Exhibit

A-60  **40 CFR 131.10 (a) Designation of Uses**  
**Rule**  
Revised July 1, 2004  
Author: Environmental Protection Agency (EPA)  
Code of Federal Regulations (CFR)  
Washington, D.C.  
pp.370-1  
(Waste Assimilation Not a Beneficial Use).  
http://www.gpoaccess.gov/fr/index.html

A-61  **Water Quality Standards Handbook: 2nd Ed.**  
**Guide**  
EPA  
Washington, D.C.  
August 1994  
EPA-823-B-94-005a; pp.2-1, 2-2  
http://www.epa.gov

[2.1] Use Classification - 40 CFR 131.10(a) in Chapter 2, "Designation of Uses"

A-62  **40 CFR 131.12 Antidegradation Policy**  
**Rule**  
Revised July 1, 2005  
Author: Environmental Protection Agency (EPA)  
Code of Federal Regulations (CFR)  
Washington, D.C.  
pp.390-1  
Title 40 "Protection of Environment”; Part 131 "Water Quality Standards"  
http://www.gpoaccess.gov/fr/index.html

A-63  **Water Quality Standards Handbook: 2nd Ed.**  
**Guide**  
EPA  
Washington, D.C.  
August 1994  
EPA-823-B-94-005a; pp.4-1 to 4-14  
http://www.epa.gov

Chapter 4 - Antidegradation

A-64a  **Subject: Update on Proposed Revisions and Additions to Minnesota Water Quality Standards**  
From David E. Maschwitz, Greg Gross - Supervisor, and Marvin E. Hora, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)  
Memo  
MPCA  
January 13, 2006  
St. Paul  
http://www.dnr.state.mn.us

To MPCA Citizens’ Board  
with cover letter to interested parties dated January 13, 2006, and list of 72 interested parties that received a copy of the memo to the Agency Board. (Agency Board meeting was on January 24, 2006)

A-64b  **Triennial Review of Water Quality Standards: Update on Revisions of Minn. R. ch. 7050**  
**Presentation**  
January 24, 2006  
St. Paul  
To MPCA's Citizens' Board
A-65a Proposed Water Quality Standards Rule Revisions (Update)
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Website MPCA St. Paul
Revised July 28, 2006 http://www.pca.state.mn.us
Included Draft Minn. R. chs. 7050 and 7053 and Outline of Acetochlor and Metolachlor Standards

A-65b Proposed Water Quality Standards Rule Revisions (Update)
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Website MPCA St. Paul
June 6, 2007 http://www.pca.state.mn.us
Includes Proposed Minn. R. chs. 7050 (Exhibit A-15a) and 7053 (Exhibit A-15b) and Outline of Acetochlor and Metolachlor Standards; Attached email to Interested Parties

A-66 Subject:
From Tom Poleck, Water Quality Branch, Environmental Protection Agency (EPA)
Letter Chicago
December 19, 2005
To Dave Maschwitz, Environmental Outcomes Division, MPCA
"...initial response to changes that the Minnesota Pollution Control Agency (MPCA) is considering making to certain aspects of Minn. R. ch. 7050, including proposed rule revisions that MPCA posted on its website on August 9, 2005."

A-67a Subject: Water Quality Standards for Mercury
From Char Brooker e-mail Maplewood
February 3, 2006
To David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Example of emails received after January 24, 2006 presentation at the MPCA’s Citizen Board Meeting

A-67b Subject: FW: FW: Act to Reduce Mercury in Minnesota Fish!
From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
e-mail St. Paul
March 2, 2006
To Interested Party

EC-1 Ambient Water Quality Criteria for Bacteria-1986
Author: Environmental Protection Agency's (EPA's) Office of Research and Development Microbiology and Toxicology Div., Cincinnati, OH and Office of Water Regulations and Standards, Criteria and Standards Div., Washington, D.C.
EPA Report EPA Washington, D.C
Bacteriological Ambient Water Quality Criteria for Marine and Fresh Recreational Waters

EC-2 Implementation Guidance for Ambient Water Quality Criteria for Bacteria
Primary Authors: Jim Keating, Jennifer Wigal, and Lars Wilcut, Office of Water (4305T), Environmental Protection Agency (EPA)
Guidance EPA Washington, D.C

EC-3 Fecal Contamination of Surface and Recreational Waters: Disease Transmission and Public Health Protection [DRAFT]
Prepared by Tetra Tech EM Inc. for Minnesota Pollution Control Agency (MPCA);
Report MPCA St. Paul
September 30, 1997 pp. i-ii, 1-28 http://www.pca.state.mn.us

EC-4 Microbial Indicators of Faecal Contamination In Water: A Current Perspective
Author: Pam Tallon, Brenda Magajna, Cassandra Lofranco and Kam Tin Leung, Department of Biology, Lakehead University, and Ontario Ministry of the Environment, Standards Development Branch, Etobicoke
Journal Water, Air and Soil Pollution Ontario -Canada
2005 Vol 166; pp.139-166 http://springerlink.metapress.com/content/1573-2932/
Do U.S. Environmental Protection Agency Water Quality Guidelines for Recreational Waters Prevent Gastrointestinal Illness? A Systematic Review and Meta-Analysis

Author: Timothy J. Wade, N. Pai, Joseph N.S. Eisenberg, and J. Colford, Jr., Epidemiology and Biomarkers Branch, Environmental Protection Agency (EPA), Research Triangle Park, NC; School of Public Health, Div. of Epidemiology, Univ. of California

June 2003

Method 1603: Escherichia coli (E. coli) in Water by Membrane Filtration Using Modified membrane-Thermotolerant Escherichia coli Agar (Modified mTEC)

Author: Office of Water (4303T) Environmental Protection Agency (EPA)

September 2002

Part III. Guidelines Establishing Test Procedures for the Analysis of Pollutants; Analytical Methods for Biological Pollutants in Ambient Water [Final Rule]

Author: Environmental Protection Agency (EPA)

July 21, 2003

Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Notice of Data Availability

Author: Environmental Protection Agency (EPA)

April 11, 2006

Rapidly Measured Indicators of Recreational Water Quality are Predictive of Swimming Associated Gastrointestinal Illness

Author: Timothy J. Wade, Rebecca L. Calderon, Elizabeth Sams, Michael Beach, Kristen P. Brenner, Ann H. Williams, and Alfred P. Dufour, The National Institute of Environmental Health Sciences, U.S. Department of Health and Human Services

Online: September 1, 2005

South Zumbro River in Rochester Fecal Coliform and E. coli Monitoring (2001) [DRAFT]

Author: Norman Senjem and Lee Ganske, Minnesota Pollution Control Agency (MPCA)

April 2003

Regional Total Maximum Daily Load Evaluation of Fecal Coliform Bacteria Impairments in the Lower Mississippi River Basin in Minnesota

Submitted by: Norman Senjem, Lee Ganske, Gregory Johnson, David Morrison, and Bill Thompson, Regional Environmental Management Division, Minnesota Pollution Control Agency (MPCA)

October 2002

Water-Resources Investigations. Escherichia coli and Fecal-coliform Bacteria as Indicators of Recreational Water Quality

Author: Donna S. Francy, Donna N. Myers, and Kevin D. Metzker, U.S. Geological Survey

1993

Surface Water Pathogen Study

Prepared by Wenck Associates, Inc.

Minnehaha Creek Watershed District

Study Completion: July 2003

Prepared for the Minnehaha Creek Watershed District

1984 Mississippi River Bacteria Study

Author: Gary L. Fandrei, Minnesota Pollution Control Agency (MPCA)

April 1985

1984 Mississippi River Bacteria Study

Author: Gary L. Fandrei, Minnesota Pollution Control Agency (MPCA)

April 1985
EC-13  **Health Effects Criteria for Fresh Recreational Waters**  
Author: Alfred P. Dufour, Toxicology and Microbiology Division, Environmental Protection Agency (EPA)  
**EPA Report**  
August 1984  
EPA-600/1-84-004  
http://www.epa.gov

EC-14  **Fecal Coliform vs. E. coli Water Quality Standards**  
Author: Dave Christopherson, Minnesota Pollution Control Agency (MPCA)  
**MPCA Document**  
May 2003

EC-15  **Water Pollution Control Act of 1972 Amendment to Section 303(i) Beaches Environmental Assessment and Coastal Health Act of 2000**  
106th Congress  
**Law**  
October 10, 2000  
Public Law 106-284; 114 STAT.870  
http://www.gpoaccess.gov/uscode/index.html

EC-16a **Subject: Reminder of Deadline and Advisement of EPA's Plans to Comply with Requirements of Section 303(i) of the Clean Water Act, Also Known As the BEACH Act**  
From Benjamin H. Grumbles, Office of Water, Environmental Protection Agency (EPA)  
**Letter**  
April 19, 2004  
To Sheryl A. Corrigan, Commissioner, Minnesota Pollution Control Agency (MPCA)  
_with Attachment - Outline/Requirements: "General Background of the BEACH Act"

EC-16b **Subject: Federal Promulgation of Water Quality Criteria for Bacteria**  
From Sheryl A. Corrigan, Commissioner, Minnesota Pollution Control Agency (MPCA)  
**Letter**  
May 7, 2004  
To Benjamin H. Grumbles, Office of Water Environmental Protection Agency (EPA)  
_Response to EPA

