Comments received from the MPCA Wild Rice Standards Study Advisory Committee
on the final draft protocol
The Sulfate Standard to Protect Wild Rice: Study Protocol
(MPCA, September 26, 2011 version)

To discourage automated harvesting of email addresses when this is posted on the MPCA web site, all "@" symbols in the email addresses have been replaced with "#$".

From: Joe Mayasich [mailto:Joe.Mayasich#$WLSSD.Duluth.MN.US]
Sent: Tuesday, October 11, 2011 9:50 AM
To: Lotthammer, Shannon (MPCA); edward.swain#$sate.mn.us
Subject: Non-Target Plant Testing under FIFRA

This is in follow-up to my comments yesterday regarding methods and technical considerations applicable to assessing deleterious effects on non-target plants. Note the emphasis on a tiered approach. This is a very thorough and unbiased review of the subject and there are several good references cited at the end of the document. I see no reason why sulfate should not be viewed as surrogate herbicide and wild rice is obviously a (desirable) non-target plant. This stuff is applicable to our task/charge.

<<SAP_junefinal_FIFRA non-target plant.pdf>> (See link below for this document.)

Joseph M. Mayasich, Ph.D.
Director of Environmental Services
Western Lake Superior Sanitary District
2626 Courtland Street
Duluth, MN 55806-1894
General Phone 218.722.3336
Direct Phone 218.740.4806
FAX 218.727.7471
joe.mayasich#$wlssd.com

Note: The review referenced above is available at the following link:
http://www.epa.gov/scipoly/sap/meetings/2001/june/junefinal.pdf

---

From: Robert Shimek [mailto:bob#$welrp.org]
Sent: Monday, October 10, 2011 4:16 PM
To: Engelking, Pat (MPCA)
Subject: RE: Draft Protocol, Agenda and Meeting Details for Wild Rice Standards Study Advisory Group

Pat,
My first comment on process and protocol is that this entire project may be designed by the state legislature, to fail. In listening through the 3 hour phone call today, and the various perspectives presented, the possibility exists that the state legislature, either by intent, or by ignorance, neither gave the project enough time or possibly money, to do a thorough and proper investigation. With that said, it becomes a little bit easier to induce outcomes one way or the other by what gets included in the project and what gets left out, because of lack of time or money.
Second comment. While the argument can be made to focus initially on previously conducted lab studies, I think it is important to have a vigorous and robust field investigation of what's actually happening in manoomin producing areas, areas that are not producing but could, and areas that are marginally producing.
I may not be internet accessible for a week or two. As I think of other comments, I may call you.

Robert Shimek
White Earth Land Recovery Project
607 Main Avenue
PO Box 97
Callaway, Minnesota 56521
Phone: (218) 375-2600
Fax: (218) 375-2603
www.welrp.org

From: Bethel [mailto:bander#$northlc.com]
Sent: Tuesday, October 11, 2011 11:12 AM
To: Engelking, Pat (MPCA)
Cc: Blaha, Gerald (MPCA); Ed Swain
Subject: Comments on Oct. 10 sulfate-wild rice meeting

Thank you all for a well-run productive meeting and the nice offer to come up to meet in Duluth.

I am well aware of the tribal concerns regarding, F. Effect of elevated sulfate, utilizing *in situ* mesocosms. I don't share those concerns, but I respect them and think they should be honored. However, there may be ways to access similar data that is not offensive to anyone. With the technology that Ed mentioned where by you can extract pore water in the top sediments, you should be able to test sediments where there is a known fluctuation of sulfate concentration in the past and therefore an expected fluctuation in the future. It would be best if this occurred in wild rice waters. An example might be in the Embarrass River. In Sources and Fate of Sulfate in NE Minnesota Watersheds by Bavin and Berndt, Man 16 2008, we see on P.44 a possible sample site. Between 2004 and 2007, 16 measurements show at PM-13 Embarrass River at HW 135, a sulfate concentration of 83 mg/L with a Standard Error of 40.9. Travis or Mike or Nathan Johnson or Barr Engineering could probably find sites with even more variations over a one year time span. I highly value real world data with undisturbed sediments which contain the intact plant and animal communities that live and modify their surroundings from season to season.

I know there is ongoing discussion of wild rice taxonomy. Regardless of what taxonomic scheme you use, we know there are different varieties of wild rice and maybe different tolerances to sulfate-sulfide exposures. I hope your seed sources reflect those varietal differences. If not, then I would recommend that in the field work done next year, you could sample with a greater emphasis on genetic diversity.

I strongly concur with the suggestion of finding a plant ecologist with experience in identifying aquatic plant assemblages that naturally occur with and those that compete with wild rice. Then you could study those sediments.

