BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO:	)	
35 Ill. Adm. Code 302.102(b)(6), 302.102(b)(8)	)	R07-09
302.102(b)(10), 302.208(g), 309.103(c)(3),	)	(Rulemaking - Water)
405.109(b)(2)(A), 405.109(b)(2)(B), 406.100(d);	)	
REPEALED 35 Ill. Adm. Code 406.203, PART 407; and	)	
PROPOSED NEW 35 Ill. Adm. Code 302.208(h)	)	

NOTICE OF FILING

Dorothy Gunn, Clerk
Illinois Pollution Control Board
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601

Marie E. Tipsord
Hearing Officer
Illinois Pollution Control Board
100 West Randolph, Suite 11-500
Chicago, Illinois 60601

Mathew Dunn
Illinois Attorney General's Office
Environmental Control Division
James R. Thompson Center
100 West Randolph Street
Chicago, Illinois 60601

Jonathan Furr
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, Illinois 62702-1271

ALSO SEE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board the Illinois Environmental Protection Agency's written testimony of Robert Mosher and Brian Koch, a copy of which is herewith served upon you.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

By:_____
Sanjay K Sofat, Assistant Counsel
Division of Legal Counsel

Dated: February 2, 2004
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, Illinois 62794-9276
(217) 782-5544

RECEIVED
CLERK'S OFFICE
FEB 05 2007
STATE OF ILLINOIS
Pollution Control Board

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO:	)	
35 Ill. Adm. Code 302.102(b)(6), 302.102(b)(8)	)	R07-09
302.102(b)(10), 302.208(g), 309.103(c)(3),	)	(Rulemaking - Water)
405.109(b)(2)(A), 405.109(b)(2)(B), 406.100(d);	)	
REPEALED 35 Ill. Adm. Code 406.203, PART 407; and	)	
PROPOSED NEW 35 Ill. Adm. Code 302.208(h)	)	

TESTIMONY OF ROBERT MOSHER

Qualifications/Introduction

My name is Robert Mosher and I have been employed by the Illinois Environmental Protection Agency for over 21 years. For almost the last 20 years I have been the manager of the Water Quality Standards Unit. My duties in this capacity are primarily to oversee the development of new and updated water quality standards and together with others in the Division of Water Pollution Control, to apply those standards in NPDES permits and Section 401 Water Quality Certifications. I have a B.S. in zoology and environmental biology and an M.S. in zoology from Eastern Illinois University.

In my testimony today, I will discuss the current regulatory environment that necessitates changes to water quality standards for sulfate, total dissolved solids ("TDS") and mixing zones. First, I will relate the general benefits that the Agency's proposed changes will bring to our system of water quality standards and water quality based effluent limitations in NPDES permits. Second, I will discuss the deletion of the water quality standard for total dissolved solids. Third, I will explain the changes proposed for

mixing zone standards and the basis for these in terms of the reasoning behind the changes and the discharges that would benefit from these changes. Finally, I will cover the reasons for the deletion of portions of 35 Illinois Administrative Code ("IAC") Subtitle D, Mine Related Water Pollution regulations.

Sulfate Aquatic Life Water Quality Standard:

General Use water quality standards for sulfate (500 mg/L) and TDS (1,000 mg/L) have existed in Illinois regulations since 1972. These standards were adopted to protect aquatic life and agricultural uses, however, few modern studies were available to determine appropriate values. Adopted standards stemmed more from the opinion of a few experts.than from documented scientific experiments. Because coal mine effluents in particular are often high in sulfate, a special standard was developed that is unique to mine discharges and is found in Title 35, IAC, Subtitle D, Mine Related Water Pollution. Adopted in 1984, this sulfate standard of 3,500 mg/L also was not documented by the kind of aquatic life toxicity or livestock tolerance studies that are now expected in standards development. Under existing General Use water quality standards, permitting many mine discharges without the special rules provided in Subtitle D would be problematic because many mines cannot meet General Use sulfate and TDS standards in effluents at the point of discharge and do not qualify for conventional mixing zones. Other industries also have difficulty meeting the general standards and many have received adjusted standards or site-specific water quality standards relief from the Illinois Pollution Control Board given that regardless of the source, sulfate and many of the other constituents of TDS are not treatable by any practical means.

A solution to this dilemma was to re-evaluate the sulfate and TDS standards that account for most of the permitting problems. Studies of aquatic life communities downstream from high sulfate and TDS discharges appeared to show that organisms incur no detrimental effect from concentrations of these pollutants higher than the existing water quality standards. Since no national criteria exist for these pollutants and few other states even have sulfate and TDS standards, a long process was begun to gather existing information on sulfate aquatic life toxicity. When available data proved inadequate to derive a standard, new studies were commissioned with sponsorship from USEPA, the Illinois Coal Association and Illinois EPA. At the same time, investigations on the tolerance of livestock to sulfate in drinking water were begun.