EC-17  **40 CFR Part 131**  
Part II. Water Quality Standards for Coastal and Great Lakes Recreation Waters; Final Rule  
Author: Environmental Protection Agency (EPA)  
**Public Notice**  
November 16, 2004  
Vol 69(220); pp.67218-67243  
http://www.epa.gov/fedregstr

Rules and Regulations. (EPA Promulgation of Standards for States Not Meeting Deadline)

EC-18  **Minnesota Lake Superior Beach Program**  
Author: Minnesota Pollution Control Agency (MPCA)  
**Website**  
June 24, 2004; Accessed: March 3, 2005  
http://www.pca.state.mn.us/water/beaches/index.html

EC-19  **Draft Matrix of Protocols and Criteria Used in Beach Closing Decisions**  
[DRAFT]  
Prepared by the Metro Area Beach Monitoring Group, Minnesota Pollution Control Agency (MPCA)  
**MPCA Document**  
September 2005  
_Headings: Sampling and Analysis Methods; ods; Thresholds; Actions; Other Items_

EC-20 **Subject: Comments on the May 2002 Draft "Implementation Guidance for Ambient Water Quality Criteria for Bacteria"**  
From Marvin E. Hora, Manager, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)  
**Letter**  
August 2002  
To Mr. William Morrow, Assistant Branch Chief, Water Quality Standards Branch, U.S. Environmental Protection Agency (EPA)
EC-21 Microbiological Quality of Puget Sound Basin Streams and Identification of Contaminant Sources  
Author: Sandra S. Embrey, Hydrologist, U.S. Geological Survey  
Journal J. of the American Water Resources Assoc. (JAWRA)  
Tacoma

EC-22 Accommodating Change of Bacterial Indicators In Long Term Water Quality Datasets  
Author: Curtis G. Cude, Natural Resource Specialist, Oregon Department of Environmental Quality, MSD/BSD  
Journal J. of the American Water Resources Assoc. (JAWRA)  
February 2005 Vol 41(1); pp.47-54 http://www.awra.org/publicationindex.htm  
Portland

EC-23 Bacterial Water Quality Standards for Recreational Waters (Freshwater and Marine Waters)  
Author: Office of Water (4305T), Environmental Protection Agency (EPA)  
Washington, D.C.

EC-24 Environmental Sampling and Analytical Contract Valid from July 1, 2004 Through June 30, 2006  
Author: Minnesota Pollution Control Agency (MPCA)  
MPCA Document MPCA  
June 30, 2006 Vol 2 (1); pp.1-6  
St. Paul

Prepared by Steven A. Heiskary, Environmental Analysis & Outcomes Division, Water Assessment & Environmental Information, and C. Bruce Wilson Watershed Section, Regional Division, Minnesota Pollution Control Agency (MPCA)  
Report MPCA September 2005 http://www.pca.state.mn.us/water  
St. Paul

EU-2 The Changing Lake Regions of Minnesota  
Author: Minnesota Lakes (MLA) Reporter  
Newspaper Minnesota Lakes Association Reporter  
July 2003 Vol 7 (2); pp.1 & 6 http://www.mnlakes.org  
David E. Maschwitz, Environmental Outcomes Division, MPCA

EU-3a Ecological Disaster. The State We’re In. One of a Series of Articles About Conservation, Chapter 3: Clearing the Shorelines  
Author: Dennis Anderson, Star Tribune Staff Writer  
Newspaper Minneapolis Star Tribune -Metro Edition  

EU-3b State of the Lakes. Minnesota is Known as the State of 10,000 Lakes and the Land of Sky Blue Waters. But Who's Looking After Our Trademark Waters?  
Author: Greg Breining, Minnesota Department of Natural Resources (MDNR)  
Journal Minnesota Conservation Volunteer  
July-August, 2003 http://www.dnr.state.mn.us/volunteer  
St. Paul

EU-3c 'Dog Days' of Summer Bring the Greening of Minnesota’s Lakes. The Solution to Lake Water Degradation May Be in Our Own Backyards  
Author: Forrest Peterson, Minnesota Pollution Control Agency (MPCA)  
MPCA Publication Minnesota Environment  
Fall 2001 Vol 2 (1); pp.1-6 www.pca.state.mn.us  
St. Paul

Author: Keith A. Anderson, University of Minnesota Sea Grant Program  
Newsletter The Seiche Newsletter  
### EU-14 Ecoregional Nutrient Criteria
Author: Office of Water, Environmental Protection Agency (EPA)

**Fact Sheet**
EPA
October 2002
EPA-822-F-02-008
http://www.epa.gov/OST/standards/nutrient.html

### EU-15 Nutrient Criteria Development; Notice of Ecological Nutrient Criteria (66 FR 1671)
Author: Environmental Protection Agency (EPA)

**Public Notice**
Federal Register (FR)
January 9, 2001
Vol 66(6); pp.1671-4
http://www.epa.gov/fedregstr/

Author: George Gibson, et al., Office of Water, Office of Science and Technology
Environmental Protection Agency (EPA)

**Guidance**
EPA
Washington,
April 2000
EPA-822-B00-001
http://www.epa.gov

### EU-17 Subject: Development and Adoption of Nutrient Criteria into Water Quality Standards
From/Signed by Geoffrey Grubbs, Director, Office of Science & Technology, Environmental Protection Agency (EPA)

**Memo**
EPA
November 14, 2001
http://www.epa.gov/OST/standards/nutrient.html

To Water Directors, Regions I - X; Directors, State Water Programs; Directors, Great Water Body Programs; Directors, Authorized Tribal Water Quality Standards Programs; State & Interstate Water Pollution Control Administrators

### EU-18 Subject: EPA Policy as it Relates to the Phosphorus Objectives for the Nation's Receiving Waters
From Francis T. Mayo, Regional Administrator, Environmental Protection Agency (EPA)

**Letter**
EPA Region V
Chicago
April 20, 1973
To Clarence A. Johannes, Director, Division of Water Quality, MPCA

### EU-19a Minnesota's Plan for Development of Nutrient Criteria
Author: Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Plan**
MPCA
April 2003
To U. S. Environmental Protection Agency (EPA), Region V, Chicago, IL
(Including: Schematic, Summary, Timeline & Narrative)

### EU-19b Minnesota's Plan for Development of Nutrient Criteria
From Environmental Outcomes and Analysis Division, Minnesota Pollution Control Agency (MPCA)

**Plan**
MPCA
September 2006
To U. S. Environmental Protection Agency (EPA), Region V, Chicago, IL
(Including: Schematic, Summary, Timeline & Narrative)

### EU-20 Subject: Minnesota's Nutrient Criteria Development Plan
From Michael J. Sandusky, Division Director, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

**Letter**
St. Paul
April 2003
To Mr. David Pfeifer, U.S. Environmental Protection Agency (EPA), Region V
Cover Letter to April 2003 Nutrient Plan (Exhibit EU-19a)

### EU-21
From Jo Lynn Traub, Director Water Division, Environmental Protection Agency (EPA), Region V

**Letter**
EPA Region V
Chicago
May 5, 2003
To Michael Sandusky, Director, Environmental Outcomes Division, MPCA
EPA Approval of 2003 Nutrient Plan (Exhibit EU-19a)
EU-22a  **Subject: Minnesota Nutrient Criteria Plan Update: 2004**
From Steven A. Heiskary, Environmental Analysis & Outcomes Division, Water Assessment & Environmental Information, MPCA
Memo MPCA St. Paul
April 7, 2004
To Dave Pfeifer, U. S. Environmental Protection Agency (EPA), Region V

EU-22b  **Subject: Cover Letter - Response to a Request for Progress on Minnesota's Nutrient Criteria Development Plan**
From Leo Raudys, Division Director, Regional Division, Minnesota Pollution Control Agency (MPCA)
Letter MPCA St. Paul
December 1, 2004
To Jodi Lynn Traub, U. S. Environmental Protection Agency (EPA), Region V
Response to Exhibit EU-21

EU-23  **Minnesota Ecoregions**
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document MPCA St. Paul
1993
MPCA Map & Ecoregion Descriptions

EU-24  **Analysis of Regional Patterns in Lake Water Quality: Using Ecoregions for Lake Management in Minnesota**
Author: Steven A. Heiskary, C. Bruce Wilson, Division of Water Quality, Minnesota Pollution Control Agency (MPCA) and David P. Larsen, Environmental Research Lab, Environmental Protection Agency (EPA), Corvallis, Oregon
Journal Lake & Reservoir Management (LRM) - Intl

EU-25  **Developing Eutrophication Standards for Lakes and Reservoirs**
Prepared by the Lake Standards Subcommittee, North American Lake Management Society (NALMS)
Report NALMS Alachua
May 1992 http://www.nalms.org
Chair: Steve Heiskary, MPCA

EU-26  **No Exhibit**

EU-27  **The Regional Nature of Lake Water Quality Across Minnesota: An Analysis for Improving Resource Management**
Author: Steven Heiskary and Bruce Wilson, Research Scientists, Program Development Section, Water Quality Division, Minnesota Pollution Control Agency (MPCA)
Journal Journal of the Minnesota Academy of Science (JMAS) St. Paul
1989 Vol 55(1); pp.71-7

EU-28  **Minnesota Lake Water Quality Assessment Report, Second Edition**
A Practical Guide for Lake Managers
Author: Steven A. Heiskary and C. Bruce Wilson, Program Development Section Division of Water Quality, Minnesota Pollution Control Agency (MPCA)
Report MPCA St. Paul
May 1990 http://www.pca.state.mn.us

EU-29  **Lake Assessment Program: A Cooperative Lake Study Program**
Author: Steven A. Heiskary, Environmental Analysis & Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Journal Lake and Reservoir Management (LRM) St. Paul

EU-30  **Developing Phosphorus Criteria for Minnesota Lakes**
Author: Steven A. Heiskary, Environmental Analysis & Outcomes Division, Minnesota Pollution Control Agency (MPCA), and W. W. Walker, Jr., Environmental Engineer, Concord, Massachusetts
Journal Lake and Reservoir Management (LRM) St. Paul
EU-32  A Chlorophyll a Trophic Status Classification System for South African Impoundments
Author: R. D. Walmsley
Journal  Journal of Environmental Quality
1984 Vol 13(1); pp.97-104 http://jeq.scijournals.org

EU-33  Analysis and Application of Lake User Survey Data
Author: Eric Smeltzer, Vermont Department of Environmental Conservation and S. A. Heiskary, Environmental Outcomes & Analysis, Minnesota Pollution Control Agency (MPCA)
Journal  Lake and Reservoir Management (LRM)

EU-34  Citizen Lake-Monitoring Program - 2001 Secchi Data Sheet
From Minnesota Pollution Control Agency (MPCA)
Form  MPCA
November 17, 2001 http://www.pca.state.mn.us
Includes choices for perceptions of physical condition and suitability for recreation.