Again, thanks for the opportunity to participate in this important work. Len Anderson

---

From: Steven Nyhus [mailto:swnyhus#$flaherty-hood.com]
Sent: Monday, October 17, 2011 4:28 PM
To: Engelking, Pat (MPCA)
Cc: Lane, David (dlane#$rochestermn.gov)
Subject: MESERB Comments on Wild Rice Sulfate Study Protocol

Good afternoon,

This is in response to MPCA's request for comments on "The Sulfate Standard to Protect Wild Rice: Study Protocol," dated September 26, 2011. These comments are offered on behalf of the Minnesota Environmental Science and Economic Review Board (MESERB).

MESERB has only a couple of very brief comments to offer:

1. Beginning on page 15, the details of the various response options provided – indoor lab, mesocosms, field sampling, and the like – involve a level of technical detail that seems more appropriate for someone with a Ph.D. in ecology or biology. It will be a challenge for MESERB, whose membership is comprised of wastewater treatment professionals, to provide useful input on topics with this level of technicality.

2. As noted by Ms. Ekola at the October 10 meeting, the protocol document does not discuss how other variables such as climate change, groundwater impacts, background concentrations or other factors will be evaluated and taken into consideration. Given the complexity of the issue as discussed in that meeting, it would seem that a careful consideration of these factors would be appropriate.

Thank you for the opportunity to offer these comments.

Steven W. Nyhus, Senior Attorney
Flaherty & Hood, P.A.
525 Park Street, Suite 470
St. Paul, MN 55103
Office 651-225-8840
Toll-Free 1-877-846-4662
Fax 651-225-9088
http://www.linkedin.com/in/stevennyhus

From: bhall_anelson#$q.com [mailto:bhall_anelson#$q.com]
Sent: Monday, October 17, 2011 8:33 PM
To: Engelking, Pat (MPCA)
Subject: Re: Thank you and follow up

Hi Pat:

Thank you to the MPCA for putting together a diverse group of people. I have just a couple of comments. First, I think the final protocol appears to have set priorities in a fair and reasonable fashion. However, I think the comments from tribal representatives need to be taken very seriously with respect to cultural concerns. I think it is also very important to find out which lakes, wetlands or streams had harvestable wild rice in the past, but do not now, and tribal research would probably be the first place I would look for assistance in identifying these areas.

Other than that, I feel my thoughts have already been adequately expressed by others.

Thank you again for the opportunity to participate. I look forward to hearing the results of the summer field study.

Anne Nelson
St. Cloud, MN

From: rodustipak#$charter.net [mailto:rodustipak#$charter.net]
Sent: Friday, October 21, 2011 6:21 AM
To: Engelking, Pat (MPCA)
Subject: RE: Thank you and follow up

Hi Pat, Thank you for allowing me to participate/listen in by phone.I have been traveling for work extensively since then and only was able to read your follow up last night in Canada. I would first like to complement the PCA for producing a neutral, well thought out study protocol document. Balancing the needs of commerce and nature is at best a difficult task as we all are aware. Any research which enhances our understanding of Minnesotas State Grain and arguably Minnesota's most iconic plant is welcome. Increased awareness and protection of wild rice is a worthy goal and I look forward to sharing the scientific journey which will hopefully lead us to that end. Thanks again!
Rod

Paula Goodman Maccabee, Esq.
Just Change Law Offices
1961 Selby Ave., St. Paul, Minnesota 55104, pmaccabee@justchangelaw.com
Ph: 651-646-8890, Fax: 651-646-5754, Cell 651-775-7128
http://justchangelaw.com

October 14, 2011

Shannon Lotthammer (shannon.lotthammer@state.mn.us)
Pat Engelking (pat.engelking@state.mn.us)
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

RE: September 26, 2011 Draft Wild Rice/Sulfate Study Protocol

Dear Shannon, Pat:

Thank you for providing the Advisory Committee with an opportunity to comment on the most recent September 26, 2011 version of the Study Protocol. WaterLegacy suggests the following:

Distinguish Scientific Model from Regulatory Standard.
New text on pages 25-26 may have been intended to distinguish between scientific modeling and setting an appropriate regulatory limit for sulfate discharge, but the language is confusing. A simpler text is suggested below for paragraphs beginning, "Much of this protocol. . ."

> "The goal of the study protocol is to develop a model or models that explain the relationship between changing sulfate concentrations and wild rice, addressing magnitude, duration and frequency of changing sulfate concentrations, along with other potential variables that may influence production of sulfide in the rooting zone of sediment and other conditions that could affect wild rice growth. The study protocol will consider factors including hydrology, bacterial activity, geochemistry, plant physiology, varietal susceptibility and interspecies competition.
>
> "In addition to modeling and study of sulfate relationships, evaluation of Minnesota's sulfate standard will be based on an overall weight-of-the-evidence approach, including statistical analysis of field investigations, historical information, review of existing field data, and review of the scientific literature. Any revision or clarification of Minnesota's water quality standards would be the responsibility of MPCA scientists, with input from EPA scientists, as part of a formal rulemaking process based on all applicable evidence."