EU-35  Reconstructing Historical Water Quality in Minnesota Lakes from Fossil Diatoms
Author: Steven A. Heiskary, Edward B. Swain, Minnesota Pollution Control Agency (MPCA), and Mark B. Edlund, Science Museum of Minnesota, St. Croix Watershed Research Station
MPCA Publication  Environmental Bulletin
September 2004 No. 4 http://www.pca.state.mn.us

EU-36  Water Quality Reconstruction from Fossil Diatoms: Applications for Trend Assessment, Model Verification, and Development of Nutrient Criteria for Lakes in Minnesota, USA
Author: Steven A. Heiskary, Environmental Analysis & Outcomes Division, Water Assessment & Environmental Information and Edward B. Swain, Ph.D., Minnesota Pollution Control Agency (MPCA)
Report  MPCA
September 2002 St. Paul http://www.pca.state.mn.us/water/lakequality.html reports
Part of a Series on Minnesota Lake Water Quality Assessment

EU-37  Shallow Lakes of Southeastern Minnesota: Status and Trend Summary for Selected Lakes
Author: Steven A. Heiskary, Howard Markus, and Matt Lindon, Environmental Analysis & Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Report  MPCA
Part of a Series on Minnesota Lake Water Quality Assessment

EU-38  Interrelationships Among Water Quality, Lake Morphometry, Rooted Plants and Related Factors for Selected Shallow Lakes of West-Central Minnesota
Author: Steven A. Heiskary and Matt Lindon, Environmental Analysis & Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Report  MPCA
March 2005 St. Paul http://www.pca.state.mn.us
Part of a Series on Minnesota Lake Water Quality Assessment

EU-39  Lakeshore Property Values and Water Quality: Evidence from Property Sales in the Mississippi Headwaters Region
Author/Submitted by: Charles Krysel, Elizabeth Marsh Boyer, Charles Parson, Ph.D., and Patrick Welle, Ph.D., Mississippi Headwaters Board & Bemidji State University
Report  Mississippi Headwaters Board
June 2003 Bemidji http://www.mississippiheadwaters.org
Submitted To the Legislative Commission on Minnesota Resources
EU-40 Economic Value of Protecting Minnesota's Lakes
Author: Harold E. Dziuk, Ph.D., Board Member for the Itasca Coalition of Lake Associations (CLA)
Newspaper Minnesota Lakes Association Reporter
November 2005 Vol 9(4); pp.1, 6-7 http://www.mnlakes.org

EU-41 Importance of Lakes to Minnesota's Economy
Author: Hank Todd, Minnesota Office of Tourism
Report Minnesota Lake Management Conference
October 1989 http://www.mnlakes.org

EU-42 No Exhibit

EU-43 Economic Values of Lakes
A publication of the North American Lake Management Society (NALMS)
Journal LakeLine
Fall 2003 Vol 23(3); pp.1-48 http://www.nalms.org/lakeline/lakeline.htm

EU-44 Shallow Lakes
A publication of the North American Lake Management Society (NALMS)
Journal LakeLine
Spring 2003 Vol 23(1); pp.11-36 http://www.nalms.org/lakeline/lakeline.htm
Special Issue of Lake Line

EU-45 Developing Environmental Indicators for Minnesota. Lakes. The Environmental Indicators Initiative
Author: State of Minnesota, Funded by the Minnesota Legislature on Recommendation of the Legislative Commission on Minnesota Resources (LCMR), Sponsored by The Environmental Quality Board (EQB)
Report Legislative Commission on Minnesota Resources (LCMR)
1998 http://www.commissions.leg.state.mn.us/lcmr/lcmr.htm

EU-46a Statement of Need and Reasonableness: In the Matter of Proposed Revisions of Minnesota Rules Chapter 7050, Relating to the Classification and Standards for Waters of the State
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document MPCA
April 2002 St. Paul Assessment Factors Rule Revision

EU-46b Staff Post-hearing Response to Public Comments
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document MPCA
July 8, 2002 St. Paul Assessment Factor Rule Revision [Attachments not part of the exhibit]

EU-46c Staff Final Response to Public Comments
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document MPCA
July 15, 2002 St. Paul Assessment Factor Rule Revision

EU-47 Measuring the Economic Value of Water Quality: The Case of Lakeshore Land
Author Donald N. Steinnes, Department of Economics, University of Minnesota Duluth
Journal The Annals of Regional Science
1992 Vol 26; pp.171-6
EU-48 **Protecting Aesthetics and the Visual Resource Quality of Lakes**

Author: Eric J. Macbeth, Minnesota-Wisconsin Boundary Area Commission

Journal Proceedings of a National Conference on Enhancing the States' Lake Management Program

Chicago 1991; pp.17-23

EU-49 **Subject: Nutrient Pollution and Numeric Water Quality Standards**

From Benjamin H. Grumbles, Assistant Administrator, Office of Water Environmental Protection Agency (EPA)

Memo EPA

Washington, D.C.

May 25, 2007

To Director, State Water Programs

H-1 **Subject: Request for Development of Water Quality Standards**

From Dan Stoddard, Manager, Agricultural Chemical Environmental Section, Minnesota Department of Agriculture (MDA)

Letter St. Paul

February 27, 2002

To Greg Gross, Environmental Outcomes Division, MPCA

H-2a **Subject: Water Quality Criterion for the Wrogge Spill**

Author: Dann D. White, Monitoring and Assessment, Water Quality Division, Minnesota Pollution Control Agency (MPCA)

Letter St. Paul

June 10, 1996

To Ms. Michelle Puchalski, Agronomy Services Division, Incident Response Section, Minnesota Department of Agriculture (MDA)

H-2b **Aquatic Life Criteria (Summary Sheet): Acetochlor**

Author: Minnesota Pollution Control Agency (MPCA)

Summary MPCA St. Paul

January 29, 1998

Includes Cover Letter

To Ms. Michele Puchalski, Agronomy Services Division, Incident Response Section, Minnesota Department of Agriculture. From Dann D. White

H-3 **Subject: Interim Water Quality Guideline Value for Metolachlor**

From Dann D. White, Monitoring and Assessment, Water Quality Division, Minnesota Pollution Control Agency (MPCA)

Letter St. Paul

February 23, 1998

To Ms. Michelle Puchalski, Agronomy Services Division, Incident Response Section, Minnesota Department of Agriculture (MDA)

H-4 **Acetochlor Supplement: Supplementary Information on Acetochlor and Metolachlor**

Author: Angela L. H. Preimesberger and David E. Maschwitz, Environmental Analysis and Outcomes Division, Minnesota Pollution Control Agency (MPCA)

MPCA Document MPCA St. Paul

November 7, 2005

Developed by the Water Quality Standards Unit, MPCA, in Cooperation with the Minnesota Department of Agriculture, Agronomy and Plant Protection Division

H-5 **Metolachlor Supplement: Supplementary Information on Acetochlor and Metolachlor**

Author: Angela L. H. Preimesberger and David E. Maschwitz, Environmental Analysis and Outcomes Division, Minnesota Pollution Control Agency (MPCA)

MPCA Document MPCA St. Paul

November 8, 2005

Developed by the Water Quality Standards Unit, MPCA, in Cooperation with the Minnesota Department of Agriculture, Agronomy and Plant Protection Division

H-6 **Subject: Request for Development of Water Quality Standards**

From Dan Stoddard, Manager, Agricultural Chemical Environmental Section, Minnesota Department of Agriculture (MDA)

Letter St. Paul

April 11, 2003

To Greg Gross, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Subject: Request for Development of Water Quality Standards

From Dan Stoddard, Manager, Agricultural Chemical Environmental Section, Minnesota Department of Agriculture (MDA)  
Letter  
June 23, 2004  
To Greg Gross, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)

Water Quality Best Management Practices for Agricultural Herbicides

Author: Minnesota Department of Agriculture (MDA)  
Guide  
February 2004  
http://www.mda.state.mn.us

Aquatic Life Criteria: Acetochlor [PROPOSED]

Author: Minnesota Pollution Control Agency (MPCA)  
Summary  
March 14, 2006  
Summary Sheet (5pgs) & Tables 1-5

Aquatic Life Criteria: Metolachlor (50:50 Formula) [PROPOSED]

Author: Minnesota Pollution Control Agency (MPCA)  
Summary  
March 15, 2006  
Summary Sheets (4pgs) & Tables 1-5

Aquatic Life Criteria: Metolachlor (88:12) formula [PROPOSED]

Author: Minnesota Pollution Control Agency (MPCA)  
Summary  
February 7, 2006  
Summary Sheets (4pgs) & Tables 1-5

Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses

Guide  
July 30, 1985  
pp.i-vi, 1-98  
http://www.epa.gov

Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:  
Acetochlor: Acute Toxicity to Rainbow Trout (Salmo gairdneri). Prepared by ICI Group Environmental Laboratory, Brixham, Devon, UK. Submitted by ICI Americas, Inc.  
Reviewed by Mark A. Mossler, M.S., Associate Scientist, KBN Engineering and Applied Sciences, Inc.  
Evaluation  
Reviewed: November 18, 1991  
OPP# (MRID No.) 419633-06; Registrant Report# BL3960/B  
http://www.epa.gov

Acetochlor: Acute Toxicity to Rainbow Trout (Salmo gairdneri). Prepared by ICI Group Environmental Laboratory, Brixham, Devon, UK. Submitted by ICI Americas, Inc.  
Author: J. F. Tapp, S. A. Sankey, J. E. Caunter, P. A. Johnson and D. S. Adams  
Study  
1991  
Registrant Report# BL3960/B; OPP# (MRID No.) 419633-06  
Attachment: MPCA Reference Review Form by D. White (Exhibit H-12a)

Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:  
Submitted 10-27-81 Under Accession (SIC) No. 246128  
Reviewed by J. Tice, Fish & Wildlife Biologist; HED/EEB  
Evaluation  
Reviewed: November 5, 1981  
OPP# 85993 and OPP# ACC246128  
http://www.epa.gov

Attachment: MPCA Reference Review Form by D. White

For Monsanto Company

Attachment: MPCA Reference Review Form by D. White (Exhibit 13a)

H-14a  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Acetochlor: Determination of Acute Toxicity to Bluegill Sunfish (Lepomis macrochirus). Brixham Study No. R1072/B. Study performed by Imperial Chemical PLC, Brixham Laboratory, Freshwater Quarry, Brixham, Devon, U.K. Submitted by ICI Americas, Inc.

Reviewed by Rosemary Graham Mora, M.S., Associate Scientist, KBN Engineering and Applied Sciences, Inc.

Attachment: MPCA Reference Review Form by D. White (Exhibit H-14a)

H-15  Acetochlor Fish Studies - Acetochlor: Determination of Acute Toxicity to Mirror Carp (Cyprinus carpio), Submitted by ICI Brixham Environmental Laboratory

Attachment: MPCA Reference Review Form by D. White (Exhibit H-15)

H-16a  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Acetochlor: An Investigation of the Toxicity of Technical Material and Formulation WF2061 to First Instar Daphnia magna. Laboratory Report No. RJ 0744B. Study performed by ICI Agrochemicals, Jealott's Hill Research Station, Bracknell, Berkshire, U.K. Submitted by ICI Americas, Inc.

Attachment: MPCA Reference Review Form by D. White (Exhibit H-16a)

H-17  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Acute Toxicity to Daphnids (Daphnia magna) Under Static Conditions, Springborn Laboratories, Inc., Wareham, MA. Ciba-Geigy Corporation, Greensboro, NC

Attachment: MPCA Reference Review Form by D. White
H-18a Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation: CGA 77102 - Acute Toxicity to Rainbow Trout (Oncorhynchus mykiss) Under Static Conditions. Springborn Laboratories, Inc, Wareham, MA. Ciba-Geigy Corporation, Greensboro, NC
Reviewed by Mark Mossler, M.S., Environmental Toxicologist, Golder Associates Inc.
Evaluation EPA
Reviewed: May 20, 1996 OPP# (MRID No.) 439289-11 http://www.epa.gov
Attachment: MPCA Reference Review Form by D. White

Author: Maura K. Collins, Study Director, Springborn Laboratories Inc.
Study Syngenta (Ciba-Geigy Corporation)
December 12, 1995 Regrantist Report# CGA-77102; OPP# (MRID No.) 439289-11
Submitted To: Ciba-Geigy Corporation (Greensboro, NC)
Attachment: MPCA Reference Review Form by D. White

H-19a Data Evaluation Record (Validation Sheet) - EPA, Office of Pesticide Programs (OPP) Database - Citation: Acute Toxicity of CGA-24705 to Rainbow Trout (Salmo gairdneri) Report# BW-78-6-186
Author: R. Balcomb
Evaluation EPA
Reviewed: July 20, 1978 OPP# (MRID No.) 18722 http://www.epa.gov
Attachment: MPCA Reference Review Form by D. White

H-19b Acute Toxicity of CGA-24705 to Rainbow Trout (Salmo gairdneri)
Prepared by Robert J. Buccafusco, EG & G, Bionomics, Aquatic Toxicology Laboratory
Study Syngenta (Ciba-Geigy Corporation)
June 1978 Report# CGA-24705; OPP# (MRID No.) 18722
Attachment: MPCA Reference Review Form by D. White

H-20 Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
Author: Foster L. Mayer and Mark R. Ellersieck

H-21a Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation: (Acetochlor: Daphnia magna Life-Cycle Study. Prepared by ICI Agrochemicals, Jealott’s Hill Research Station, Bracknell, Berkshire, UK. Submitted by ICI Americas, Inc. Wilmington, DE)
Reviewed by Louis M. Rifici, M.S., Associate Scientist, KPN Engineering and Applied Sciences, Inc.
Evaluation EPA
Reviewed: October 4, 1991 OPP# (MRID No.) 415651-38 http://www.epa.gov
Attachment: MPCA Reference Review Form by D. White

H-21b Acetochlor Aquatic Invertebrate Studies - Acetochlor: Daphnia magna Life-Cycle Study
Prepared by ICI Agrochemicals
Study Monsanto
1990 Report# RJ0785B; OPP# (MRID No.) 415651-38
Attachment: MPCA Reference Review Forms by D. White

H-22a Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation: Acetochlor: Determination of Chronic Toxicity to Fathead Minnow (Pimphales promelas) Embryos and Larvae. Prepared by ICI PLC, Brixham Laboratory, Brixham, Devon, UK. Submitted by ICI Americas, Inc.
Reviewed by Louis M. Rifici, M.S., Associate Scientist, KBN Engineering and Applied Sciences, Inc.
Evaluation EPA
Reviewed: October 4, 1991 OPP# (MRID No.) 415920-11 http://www.epa.gov
Attachment: MPCA Reference Review Form by D. White
H-22b Acetochlor: Determination of Chronic Toxicity to Fathead Minnow (Pimphales promelas) Embryos and Larvae. Prepared by ICI PLC, Brixham Laboratory, Brixham, Devon, UK.; Submitted by ICI Americas, Inc.

Author: J. F. Tapp, J. E. Caunter and R. D. Stanley

Study 1989

Report# BL/B/3669; OPP# (MRID No.) 415920-11

Attachment: MPCA Reference Review Form by D. White (Exhibit H-22a)

H-23 Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Chronic Toxicity of Acetochlor to Daphnia magna Under Flow-Through Test Conditions. Study conducted by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO. Submitted by Acetochlor Registration Partnership, c/o Monsanto Agricultural Company, St. Louis, MO

Reviewed by William S. Rabert, Biologist, Ecological Effects Branch, Environmental Fate and Effects Division (7507C), Environmental Protection Agency (EPA)

Evaluation EPA

Reviewed: November 2, 1993 OPP# (MRID No.) 427131-05 http://www.epa.gov

Attachment: MPCA Reference Review Form by D. White

H-24a Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
S-Metolachlor (CGA-77102): Early Life-Stage Toxicity Test with Fathead Minnow (Pimephales promelas). Springborn Laboratories, Inc, Wareham, MA. Novartis Crop Protection Inc., Greensboro, NC

Reviewed by Mark Mossler, M.S., Environmental Toxicologist, Golder Associates Inc.

Evaluation EPA

Reviewed: May 2, 2000 OPP# (MRID No.) 449959-03 http://www.epa.gov

Attachment: MPCA Reference Review Form by D. White

H-24b s-Metolachlor (CGA-77102): Final Report
s-Metolachlor (CGA-77102) - Early Life-Stage Toxicity Test with Fathead Minnow (Pimephales promelas)

Author: J. V. Sousa, Study Director, Springborn Laboratories Inc.

Study Syngenta (Novartis Crop Protection, Inc.)

Study Completion: November 30, 1999 Regisntant Report# CGA-77102; OPP# (MRID No.) 449959-03

Attachment: MPCA Reference Review Form by D. White

H-25a Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Acetochlor: Determination of Toxicity to the Green Alga Selenastrum capricornutum. Laboratory ID No. R1072/I. Conducted by Imperial Chemical Industries PLC, Brixham, Devon, UK. Submitted by ICI Americas, Inc.

Reviewed by Mark A. Mossler, M.S., Associate Scientist, KBN Engineering and Applied Sciences, Inc.

Evaluation EPA

Reviewed: January 17, 1992 OPP# (MRID No.) 415651-41 http://www.epa.gov

Attachment: MPCA Reference Review Form by D. White

H-25b Acetochlor: Determination of Toxicity to the Green Alga Selenastrum Capricornutum. Laboratory ID No. R1072/I. Conducted by Imperial Chemical Industries PLC, Brixham, Devon, UK. Submitted by ICI Americas, Inc.