Describe Additional Evidence-Gathering Process
It would be helpful to have a brief memo describing steps being taken, such as documentary history, oral history and phytolith examination, to review waters "used for the production of wild rice," both under a beneficial use analysis since 1975 and in connection with treaty rights under the 1837 Treaty. This memo could also summarize how and when MPCA will conduct literature review, review existing state data, review data collected by tribes and other parties and use statistical analysis to evaluate the wild rice sulfate standard.

Sincerely yours,

Paula Goodman Maccabee
Counsel for WaterLegacy

MINNESOTA CHAMBER of COMMERCE 100 business unified.

October 17, 2011

Ms. Pat Engelking
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155

RE: Comments on Draft Wild Rice Research Protocol

Dear Ms. Engelking:

Thank you for the opportunity to provide further comments on the September 26th draft of the Wild Rice Research Protocol. Attached are the complete comments of the Minnesota Chamber of Commerce (Chamber). This letter will highlight our concerns.

As we have stated on many occasions, the Chamber supports the development of standards to protect wild rice that are based on current science. We supported the legislation passed this year to provide funding and direction to the MPCA on the wild rice research and rulemaking process and the creation of an advisory group to provide input to the process. We thank the Agency for creating the advisory committee that met for the first time on October 10th.

We are concerned that the draft protocol attempts to accomplish too much. All of the tasks in the draft cannot be accomplished with the $1.5 million appropriated by the Legislature and the objective of creating a model that could be used to determine a standard will certainly take many years to develop and verify as reliable. We are not aware of any similar plant toxicity model that has been developed for the purposes of establishing water quality standards.

The Chamber believes that research focused on assessing the effects of sulfate on wild rice must begin as soon as possible. Our members have permits and projects that are affected by water quality standards. It is imperative that a realistic plan for scientific research move forward so that the state objective of protecting the resource and growing our economy will be realized.

We look forward to our continuing dialogue on these issues and the next meeting of the advisory before the end of the year.

Sincerely,

Mike Robertson

Mike Robertson
Environmental Policy Consultant
Minnesota Chamber of Commerce

400 ROBERT STREET NORTH, SUITE 1500, ST. PAUL, MN 55101
T: 651/292-4650 800/821-2230 F: 651/292-4656 WWW.MNCHAMBER.COM

Comments on
The Sulfate Standard to Protect Wild Rice: Study Protocol, MPCA
Draft: September 26, 2011
Minnesota Chamber of Commerce
October 17, 2011

Overview

In the 2011 regular and special sessions, the Minnesota Chamber of Commerce (Chamber) supported the appropriation of funds for wild rice research and the creation of a widely representative advisory panel to guide the research. However, the Chamber is concerned that the draft protocol developed by the agency attempts to accomplish too many things, and, as a result, lacks the focus needed to undertake the rule amendment required by the Legislature in Laws of MN 2011, 1st Special Session, Chapter 2, Article 4, Section 32(c):

> *"(a) Upon completion of the research referenced in paragraph (d), the commissioner of the Pollution Control Agency shall initiate a process to amend Minnesota Rules, chapter*
> *7050. The amended rule shall:*
> > *(1) Address water quality standards for waters containing natural beds of wild rice, as*
> > *well as for irrigation waters used for the production of wild rice;*
> > *(2) designate each body of water, or specific portion thereof, to which wild rice water quality standards apply; and*
> > *(3) designate the specific times of year during which the standard applies. Nothing in this paragraph shall prevent the Pollution Control Agency from applying the narrative standard for all class 2 waters established in Minnesota Rules,*
> > *part 7050.0150, subpart 3."*

The Chamber requests that the scope of the protocol be focused to generate the data needed for the assessment of the water quality criterion for sulfate in water used for the production of wild rice.

The law requires that the commissioner submit a report to the Legislature on December 15, 2011. That report should contain, among other things, "an estimated timeline for completion of the wild rice research plan and initiation and completion of the formal rulemaking process under Minnesota Statutes, chapter 14". (Section 32 (h)). As we discussed at the Advisory Committee meeting on Monday, October 10, a schedule would help focus and refine the research protocol prior to development and publication of the Request for Proposal (RFP).

The Chamber does not believe that all the hypotheses and tasks enumerated in the September 26 protocol can be accomplished in time for the current triennial review or even the next triennial review, for that matter. The Chamber does not believe that the hypotheses and tasks enumerated in the September 26 protocol can be accomplished with the funds appropriated. The Chamber does not believe that all of the hypotheses and tasks identified in the protocol need to be accomplished to meet the requirements of the legislation.

At the Advisory Committee meeting, Dr. Swain presented a very complex analysis of a possible relationship between sulfate and sulfide and the potential impacts on wild rice. While such a complex relationship might be very interesting to research, the Chamber doubts that the agency can develop a robust enough model that then can be translated into a water quality criterion or set of criteria with the funds appropriated by the Legislature.