Author: D. V. Smyth, J. F. Tapp, S. A. Sankey and R. D. Stanley

Study Monsanto 1989

OPP# (MRID No.) 415651-41

Attachment: MPCA Reference Review Form by D. White

H-26a Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Acetochlor Toxicity to the Duckweed (Lemna gibba). Laboratory ID No. W556/D (FT21/92). Conducted by ZENECA Agrochemicals, Surrey, UK

Reviewed by William S. Rabert, Biologist, Ecological Effects Branch, Environmental Fate and Effects Division (7507C)

Evaluation EPA

Reviewed: November 4, 1993 OPP# (MRID No.) 427131-07 http://www.epa.gov

Attachment: MPCA Reference Review Form by D. White

H-26b Acetochlor Toxicity to the Duckweed (Lemna gibba). Laboratory ID No. W556/D (FT21/92). Conducted by ZENECA Agrochemicals, Surrey, UK

Author: D. V. Smyth, S. A. Sankey, and A. J. Penwell

Study Monsanto 1993 OPP# (MRID No.) 427131-07

Attachment: MPCA Reference Review Form by D. White (Exhibit H-26a)
H-27  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Acetochlor: Toxicity to the Freshwater Diatom Navicula pelliculosa. Laboratory ID No. W566/C (FT20/92). Conducted by
Imperial Chemical Industries PLC, Devon, UK. Submitted by ICI Agrochemicals, Surrey, UK
Reviewed by Mark A. Mossler, M.S., Associate Scientist, KBN Engineering and Applied Sciences, Inc.
Evaluation EPA
Reviewed: May 24, 1993  OPP# (MRID No.) 427131-08 http://www.epa.gov
Attachment: MPCA Reference Review Form by D. White

H-28  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Acetochlor: Toxicity to Blue-green Alga Anabaena flos-aqua. Laboratory ID. No. W566/A (FT18/92). Conducted by Imperial
Chemical Industries PLC, Devon, UK. Submitted by ICI Agrochemicals, Surrey, UK
Reviewed by Mark A. Mossler, M.S., Associate Scientist, KBN Engineering and Applied Sciences, Inc.
Evaluation EPA
Reviewed: June 1, 1993  OPP# (MRID No.) 427131-09 http://www.epa.gov
Attachment: MPCA Reference Review Form by D. White

H-29  Acetochlor Laboratory Aquatic Macrophyte Tests - Determination of the Effect of One Day Exposure to Technical Acetochlor
on Elodea canadensis Acquired from an Outdoor Pond
Author: E. M. Foekema, M. T. Collombon, G. Hoornsman
Study Monsanto
Attachment: MPCA Reference Review Form by D. White

H-30  Acetochlor Laboratory Aquatic Macrophyte Tests - Determination of the Effect of a Single Application of Technical Acetochlor
in a Static Test on Elodea canadensis Acquired from an Outdoor Pond
Author: E. M. Foekema, M. T. Collombon, G. Hoornsman
Study Monsanto
2004  Registrant Report# TN-2004-009
Attachment: MPCA Reference Review Form by D. White

H-31  Acetochlor Laboratory Aquatic Macrophyte Tests - Determination of the Effect of a Single Application of Technical Acetochlor
in a Static Test on Elodea canadensis Acquired from a Commercial Supplier
Author: E. M. Foekema, M. T. Collombon, G. Hoornsman
Study Monsanto
2004  Registrant Report# TN-2004-010
Attachment: MPCA Reference Review Form by D. White

H-32  Acetochlor Outdoor Microcosm/Mesocosm Studies - The Determination of the Biological Effects of a Single Pulse of Technical
Acetochlor in Outdoor Ponds
Author: E. M. Foekema
Study Monsanto
Attachment: MPCA Reference Review Form by D. White

H-33  Acetochlor Algae Studies - Acetochlor Technical-Toxicity Test and Recovery Period with Freshwater Green Alga,
Psudokchneriella subcapitata
Author: J. R. Hoberg
Study Monsanto
Attachment: MPCA Reference Review Form by D. White

H-34  Acetochlor Algae Studies - Acetochlor Technical-Toxicity Test and Recovery Period with Marine diatom, Skeletonema costatum
Author: J. R. Hoberg
Study Monsanto
2003  Registrant Report# SE-2003-098
Attachment: MPCA Reference Review Form by D. White
H-35  **Acetochlor Outdoor Microcosm/Mesocosm Studies - An Assessment of Toxicity of Technical Acetochlor to the Aquatic Macrophytes Glyceria maxima, Myriophyllum spicatum, and Lagarosiphon major.**


Study  Monsanto (Dow Agrosciences)

2003  Registrant Report# DAS 011246

Attachment:  MPCA Reference Review Form by D. White

H-36  **Acetochlor Laboratory Aquatic Macrophyte Tests - Acetochlor Technical-Toxicity Test and Period with Duckweed, Lemna gibba**

Author: A. E. Putt

Study  Monsanto

2003  Registrant Report# SE-2003-095

Attachment:  MPCA Reference Review Form by D. White

H-37  **Factors Determining the Bioaccumulation Potential of Pesticides in the Individual Compartments of Aquatic Food Chains**

Author: H. Ellgehausen, J. A. Guth, and H. O. Esser, Agricultural Division, CIBA-GEIGY Ltd., Basel, Switzerland

Journal  Ecotoxicology and Environmental Safety

1980  Vol 4 (2); pp.134-157; ECOTOX# 6458

Attachment:  MPCA Reference Review Form by D. White

H-38  **Short-Term Effects of Herbicides on Primary Productivity of Periphyton in Lotic Environments**

Author: K. E. Day

Journal  Ecotoxicology

1993  Vol 2 (2); pp.123138; ECOTOX# 13325

Attachment:  MPCA Reference Review Form by D. White

H-39  **Metolachlor and 2,4-Dichlorophenoxyacetic Acid Sensitivity of Salvinia natans**

Author: A. M. Goncz, and L. Sencic

Journal  Bulletin of Environmental Contamination and Toxicology

1994  Vol 53 (6); pp.852-5; ECOTOX# 13738

Attachment:  MPCA Reference Review Form by D. White

H-40  **Aquatic Phyto-Toxicity of 23 Pesticides Applied at Expected Environmental Concentrations**

Author: H. G. Peterson, C. Boutin, P. A. Martin, K. E. Freemark, N. J. Ruecker, and M. J. Moody

Journal  Aquatic Toxicology

1994  Vol 28 (3/4); pp.275-92; ECOTOX# 13860

http://www.elsevier.com/wps/find/journaldescription.cws_home/622819/description#

Attachment:  MPCA Reference Review Form by D. White

H-41  **Comparative Sensitivity of Selenastrum capricornutum and Lemna minor to Sixteen Herbicides**

Author: J. F. Fairchild, D. S. Ruessler, P. S. Haverland, and A. R. Carlson

Journal  Archives of Environmental Contamination and Toxicology

1997  Vol 32; pp.353-57; ECOTOX# 18093

Attachment:  MPCA Reference Review Form by D. White

H-42  **Comparative Sensitivity of Five Species of Macrophytes and Six Species of Algae to Atrazine, Metribuzin, Alachlor, and Metolachlor**

Author: J. F. Fairchild, D. S. Ruessler, and A. R. Carlson

Journal  Environmental Toxicology and Chemistry

1998  Vol 17 (9); pp.1830-4; ECOTOX# 19461

http://etc.allenpress.com/entconline/?request=index-html

Attachment:  MPCA Reference Review Form by D. White
H-43  Comparative Assessment of Herbicide Phytotoxicity to Selenastrum capricornutum Using Microplate and Flask Bioassay Procedures
Author: D. St. Laurant, and C. Blaise
Journal  Environmental Toxicology and Water Quality: An International Journal
1992  Vol 7; pp.35-48 (OECDG Data File); ECOTOX#  56387  http://www3.interscience.wiley.com/cgi-bin/jhome/10008541
Attachment:  MPCA Reference Review Form by D. White

H-44  An Aquatic Risk Assessment of Four Herbicides Using Six Species of Algae and Five Species of Aquatic Macrophytes
Author: J. F. Fairchild, S. D. Ruessler, M. K. Nelson, and A. R. Carlson
Journal  Society of Environmental Toxicology and Chemistry (SETAC)
1994  Conference Proceeding;  ECOTOX# 61707  http://www.setac.org
Presented at the 1994 SETAC Meeting, Oct. 30-Nov. 3, 1994, Denver, CO
Attachment:  MPCA Reference Review Form by D. White

H-45  The Toxicity of the Herbicide Metolachlor, Some Transformation Products and a Commercial Safener to an Alga (Selenastrum capricornutum), a Cyanophyte (Anabaena cylindrica) and a Macrophyte (Lemna gibba)
Author: K. E. Day, and V. Hodge
Journal  Water Quality Research Journal -Canada
1996  Vol 31 (1); pp.197-214  http://www.cciw.ca/wqrjc/wqrjce.htm
Attachment:  MPCA Reference Review Form by D. White

H-46  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Metolachlor-technical-5 Day Toxicity to Freshwater Green Alga, Anabaena flos-aqua. Springborn Laboratories, Inc., Wareham, MA. Ciba Crop Protection, Greensboro, NC
Reviewed by William Erickson, Biologist, EEB/EFED
Evaluation  EPA
Reviewed: January 26, 1995  OPP# (MRID No.) 434871-04  http://www.epa.gov
Attachment:  MPCA Reference Review Form by D. White