The Chamber reminds the agency that there are only three water quality criteria which have a dependency on other chemical or physical properties of the water. In the Minnesota Class 2 standards, the unionized ammonia criterion is dependent upon pH and temperature.[1] Also in the Minnesota Class 2 standards, certain metals (such as cadmium, trivalent chromium, copper, lead, nickel, silver and zinc) are dependent upon total hardness of the water .[2] The Class 2 pentachlorophenol criterion is dependent upon pH.[3]

All of these dependent water quality criterion took many years to develop and are based on a much simpler model than the potential model presented by Dr. Swain. Before the agency commits to research for a sulfate standard that relies on a complex sulfide model, the initial research must assess the impact of sulfate in the water column.

The development of a standard based on a model with the level of complexity described by the MPCA has never been developed in Minnesota, other states or by the EPA. US EPA has been attempting to develop suspended and bedded sediments (SABS) criteria since the late 1980's, and has been to date, unsuccessful in developing the kind of criteria which the agency is attempting here. US EPA recently concluded:

> *"U.S. EPA has concluded that sound exposure-response, SABS data are lacking for most species, and standardized consensus-based test methods for determining SABS effects are generally unavailable. Therefore, it is unlikely that a list of acute and chronic values for SABS can be developed in the short-term and such an effort would require substantial resources. A second difficulty is that SABS can consist of many substances depending on the site. Therefore, much like other "conglomerate" substances such as oil and grease or dissolved solids, it will be difficult to identify appropriate criteria for SABS without first determining the specific type of SABS (organic vs. inorganic; silt vs. clay, fine vs. coarse, etc.)."*[4]

After carrying out research to determine the direct impact of sulfate on wild rice, the next step/set of steps may be to determine whether sulfate transforms to sulfide and the potential effects of sulfide on wild rice growth and production in the rooting zone. This research may be necessary to determine whether the transformation of surface water sulfate to porewater sulfide in sediment coincides in depth with the rooting zone of wild rice. It may also be necessary to determine whether sulfide in the rooting zone is toxic to wild rice. Such research will require many steps, has statistical error associated with each of those steps, and will take many years

[1] MN Rules 7050.0222, subpart 2, for example
[2] Ibid
[3] Ibid
[4] Framework for Developing Suspended and Bedded Sediments (SABS) Water Quality Criteria, EPA-822-R-06-001 May 2006

and cost many millions of dollars (more than two million). In addition, because of the unique and widely variable characteristics of the sediment hosting wild rice, there likely could not be a single model that would apply across the board; the variable nature of the sediment would require site-specific research before standards could be developed. Additional confounding variables may make this task impossible.

As cited in the Protocol, to adequately carry out this research, the following determinations, at minimum, must be made:

- Determining which conditions or combination of conditions results in the transformation of sulfate to sulfide (e.g. presence and concentration of dissolved metals in porewater, organic content of sediment, concentration of nitrate in porewater, redox conditions/profile of redoxcline in sediment);

- Determining the relationship between the rate and timing of sulfate discharge into surface water and the response rate and timing of sulfate transformation to sulfide in sediment porewater;

- Determining the form (i.e. chemical speciation) of sulfide that affects growth and production of wild rice;

- Determining whether and when during its life cycle wild rice toxicity is a function of sulfide concentration in the rooting zone.

Developing a model or models that produce statistically significant, biologically relevant results will take time. The model(s) must be complex enough to adequately describe a process or series of processes that links surface water sulfate concentration (or discharge rate) to porewater sulfide concentration (or production rate) to wild rice toxicity. Yet, the model must not be so complex that it is difficult to explain how its inputs produce its outputs or results. The model or models must also be developed iteratively. That is, even if data representative of the vast range of site conditions were collected within the first few years of the research, the model would require several iterations before it would be fully tested and would produce confirmatory results. Because the process of data collection, modeling, and model confirmation is necessarily iterative, it is difficult to predict the time it will take to adequately carry out experimental research and develop a fully tested, validated model. It is not unrealistic, however, to estimate a period of ten years for development of a fully validated model, given the complexity of this question and the lack of research and literature compiled to date. The Chamber is not aware of any similar plant toxicity model that has been developed for the purpose of establishing water quality standards.

The Chamber does not oppose rigorous research on wild rice. The Chamber simply believes that research cannot be carried out adequately within the time and resource constraints of the legislation. The Chamber does, however, believe that sufficient information can be obtained in the next 18 to 24 months that can address the issue of sulfate toxicity to wild rice. Therefore the Chamber urges the agency to forego any research on Tasks B, C, D and F, and to focus on only

Tasks A and E that address the impact of sulfate on wild rice. Task E should be carried out after review of the 2011 field study and after consultation with the Advisory Committee.

Recommendations

Specifically, the Chamber suggests the following to better focus the research so that the information obtained can be used in the rulemaking required by the law.