H-47a  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Metolachlor technical-Toxicity to Duckweed (Lemna gibba). Springborn Laboratories, Inc., Wareham, MA. Ciba Crop Protection, Greensboro, NC
Reviewed by William Erickson, Biologist, EEB/EFED
Evaluation  EPA
Reviewed: January 26, 1995  OPP# (MRID No.) 434871-05  http://www.epa.gov
Attachment:  MPCA Reference Review Form by D. White

H-47b  Metolachlor technical - Toxicity to Duckweed (Lemna gibba)
Author: James R. Hoberg
Study  Syngenta (Ciba-Geigy Corporation)
January 9, 1995  SLI Registrant Report# 94-8-5404; OPP# (MRID No.) 43487105
Attachment:  MPCA Reference Review Form by D. White

H-48  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Metolachlor technical-Toxicity to the Marine diatom, Skeletonema costatum. Springborn Laboratories, Inc., Wareham, MA. Ciba Crop Protection, Greensboro, NC
Reviewed by William Erickson, Biologist, EEB/EFED
Evaluation  EPA
Reviewed: January 26, 1995  OPP# (MRID No.) 434871-06  http://www.epa.gov
Attachment:  MPCA Reference Review Form by D. White

H-49  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation:
Metolachlor technical-5-Day Toxicity to the Freshwater Green Alga, Selenastrum capricornutum, Using Acetone as a Carrier Solvent. Springborn Laboratories, Inc., Wareham, MA. Ciba Crop Protection, Greensboro, NC
Reviewed by William Erickson, Biologist, EEB/EFED
Evaluation  EPA
Reviewed: March 1, 1995  OPP# (MRID No.) 435413-01  http://www.epa.gov
Attachment:  MPCA Reference Review Form by D. White
H-56a  Data Evaluation Record - EPA, Office of Pesticide Programs (OPP) Database - Citation: CGA 77102: Toxicity to Duckweed Lemna gibba. Springborn Laboratories, Inc., Wareham, MA. Ciba-Geigy Corporation, Greensboro, NC
Reviewed by Max Feken, M.S., Environmental Toxicologist, KBN Engineering and Applied Sciences, Inc.
Evaluation EPA
Reviewed: May 16, 1996 OPP# (MRID No.) 439289-31 http://www.epa.gov
Attachment: MPCA Reference Review Form by D. White

Author: James R. Hoberg
Study Syngenta (Ciba-Geigy Corporation)
Study Completion: September 28, 1995 Registrant Report# 95-8-6068; OPP# (MRID No.) 439289-31
Attachment: MPCA Reference Review Form by D. White

H-57  Acetochlor Plant Toxicity Data from Table 4a, Proposed Water Quality Standard
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
MPCA Document MPCA
January 19, 2006
Spreadsheets: Species Chronic Value (SCV), and Ranked Toxicity Values (January 20, 2006)

H-58  Metolachlor Plant Toxicity Data from Table 4a, Proposed Water Quality Standard
Author: David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
MPCA Document MPCA
January 19, 2006
Spreadsheets: Species Chronic Value (SCV), and Ranked Toxicity Values (January 20, 2006)

H-59  Ambient Aquatic Life Water Quality Criteria for Atrazine [REVISED DRAFT]
Author: Office of Water, Environmental Protection Agency (EPA)
EPA Report EPA Washington, D.C.
October 2003 EPA-822-R-03-23 http://www.epa.gov

H-60  New York State-Aquatic Fact Sheet: Ambient Water Quality Value for Protection of Aquatic Life [DRAFT]
From New York State
Fact Sheet
August 10, 2005

H-61  Health Risk Limits for Groundwater Chemical: Acetochlor, CAS# 34256-82-1 [DRAFT]
Author: Minnesota Department of Health (MDH)
Summary MDH St. Paul
December 28, 2006 http://www.health.state.mn.us
Part of Groundwater HRL Rule, Minnesota Rule ch. [Draft]

H-62  Subject: Health Based Values for Acetochlor ESA & Acetochlor OXA
From Helen Goeden, Health Risk Assessment Unit, Environmental Health Division, Minnesota Department of Health (MDH)
Memo St. Paul
February 13, 2006
To Dan Stoddard, Joseph Zachmann, Minnesota Department of Agriculture (MDA)
Includes Attachment: Data for Derivation of Ground Water Health Based Value (HBV)

H-63  Acetochlor Fish Studies - Acetochlor: An Investigation of Accumulation and Elimination in Bluegill Sunfish in a Flow-Through System (ICI Americas Report# RJ0846B) and Calculation of Bioconcentration Factors in Bluegill Sunfish (Addendum to RJ0846B)
Study Monsanto
Attachment: MPCA Reference Review Form by D. White (BCF Studies)
Health Risk Limits for Groundwater Chemical: Metolachlor, CAS# 51218-45-2 (and s-Metolachlor) [DRAFT]
Author: Minnesota Department of Health (MDH)
Summary
July 26, 2004
http://www.health.state.mn.us
Part of Groundwater HRL Rule, Minnesota Rule ch. [Draft]

Subject: Health Based Value for Metolachlor OA and Metolachlor ESA
From Anne Kukowski, Health Risk Assessment Unit, Minnesota Department of Health (MDH)
Memo
July 7, 2004
To Joseph Zachmann, Dan Stoddard, Minnesota Department of Agriculture (MDA)

Metabolism of [14C] Metolachlor in Bluegill Sunfish
Author: Sean M. Cruz, Margaret N. Scott, and Andrew K. Merrit, Metabolism Department, Agricultural Division, Ciba-Geigy Corporation
Journal Journal of Agricultural Food Chemistry
1993 Vol 41; pp.662-8
http://www.health.state.mn.us
Attachment: MPCA Reference Review Form by D. White

CORN - Minnesota Agriculture in the Classroom Program
Author: Minnesota Department of Agriculture (MDA)
Fact Sheet
2004
http://www.mda.state.mn.us/maitc
Commodity Card: Corn (Field)

S-Metolachlor; Pesticide Tolerance
Author: Environmental Protection Agency (EPA)- From the Federal Register Online via GPO Access
Public Notice Federal Register (FR)
August 30, 2006 Vol 71(168); pp.51505-10 http://www.epa.gov/fedrgstr/

Subject: Transmittal Memo for the Ecological Risk Assessment for the Use of S-Metolachlor on Pumpkins and Winter Squash (IR-4, DP 324973) and on Pumpkins in New York State (S18, DP 327861)
From Paige Doelling Brown, Ph.D., Fisheries Biologist, James Hetrick, Ph.D., Senior Chemist, and Nancy Andrews, Ph.D. Branch Chief Environmental Risk Branch 1, Environmental Fate and Effects Division
To Joanne Miller, Product Manager, Herbicide Branch, Barbara Madden, Risk Integration, Minor Use, Emergency Response Branch, and Daniel Rosenblatt, Team Leader, Emergency Response Team, Registration Division

Ecological Risk Assessment for Use of S-Metolachlor (PC 108800) on Pumpkins and Winter Squash (DP324973, DP327861)
Author Environmental Fate and Effects, Environmental Protection Agency (EPA)
EPA Document EPA Washington, D.C.
May 2006 http://www.epa.gov
Referenced in Memo (Exhibit H-68b)

Subject: S-metolachlor Human Health Risk Assessment for Proposed Section 18 Uses on Cilantro, Collards, Kale, and Mustard Greens; Section 3 Use on Pumpkins; and Tolerance on Winter Squash without a US Registration. PC Code: 108800 S-metolachlor & 108801 Metolachlor, ID#: 06OH05 & PP#E7015, DP Numbers: 329117 & 326011. [Executive Summary]
From W. Cutchin, Chemist, ARIA Team, Technical Review Branch, Registration Division
Memo EPA Washington, D.C.
July 13, 2006 pp.1-11
To Barbara Madden and A. Ertman PM-5, Risk Integration Minor Use and Emergency Response Branch, Registration Division; Through Christina Swartz, Chief Registration Action Branch, Health Effects Division
Toxicity to Daphni magna, Hyalella azteca, Oncorhynchus kisutch, Oncorhynchus mykiss, Oncorhynchus tshawytscha, and Rana catesbeiana of Atrazine, Metolachlor, Simazine, and Their Formulated Products

Author: M. T. Wan, C. Buday, G. Schroeder, J. Kuo, and J. Pasternak

Journal: Environmental Contamination and Toxicology

2006, Vol 76, pp.52-58


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**HH-1**

**Current Drinking Water Standards: List of Drinking Water Contaminants and MCLs**

Author: Ground Water and Drinking Water, Environmental Protection Agency (EPA)

Website: EPA Washington, D.C.

July 2002, Accessed: July 14, 2005

EPA 816-F-02-013

http://www.epa.gov/safewater/mcl.html

**HH-2**

**2006 Edition of the Drinking Water Standards and Health Advisories**

Author: Environmental Protection Agency (EPA)

EPA Report: EPA Washington, D.C.

August 2006

EPA 822-R-06-013

http://www.epa.gov/waterscience

**HH-3**

**Guidelines for the Development of Surface Water Quality Standards. For Protection of Aquatic Life, Including Human Health and Wildlife [DRAFT]**

Author: David E. Maschwitz, Environmental Outcomes Division, Environmental Standards and Analysis Section, Minnesota Pollution Control Agency (MPCA)

Guide: MPCA St. Paul

August 28, 2000

pp.1-40, and Appendix A - G1.

http://www.pca.state.mn.us

1st Version: January 1990

**HH-4**

**Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health**

Author: Office of Water, Office of Science and Technology, Environmental Protection Agency (EPA)

Guide: EPA Washington, D.C.

October 2000

EPA-822-B-00-004; pp.i-xvii, 1-1

http://www.epa.gov

through 5-67

FINAL

**HH-5**

**Health Risk Limits for Groundwater Chemical Summary: Benzene, CAS# 71-43-2 [DRAFT]**

Author: Minnesota Department of Health (MDH)

Summary: MDH St. Paul

November 24, 2004

http://www.health.state.mn.us

Part of Groundwater HRL Rule, Minnesota Rule ch. [Draft]

**HH-6**

**Health Risk Limits for Groundwater Chemical Summary: Naphthalene, CAS# 91-20-3 [DRAFT]**

Author: Minnesota Department of Health (MDH)

Summary: MDH St. Paul

February 17, 2004

http://www.health.state.mn.us

Part of Groundwater HRL Rule, Minnesota Rule ch. [Draft]

**HH-7**

**Aquatic Life Criteria: Benzene, CAS# 71432**

Author: Minnesota Pollution Control Agency (MPCA)

Summary: MPCA St. Paul

January 1990, Revised February 1993

Summary Sheets (3pgs) and Tables 1-5a

**HH-8**

**Aquatic Life Criteria: Benzene, CAS# 71-43-2 [PROPOSED]**

Author: Minnesota Pollution Control Agency (MPCA)

Summary: MPCA St. Paul

February 1993, Revised January 2006

Summary Sheets (3pgs) and Tables 1-5a
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<td>Aquatic Life Criteria: Naphthalene, CAS# 91203</td>
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<td>April 1991</td>
<td>St. Paul</td>
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<td>Fact Sheet for the National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Permit Program General Permit No. MN G790000  [DRAFT]</td>
<td>Minnesota Pollution Control Agency (MPCA)</td>
<td>April 20, 2006</td>
<td>St. Paul</td>
<td>Fact Sheet</td>
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<td>Minnesota's Total Maximum Daily Load Study of Mercury  [DRAFT]*</td>
<td>Minnesota Pollution Control Agency (MPCA)</td>
<td>June 1, 2006</td>
<td>St. Paul</td>
<td>Study Study# wq-w4-01b; pp.i-xiii, 1-57, <a href="http://www.pca.state.mn.us">www.pca.state.mn.us</a> Appd.A and B</td>
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| M-3      | Sources of Mercury Pollution and the Methylmercury Contamination of Fish in Minnesota | Minnesota Pollution Control Agency (MPCA) | August 2005 | St. Paul | Fact Sheet:
| M-4      | Eat Fish Often? | Minnesota Department of Health (MDH) | May 2004 | St. Paul | Pamphlet IC# 141-0378 http://www.health.state.mn.us A Minnesota Guide to Eating Fish |
| M-6      | Subject: Bioaccumulation Factors (BAF) for Mercury in Northern Pike and Walleye: Rivers | Minnesota Pollution Control Agency (MPCA) | September 30, 2005 (Updated: August 5, 2003) | St. Paul | Memo Includes Tables |
M-7 Subject: Bioaccumulation Factors (BAF) for Mercury in Northern Pike and Walleye: Lakes [DRAFT]
From Bruce Monson, Minnesota Pollution Control Agency (MPCA)
Memo
July 30, 2003
To David E. Maschwitz, Environmental Outcomes Division, Dennis Wasley, Gary Kimball, MPCA

M-8 Notice of Draft Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion
Author: Environmental Protection Agency
Public Notice
Federal Register (FR)
August 9, 2006
http://www.epa.gov/fedrgstr/

PL-1a MPCA Phosphorus Strategy Web Page
Author: Minnesota Pollution Control Agency (MPCA)
Website
July 14, 2006
http://www.pca.state.mn.us/water/phosphorus.html

PL-1b Phosphorus Strategy: NPDES Permits (000306) - Strategy for Addressing Phosphorus in National Pollutant Discharge Elimination System (NPDES) Permitting
Author: Minnesota Pollution Control Agency (MPCA)
Fact Sheet
March 2000
http://www.pca.state.mn.us

PL-1c MPCA Phosphorus (P) Strategy: NPDES Permits [Information Packet]
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document
March 2000
Report
Report# wq-b6-01
http://www.pca.state.mn.us

Prepared by Pamela J. Davis, Coordinator, St. Croix Basin Water Resources Planning Team
Report
August 2004
http://www.pca.state.mn.us

PL-2b Wisconsin Department of Natural Resources and Minnesota Pollution Control Agency: Agreement on Nutrient and Sediment Reduction in the St. Croix River Basin
Signed: Sheryl Corrigan, Commissioner Minnesota Pollution Control Agency and Scott Hassett, Secretary Wisconsin Department of Natural Resources
Agreement
Signed: April 6, 2006

PL-3 Subject: Cost Estimates for Phosphorus Removal
From Randy Thorson, Municipal Division, Minnesota Pollution Control Agency (MPCA)
Memo
August 17, 2005
To David E. Maschwitz, Environmental Analysis and Outcomes Division, MPCA

PL-4 Wastewater Phosphorus Control and Reduction Initiative
Author: Hydroqual, Inc. in Association with H. David Stensel, Ph.D., P.E., University of Washington
Study
Minnesota Environmental Science and Economic Review Board (MESERB)
Study Completion Date: April 2005
Bio-P Study (Executive Summary)
Project #MESE0001; ppES1-14

PL-5 Joint LMC/MPCA Survey of Bio-P Costs
Survey
PL-6 Economic Evaluation of Aesthetic Amenities: A Case Study of River View
S. N. Kulshreshtha and J. A. Gillies, University of Saskatchewan
Journal Water Resources Bulletin
April 1993 Vol 29(2); pp.257-66

PL-7 Establishing Relationships Among Nutrient Concentrations, Phytoplankton Abundance, and Biochemical Oxygen Demand in Minnesota, USA, Rivers
Author: Steven A. Heiskary, Environmental Analysis & Outcomes Division, Water Assessment & Environmental Information, and Howard Markus, Monitoring & Assessment, Minnesota Pollution Control Agency (MPCA)
Journal Lake and Reservoir Management (LRM) St. Paul
2001 Vol 17(4); pp.251-62 http://www.nalms.org/journal/lrm.htm

PL-8 Establishing Relationships Among In-Stream Nutrient Concentrations, Phytoplankton and Periphyton Abundance and Composition, Fish and Macroinvertebrate Indices, and Biochemical Oxygen Demand in Minnesota USA Rivers - Final Report
Author: Steven A. Heiskary, Environmental Analysis & Outcomes Division, Water Assessment & Environmental Information, and Howard Markus, Monitoring & Assessment, Minnesota Pollution Control Agency (MPCA)
Report MPCA St. Paul
July 2003 pp.i-iv, 1-100
To USEPA Region V

PL-9 Subject: Proposed Extension of 1mg/L Phosphorus Effluent Limit to New or Expanding Discharges
From David E. Maschwitz, Environmental Outcomes Division, Minnesota Pollution Control Agency (MPCA)
Memo St. Paul
March 18, 2004
To Michael Sandusky, Director, Environmental Outcomes Division, MPCA
(without attachments)

PL-10 Municipalities Given 1 mg/L Total Phosphorus Effluent Limits Since Phosphorus Strategy Was Approved, March 2000
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document September 2005

PL-11 Industries Given 1 mg/L Total Phosphorus Effluent Limits Since Phosphorus Strategy Was Approved, March 2000 [Working DRAFT]
Author: David E. Maschwitz, Environmental Outcomes Division, MPCA
MPCA Document St. Paul
September 2005

PL-12 Evaluation of Membrane Bioreactor Process Capabilities to Meet Stringent Effluent Nutrient Discharge Requirements
Author: Edwin J. Fleischer, Thomas A. Broderick, Glen T. Daigger, Anabela D. Fonseca, R. David Holbrook, Sudhir N. Murthy
Journal Water Environment Research (WER) St. Paul

PL-13 Chapter NR 217-Effluent Standards and Limitations
Wisconsin Department of Natural Resources

PL-14 Implementation Guidance for Chapter NR 217: Phosphorus Effluent Standards and Limitations [Final Document]
Author: Wisconsin Department of Natural Resources and Bureau of Watershed Management
Guidance WI DNR June 1999 http://www.dnr.state.wi.us/

PL-15 Notice of Adopted Amendment
Illinois Pollution Control Board
Public Notice Illinois Register
February 17, 2006 Vol 30(7); pp.2365-72
UC-1 **Subject: Stream Reclassification Request of Renville County Ditch No. 45, (Branch Lateral 3)**
From Craig R. Olson (Yaggy Colby Associates) on behalf of Midwest Investors of Renville, Inc., dba Golden Oval Eggs Cooperative
Letter
June 13, 2003
To Marvin E. Hora, Manager, Environmental Outcomes Division, MPCA

UC-2 **Stream Assessment Worksheet Use Attainability Analysis, County Ditch No. 45 (Branch Lateral 3)**
Golden Oval Eggs Cooperative
Form
November 8, 2004

UC-3 **Stream Assessment Worksheet Use Attainability Analysis, County Ditch No. 45 (Branch Lateral 3)**
Southern Minnesota Beet Sugar Cooperative
Form
November 8, 2004