1. MPCA needs to follow US EPA Guidance on developing numerical water quality criteria for the protection of an aquatic organism, as a portion of the rulemaking is, in fact, a development of numerical water quality criteria for the protection of an aquatic organism – wild rice.

2. MPCA should consider following other US EPA guidance developed under TSCA, FIFRA and other regulatory programs which specify plant-testing methods. Alternatively, protocols by ASTM should be used to set testing procedures which meet the requirements of good science

3. MPCA should limit the tasks to be conducted and consult with the Advisory Committee as follows:
    a. Conduct Task A hydroponic tests on sulfate and other cations
    b. Conduct container mesocosm tests, varying sulfate and other major cations as in Task A
    c. Conduct Task E only after the results of Task A and the 2011 Field study have been reviewed by the Advisory Committee and such additional field studies will provide information needed to determine the toxicity of sulfate to wild rice.
    d. Other tasks may be undertaken, once Tasks A and E are completed, and only after consultation with the Advisory Committee

4. MPCA should delete all references to mercury methylation and sampling for mercury as this was not part of the legislation or of legislative intent.

5. MPCA should not conduct Task F. *in-situ* large scale mesocosm studies

6. Additional information should be considered. The legislation requires that the agency consider "review of all reasonably available and applicable scientific research on water quality and other environmental impacts on the growth of wild rice." The Chamber requests that the following information be considered:
    - As cited in the Protocol (p. 6), Grava noted that waters with sulfate concentrations ranging from 22 to 390 ppm have been measured in cultivated wild rice paddies along the Clearwater River in northwestern Minnesota. Additional data should be collected as part of understanding the range of water column and sediment chemistries within different sites where wild rice grows. Surface water sulfate data should be collected from a spectrum of plausible discharges including municipal waste water treatment plants, power plants or other industrial discharges. Surface water sulfate data should be collected from discharges to, within and discharges from a variety of wild rice populations including cultivated wild rice.

- Data already collected on behalf of several mining operations over the past three years regarding surface water sulfate and wild rice should be used and incorporated into the Protocol.

- At the advisory committee meeting, a number of participants also pointed to water levels and competition from other species. The agency should consider whether these other parameters are the more important threats to wild rice, and develop programs to address these parameters, rather than attempting to develop a complex model relating sulfate to sulfide and potentially to wild rice.

In his presentation at the Advisory Committee meeting, Dr. Swain's included a diagram of a complex model linking sulfate in surface water to wild rice germination, growth and reproduction. In that model were included the following elements:

- Water depth fluctuation
- Water movement horizontally
- Competition from other plants
- Light regime (algae, DOC, other plants)

At the Nibi and Manoomin: Bridging Worldviews Symposium[5], Peter David, wildlife biologist from the Great Lakes Indian Fish and Wildlife Commission (GLIFWC)presented the following top risks to wild rice:

- Disruption of natural hydraulics
- Invasive/competitive species
- Genetic engineering
- Climate change (particularly as manifested in plant diseases such as brownspot)
- Control of invasive species (e.g. application of herbicides to control eurasion milfoil which also damages rice)

MPCA needs to follow US EPA Guidance on developing a numerical water quality criteria for the protection of an aquatic organism, as a portion of the rulemaking is, in fact, a development of numerical water quality criteria for the protection of an aquatic organism – wild rice.

The Agency added the following statement to the September 6, 2011, protocol

> *"The wild rice rule was based on sound scientific evidence and, to date, the MPCA has not been presented with evidence that would support amending the rule."*

The rule was developed in 1973, based solely on field observations of wild rice during the 1930's and 1940's. What may have been state-of-the-art science more than a half century ago is not necessarily state-of-the-art science today, and does not meet current US EPA rules or guidance on development of water quality criteria. At the time of research and rule promulgation, there were no EPA rules or guidance on development of water quality criteria;

[5] Nibi and Manoomin: Bridging Worldviews Symposium, August, 2011, White Earth Anishinaabe and other Native American Bands and University of Minnesota.

indeed, EPA was only just beginning to develop such criteria itself. The US EPA has since developed guidance on development of water quality criteria to protect aquatic species.

Although the current water quality criteria for sulfate in waters used for the production of wild rice is an agricultural standard (a Class 4 standard), it is arguably designed to protect a single aquatic organism – wild rice. It is also clearly a numerical criterion. As the MPCA reviews this standard as part of the triennial standards review, the agency needs to be mindful of, and adhere to, US EPA regulations and guidance on developing numeric water quality criteria for the protection of aquatic organisms. It would not be acceptable to conduct research in a way which EPA will reject out of hand because it does not conform to their guidance.

40 CFR 131.11 contains the requirements for states to develop water quality criteria, and the manner in which those criteria must be developed:

> ***"§ 131.11 Criteria.***
>
> *(a) Inclusion of pollutants: (1) States must adopt those water quality criteria that protect the designated use.* ***Such criteria must be based on sound scientific rationale*** *and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive use.*
>
> *(2) Toxic pollutants.* ***States must review water quality data and information on discharges to identify specific water bodies where toxic pollutants may be adversely affecting water quality or the attainment of the designated water use*** *or where the levels of toxic pollutants are at a level to warrant concern and must adopt criteria for such toxic pollutants applicable to the water body sufficient to protect the designated use. Where a State adopts narrative criteria for toxic pollutants to protect designated uses, the State must provide information identifying the method by which the State intends to regulate point source discharges of toxic pollutants on water quality limited segments based on such narrative criteria. Such information may be included as part of the standards or may be included in documents generated by the State in response to the Water Quality Planning and Management Regulations (40 CFR part 35).*
>
> *(b) Form of criteria: In establishing criteria, States should:*
>
> *(1) Establish numerical values based on:*
>
> *(i) 304(a) Guidance; or*
>
> *(ii) 304(a) Guidance modified to reflect site-specific conditions; or*
>
> *(iii) Other scientifically defensible methods;*

(2) Establish narrative criteria or criteria based upon biomonitoring methods where numerical criteria cannot be established or to supplement numerical criteria."[6] (emphasis added)

In 1983, US EPA proposed "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses". Following public comment, US EPA published this guidance in 1985. [7] This guidance was updated in December 2010. Although "EPA is working on a more comprehensive update to the 1985 Guidelines, including new taxonomic tables which better reflect the large number of aquatic animal species known to be propagating in U.S. waters,"[8] the 1985 guidance is the current guidance available. The MN Chamber believes that MPCA is obligated to follow current guidance when undertaking its first review of this standard in nearly 40 years.

Part III of the guidance lists the required data for development of a water quality criterion (Emphasis added):

"III. Required data

A. Certain data should be available to help ensure that each of the four major kinds of possible adverse effects receives adequate consideration. Results of acute and chronic toxicity tests with representative species of aquatic animals are necessary so that data available for tested species can be considered a useful indication of the sensitivities of appropriate untested species. ***Fewer data concerning toxicity to aquatic plants are required because procedures for conducting tests with plants and interpreting the results of such tests are not as well developed.*** *Data concerning bioaccumulation by aquatic organisms are only required if relevant data are available concerning the significance of residues in aquatic organisms.*

B. To derive a criterion for freshwater aquatic organisms and their uses, the following should be available:

3. ***Results of at least one acceptable test with a freshwater alga or vascular plant (see Section VIII). If plants are among the aquatic organisms that are most sensitive to the material, results of a test with a plant in another phylum (division) should also be available****."*

Part VIII of guidance provides:

"VIII. Final Plant Value

---

[6] 40 CFR 131.

[7] Guidelines for Deriving Numerical National Water Quality Criteria for the Protection Of Aquatic Organisms and Their Uses, PB85-227049, by Charles E. Stephen, Donald I. Mount, David J. Hansen, John R. Gentile, Gary A. Chapman, and William A. Brungs, Office of Research and Development, Environmental Research Laboratories Duluth, Minnesota, Narragansett, Rhode Island, Corvallis, Oregon

[8] Ibid

A. Appropriate measures of the toxicity of the material to aquatic plants are used to compare the relative sensitivities of aquatic plants and animals. Although procedures for conducting and interpreting the results of toxicity tests with plants are not well developed, results of tests with plants usually indicate that criteria which adequately protect aquatic animals and their uses will probably also protect aquatic plants and their uses.

B. A plant value is the result of a 96-hr test conducted with an alga or ***a chronic test conducted with an aquatic vascular plant****.*

NOTE: A test of the toxicity of a metal to a plant usually should not be used if the medium contained an excessive amount of a complexing agent, such as EDTA, that might affect the toxicity of the metal. Concentrations of EDTA above about 200 µg/L should probably be considered excessive.

C. the Final Plant Value should be obtained by selecting the lowest result from a test with an important aquatic plant species in which the concentrations of test material were measured and the endpoint was biologically important."[9]

Based on EPA guidance, a chronic test is required for an aquatic vascular plant such as wild rice.

The criterion must be expressed as follows:

"XI. Criterion

A. A criterion consists of two concentrations: the Criterion Maximum Concentration and the Criterion Continuous Concentration.

B. the Criterion Maximum Concentration (CMC) is equal to one-half the Final Acute Value.

C. the Criterion Continuous Concentration (CCC) is equal to the lowest of the Final Chronic Value, the Final Plant Value, and the Final Residue Value, unless other data (see Section X) show that a lower value should be used. If toxicity is related to a water quality characteristic, the CCC is obtained from the Final Chronic Equation, the Final Plant Value, and the Final Residue Value by selecting the one, or the combination, that results in the lowest concentrations in the usual range of the water quality characteristic, unless other data (see Section X) show that a lower value should be used.