UC-4 **Subject: Requesting Discharge Variance and Reclassification of Judicial Ditch No. 29, Evan, Minnesota**
From Sylvia Schwarz, Arden Environmental Engineering, Inc. on behalf of the City of Evan, Minnesota
Letter
August 14, 2001
To Marvin E. Hora, Manager, Environmental Outcomes Division, MPCA

UC-5 **Stream Assessment Worksheet Use Attainability Analysis, Lateral Judicial Ditch No. 29 and Judicial Ditch No. 29**
City of Evan, Minnesota
Form
October 24, 2002

UC-6 **MPCA Board Item and Attachments Re: Evan NPDES/SDS Permit Issuance and Variance Request, Brown County — Request for Variance from the Dissolved Oxygen, Un-ionized Ammonia Nitrogen and Fecal Coliform Bacteria Water Quality Standards for Judicial Ditch No. 29**
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document
Evan
April 22, 2003
http://www.pca.state.mn.us

UC-7 **Subject: Requesting Reclassification of Judicial Ditch No. 4**
From Scott A. Johnson, Terracon on behalf of Lac Qui Parle Oil Cooperative
Letter
April 28, 2003
To Marvin E. Hora, Manager, Environmental Outcomes Division, MPCA

UC-8 **Stream Assessment Worksheet Use Attainability Analysis, County Ditch No. 4**
Lac Qui Parle Oil Cooperative
Form
November 4, 2004

UC-9 **Subject: Dawson Ditch**
From Chris Domeier, Minnesota Department of Natural Resources (MDNR) Fisheries, Ortonville, MN
e-mail
January 26, 2006
To Gerald Blaha, Environmental Outcomes Division, MPCA
Referencing April 1982 sodium hydroxide spill to Jud. Dt. No. 4 at Dawson, MN Spill File No. 10403

UC-10 **Subject: Requesting a Total Chloride Variance Request for Discharge to an Unnamed Ditch to Sater's Creek**
From Rick Serie, Agri-Energy, LLC
Letter
February 27, 2002
To Becky Olson, MPCA
UC-11 Stream Assessment Worksheet Use Attainability Analysis, Unnamed Ditch and Sater's Creek
Agri-Energy, LLC
Form
November 4, 2004

UC-12 Subject: Requesting Stream Reclassifications for Unnamed Ditches and Freeborn County Ditch No. 71 and Discharge Variances, Myrtle, Minnesota
From Dan Bigalke (Arden Environmental Engineering, Inc.), on behalf of the City of Myrtle
Letter
December 23, 2003
To Marvin E. Hora, Manager, Environmental Outcomes Division, MPCA

UC-13 Stream Assessment Worksheet Use Attainability Analysis, Unnamed Ditches and County Ditch No. 71
City of Myrtle, MN
Form
November 3, 2004

UC-14 Subject: Requesting Stream Reclassification for Freeborn County Ditch No. 11 and Discharge Variances, Manchester, Minnesota
From Dan Bigalke (Arden Environmental Engineering, Inc.) on behalf of the City of Manchester
Letter
December 23, 2003
To Marvin E. Hora, Manager, Environmental Outcomes Division, MPCA

UC-15 Stream Assessment Worksheet Use Attainability Analysis, County Ditch No. 11
City of Manchester, MN
Form
November 3, 2004

UC-16 Stream Assessment Worksheet Use Attainability Analysis, County Ditch No. 45: Class 7 Reclassification back to a Class 2B Water Use Classification
Form
November 8, 2004

UC-17 Biological Monitoring Report for CD45 and Sacred Heart Creek
Author: Barr Engineering
Report
March 2006

UC-18 2003 Aerial Photograph of the Wright Lake, Hoot Lake Area at Fergus Falls, Minnesota Showing the Locations of Waters Proposed for Class 1C Classification
U. S. Department of Agriculture, Farm Service Agency
Map(s)
2003

UC-19 Overview of Minnesota's NPDES/SDS Construction Stormwater Permit
Author: Minnesota Pollution Control Agency (MPCA)
Fact Sheet
November 2005
MPCA
Water Quality/Stormwater #2-05 http://www.pca.state.mn.us

UC-20 Summary Comparison of Chloride Water Quality Standards for EPA Region V States, North Dakota, South Dakota, and Iowa
Author: Minnesota Pollution Control Agency (MPCA)
MPCA Document
Not Given
UC-21  Minnesota Subregional Hydrologic Unit Code Chloride Data Summary retrieved from the EPA STORET National Environmental Data System  
Author: Environmental Protection Agency (EPA)  
Summary  
Accessed: May 2006  
STORET (short for STOrage and RETrieval)  
http://www.epa.gov/storet/  

UC-22  Figure 5. – Mean Hardness of Calcium Carbonate at NASQAN (National Stream Quality Accounting Network) Stations During 1975 Water Year from Quality of Rivers in the United States  
J.C. Briggs and J. F. Fricke  
Report  
U.S Geological Survey  
1977  
Open-file Report 78-200  

Author: Minnesota Pollution Control Agency (MPCA)  
MPCA Document  
MPCA  
Not Given  

UC-24  Minnesota Subregional Hydrologic Unit Code Total Hardness Data Summary retrieved from the EPA STORET National Environmental Data System  
Author: Environmental Protection Agency (EPA)  
Summary  
Accessed: May 2006  
STORET (short for STOrage and RETrieval)  

UC-25  Water Quality Criteria, Second Edition  
Editors: Jack E. McKee and Harold W. Wolf  
Report  
California State Water Resources Board  
Revised 1963  
Publication No. 3 – A  

Author: American Society for Testing and Materials  
Manual  
ASTM  
1959  
ASTM Special Technical  
Publication No. 148-D  

Author: U.S. Department of Interior, Federal Water Pollution Control Administration.  
Guidance  
May 1966  

UC-28  Water Quality Criteria, Report of the National Technical Advisory Committee to the Secretary of the Interior [Excerpt]  
Author: U.S. Department of the Interior, Federal Water Pollution Control Administration  
Report  
April 1, 1968  
pp.185-215  
[a.k.a Green Book]  

UC-29  Categorization of Surface Waters for Industrial Consumption for WPC-15  
Author: George R. Koonce, Chief - Section of Industrial and Other Wastes, Division of Water Quality, Minnesota Pollution Control Agency  
MPCA Document  
MPCA  
1973  
Rulemaking exhibit from the 1973 revisions to WPC-15 (PCA Exhibit 41, 5-31-73)
UC-30 Water Quality Criteria 1972 [Excerpt]
A Report of the Committee on Water Quality Criteria, Environmental Studies Board, National Academy of Sciences, National Academy of Engineering,
EPA Report EPA
March 1973 EPA.R3.73.033; pp.368-96 http://www.epa.gov
[a.k.a. Blue Book]

UC-31 Quality Criteria for Water 1986 [Excerpt page entries regarding Hardness]
Author: Office of Water Regulations and Standards, Environmental Protection Agency (EPA)
EPA Report EPA
May 1, 1986 EPA 440/5-86-001; Unnumbered http://www.epa.gov
[a.k.a. Gold Book]

UC-32 Non-irrigation Surface Water Permit Locations Retrieved from Minnesota Department of Natural Resources Water Appropriation Permits Database
Author: Minnesota Department of Natural Resources (MDNR)
Summary DNR
Accessed: May 2006

Author: Industrial Environmental Research Laboratory, Environmental Protection Agency (EPA)
Manual EPA
Not Given EPA-600/7-79-001; pp.237-61

UC-34 Subject: Soliciting Comments on the MPCA Proposed Class 3B to Class 3C Changes as Outlined in a May 26, 2004 Email Message from David Maschwitz (MPCA) to Keith Hanson
From Keith Hanson, Minnesota Power
e-mail
May 27, 2004
To Minnesota Chamber of Commerce Environment and Water Quality Committee

UC-35 Subject: Response to Comments on the Proposed Class 3B to Class 3C Changes
From David E. Maschwitz, Environmental Outcomes Division, MPCA
e-mail
March 4, 2005
To Kevin Kangas, Sappi Paper Cloquet, LLC,

UC-36 Cluster Rule Impact on Recovery Boiler Operations: Chloride and potassium Concentrations in the Kraft Liquor Cycle
Author: J. M. Jordan and P.S. Bryant
Journal TAPPI
December 12,1996 Vol 79(12); pp.108-16

UC-37 Dynamic Modeling of Potassium and Chloride in the Recovery Area
Author: B. Malmberg, L. Edwards, et al.
Journal TAPPI
June 2002 Vol 1(4); pp.3-6

UC-38 Selective Removal of Chloride and Potassium in Kraft Mills.
Author: L. Manuel, G.A. Ferreira, et al.
Journal TAPPI
April 2003 Vol 2(4); pp.21-5

UC-39 Mineral Scale Management, Part I. Case Studies
Author: P.W. Hart and A.W. Rudie
Journal TAPPI
June 2006 Vol 5(6); pp.22-7
UC-40  Mineral Scale Management. Part II. Fundamental Chemistry
Author: A.W. Rudie and P.W. Hart
Journal  TAPPI
July 2006  Vol 5(7); pp.17-23

UC-41  Stream Assessment Worksheet Use Attainability Analysis, Unnamed Ditch to County Ditch No. 42

Form
November 4, 2004

Winthrop

UC-42  Stream Assessment Worksheet Use Attainability Analysis, Unnamed Creek to Cedar Creek
Author: Isanti Estates Mobile Home Park
Form
November 9, 2004

Isanti