D. Round both the CMC and the CCC to two significant digits.

E. The criterion is stated as:

The procedures described in the "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" indicate

[9] Ibid.

that, except possibly where a locally important species is very sensitive, (1) aquatic organisms and their uses should not be affected unacceptably if the four-day average concentration of (2) does not exceed (3) µg/L more than once every three years on the average and if the one-hour average concentration does not exceed (4) µg/L more than once every three years on the average.

where (1) = insert "freshwater" or "saltwater" (2) = insert name of material (3) = insert the Criterion Continuous Concentration (4) = insert the Criterion Maximum Concentration."[10]

The agency should reference this guidance in the protocol and the RFP. The Chamber assumes that MPCA has already had conversations with US EPA about how to conform to this guidance and any other guidance which the US EPA may see as germane.

MPCA should consider following other US EPA guidance developed under TSCA, FIFRA and other regulator programs which specify plant testing methods. Alternatively, protocols by ASTM or OECD should be used to set testing procedures which meet the requirements of good science.

US EPA has developed guidance on determining phytotoxicity to plants, including seed germination and vegetative vigor. Although developed for testing of materials under the Toxic Substances Control Act (TSCA) or the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), they are designed to determine ecological effects on organisms. While the purpose of such tests is clearly different from this research, they may provide standardized testing protocols and end points that may be useful, may prevent the "reinvention of the wheel," and may provide data in a manner in which US EPA is used to reviewing plant data, speeding EPA's review and approval of the research and any amended water quality criterion.

For example, EPA's Seed Germination/Root Elongation Toxicity Test provides a succinct and quantifiable measurement of germination and impacts on germination:

"The test period may be ended when at least 65 percent of the control seed have germinated and developed roots that are at least 20 mm long."[11]

It also provides a standardized testing protocol.

*"(4) **Definitive test.** (i) The purpose of the definitive test is to determine the concentration-response curves, the EC10s and EC50s for seed germination and root elongation for each species tested, with the minimum amount of testing beyond the range-finding test.*

(ii) The seed of each species tested should be exposed to at least 6 concentrations of the chemical chosen in a geometric series in which the ratio is between 1.5 and 2.0

---

[10] ibid

[11] Ecological Effects Test Guidelines OPPTS 850.4200 Seed Germination/Root Elongation Toxicity Test EPA 712–C–96–154. April 1996

(e.g., 2, 4, 8, 16, 32, and 64 mg/L). The concentration ranges should be selected to determine the concentration response curves between the EC10 and EC50 for both germination and root elongation. Test solutions or substrate extracts should be analyzed to determine chemical concentration prior to use. Selection of seed from the size class lot to be exposed to each test concentration should be unbiased.

(iii) At least three replicates, each with at least 10 seed per species should be tested for each concentration and control.

(iv) Every test should include controls consisting of the same dilution water, conditions, procedures and seed from the same lot used in the exposure group, except that none of the chemical is added. If a carrier (solvent) is needed to suspend or disperse the chemical, a separate carrier control should also be used.

(v) The test period may be ended when at least 65 percent of the control seed have germinated and developed roots that are at least 20 mm long. When both conditions are satisfied, the mean number of seed germinating and mean root length per treatment (and control) can be determined.[12]

EPA's Aquatic Plant Toxicity Test is also provides a standardized testing protocol:

"(ii) At least five concentrations of chemical, exclusive of controls, should be used in the definitive test and chosen in a geometric series in which the ratio is between 1.5 and 2.0 (e.g. 2, 4, 8, 16, 32, 64 mg/L). The concentration range should be selected to define the concentration response curve between the EC5 and EC90. For each concentration and control at least three replicate containers should be used, each containing 150 mL of test solution, or enough test solution to result in a volume-to-vessel size ratio of 2:5, and three to five plants consisting of three to four fronds each should be used. See paragraph (d)(2)(i) of this guideline for a discussion on plant size and frond numbers to be used in the definitive test. Fewer replicates, each containing a greater number of colonies, may be used; however, test containers and solution volumes will have to be adjusted accordingly. The range of chemical concentrations tested should result in the highest concentration affecting at least 90 percent of the fronds and the lowest concentration affecting no more than 5 percent of the fronds compared with the controls or the selected test concentrations should bracket the expected EC50 value.

(iii) Every test should include controls consisting of the same nutrient medium, number of fronds, environmental conditions, and procedures as the test containers except that none of the chemical is added. If a solvent or carrier is used to dissolve or suspend the test chemical, additional controls containing the solvent or carrier should also be included in the test to determine any effect of the solvent or carrier on the plants. The upper limit of carrier volume is 0.5mL/L and the same amount of carrier should be added to each test concentration.

[12] Ibid

(iv) Positive controls using zinc chloride as a reference chemical should be run periodically. The purpose of a running a positive control with a reference chemical is to determine if the test Lemna fronds are responding to a known chemical in the expected manner. If the fronds respond to subsequent reference chemical tests consistently, it is assumed that the Lemna will respond to other chemicals consistently. Changes in Lemna response caused by factors such as poor nutrition, genetic drift, and contaminants, may not be detected by negative controls, yet may still influence test results. A minimum of three concentrations of the reference chemical are run at or near the expected median effect level."[13]

Although clearly a different species is proposed for the testing, the test methods may be applicable.

Measurements to determine "vegetative vigor" also are contained in EPA's guidance, which may be a standardized way to compare plant development.

"(2) ***Test report.*** *The test report should include the following information:*

(i) Severity of phytotoxicity (percent or rating), abnormal changes in growth and development, and/or abnormal changes in plant morphology as compared to the untreated control.

(ii) Tabulation of the results indicating the percentage effect level for each species as compared to untreated control plants for each test parameter (height, weight, etc.).

(iii) Data on plant dry weight, plant shoot height, root dry weight, root length/volume, number of dead plants, height or other growth parameters are recommended test endpoints.

(iv) Report the actual dates of the studies including dates of initiation (planting, transplanting, and cultural practices), applications, observations, and harvest.

(v) Electronic transfer of test data on disc is encouraged to reduce review time."[14]

Alternatively, ASTM has developed the following test methods, which may also provide standardized methods which would ensure that good science is used, minimize development of standard methods, and perhaps improve the speed with which US EPA would approve of the research and any modified water quality criteria.

ASTM E1963 - 09 Standard Guide for Conducting Terrestrial Plant Toxicity Tests (includes methods for seed germination)

ASTM E1841 - 04 Standard Guide for Conducting Renewal Phytotoxicity Tests With Freshwater Emergent Macrophytes

---

[13] Ecological Effects Test Guidelines OPPTS 850.4400 Aquatic Plant Toxicity Test Using Lemna spp., Tiers I and II, EPA712–C–96–156, April 1996

[14] Ecological Effects Test Guidelines OPPTS 850.4250 Vegetative Vigor, Tier II. EPA 712–C–96–364 April 1996

OECD/OCDE 227 (GUIDELINE FOR THE TESTING OF CHEMICALS - Terrestrial Plant Test: Vegetative Vigour Test (Adopted: 19 July 2006)

MPCA should limit the tasks to be conducted and consult with the Advisory Committee as follows:

a. **Conduct Task A hydroponic tests on sulfate and other cations**
b. **Conduct container mesocosm tests, varying sulfate and other major cations as in Task A**
c. **Conduct Task E only after the results of Task A and the 2011 Field study have been reviewed by the Advisory Committee and such additional field studies will provide information needed to determine the toxicity of sulfate to wild rice.**
d. **Other tasks may be undertaken, once Tasks A, parts of C and E are completed, and only after consultation with the Advisory Committee**

Carrying out Task A will directly address whether the sulfate ion (or other cations associated with sulfate) will affect wild rice growth and production, which is necessary for review of the existing water quality criterion. However, it is a hydroponic test, and tests of plants in sediment in containers should also be conducted to provide conditions closer to actual, natural conditions. The methyl mercury analysis should not be conducted. See Comment 4 below.

Task A addresses hypothesis 1A, 1B and 2A. Task A does not address hypotheses 8A and 8B. Tasks 8A and 8B could be examined using the outdoor container mesocosm study.

While it may be an interesting scientific question whether the transformation of sulfate to sulfide in the rooting zone effects the growth and production of wild rice, it is not possible to adequately examine this question with less than many millions of dollars and fewer than 8 to 10 years.

MPCA should delete all references to mercury methylation and sampling for mercury

The funding provided by the Legislature is specifically for wild rice research. Laws of Minnesota 2011, 1st Special Session, Chapter 6, Article 2, Section 5 (j) provides" $1,000,000 the first year and $500,000 the second year are for a wild rice standards study."

The MPCA admits that there is no relationship between the health of wild rice and formation of methyl mercury. The agency has mentioned taking water samples for mercury and methyl mercury concurrently with water chemistry sampling for wild rice parameters. However, the legislation does not allow analysis for mercury or methyl mercury using the monies appropriated for the wild rice standards study.

MPCA should not conduct Task F. in-situ large scale mesocosm studies

The Native American bands have expressed deep concerns about conducting in-situ large mesocosm studies, as envisioned in Task F. The Chamber shares those concerns, from a stewardship of limited funds perspective. Most experts believe that only limited value can be obtained from such large-scale experiments, given the many variables which cannot be controlled. A great deal of money could be expended and a great deal of time consumed

collecting data which may not shed much additional light on the issue of sulfate's effects on wild rice.

The Chamber strongly recommends that the agency remove Task F from the protocol and that the RFP not contain any reference to any large scale in-situ mesocosm studies.