This new research into sulfate toxicity found that, as suspected, high sulfate concentrations pose a problem of osmotic (salt) balance for some organisms. Many organisms, including all species of fish tested and many invertebrate species are very tolerant of sulfate, so much so that no known existing concentrations in Illinois would cause harm. Other species including the invertebrate water fleas (*Daphnia* and *Ceriodaphnia*) and scud (*Hyalella*) have a harder time maintaining salt balance under high sulfate conditions, which leads to toxicity. Unlike other toxicants that have ongoing effects that lead to mortality over extended time periods, sulfate-induced mortality occurs relatively quickly, but with no apparent residual effect. The new research also found that two common constituents of natural waters, chloride and hardness, are key to an understanding of the toxicity of sulfate. Brian Koch will further explain in his testimony how sulfate standards were developed to protect both aquatic life and livestock water uses.

TDS Water Quality Standard:

While sulfate was being evaluated, it became increasingly obvious that TDS is a very inappropriate parameter for use in water quality standards. TDS is the sum of all dissolved substances in water and is dominated by the common ions of sulfate, chloride, sodium, calcium, carbonate and magnesium in various proportions. Our investigations into sulfate toxicity reinforced the notion that it makes little sense to have a standard that covers all these substances together when the toxicity of each constituent is really what is important. For example, a water sample with high chloride and a TDS concentration of 2,000 mg/L is acutely toxic to some species of aquatic life, but a sample with high sulfate at that same TDS concentration is nontoxic. In my experience with toxicity testing with ambient waters and effluents, I am not aware of an instance where any common ions other than sulfate or chloride cause toxicity. With protective sulfate and chloride standards in force, salt toxicity is effectively regulated and there is no need for a TDS standard. Illinois EPA is therefore proposing that the TDS water quality standard be deleted along with the adoption of the new sulfate standard. The existing chloride standard is considered to be protective of uses without being overprotective and therefore is not proposed to be changed by our proposal.

Changes to the Board's Mixing Regulations at 35 Ill. Adm. Code 302.102:

Mixing zone standards at 35 IAC 302.102 dictate the conditions under which the Agency may allow dilution of an effluent by its receiving water. As regulations change, the realities of mixing needs must be reassessed. Sulfate is part of a small group of substances for which treatment is usually infeasible and for which mixing becomes an important option in regulation. The other common substances for which treatment does

not exist are chloride, boron and fluoride. It is not uncommon for discharges from coal mining operations as well as other activities to exceed these water quality standards and require some mixing zone allowance to achieve attainment of standards in the receiving stream.

Most high sulfate discharges from coal mines occur during wet weather events that bring sediment-laden water into treatment ponds and from there the water is discharged to water bodies where water quality standards apply. The ponds function to remove sediment and if necessary, control pH, but sulfate and chloride are not reduced. Water from the un-mined or reclaimed watershed also enters streams during sedimentation pond discharge events and provides dilution for these effluents. At many mines this is a simultaneous process, in other words, rain makes both the effluent and the receiving stream flow and lack of rain means both sources do not flow. For the past few years, Illinois EPA has granted wet weather discharges allowed mixing zones for sulfate and sometimes chloride, with consideration of these upstream flows. We now propose to augment the mixing regulations to make them clear in this regard. The changes to the mixing standards will allow mixing if it is verifiable that upstream dilution will always exist when an effluent is discharged.

35 Ill. Adm. Code 302.102(b)(6) and (b)(10):

Two aspects of the mixing regulations found at 35 IAC 302.102 are proposed for change. The first of these is the prohibition at 302.102(b)(6) and (10) preventing any receiving stream being entirely used for mixing. The existing standard dictates that a zone of passage, an area not impacted by the mixture of effluent with the receiving water, must be preserved for use by aquatic life whenever mixing is allowed. This is a concept recognized in regulations nationwide as a precept of mixing zones. However, there is one

circumstance of mixing of effluent with receiving water that practically and physically cannot include a zone of passage. Many discharges of storm water, particularly those from mines, are located high in the watershed where only a few square miles or less of drainage area supplies the receiving stream. These receiving streams are so small and narrow that storm water driven effluent will mix completely across the stream channel and leave no zone of passage as would have been physically realized in a wider stream. Under a strict interpretation of the existing mixing standards, these discharges would not be allowed mixing and a large segment of dischargers would not be able to exist.

If the Agency's proposal to do away with the zone of passage requirement in very small streams high in watersheds is to be functional, a method of defining 'very small streams' is needed. With the help of the Illinois State Water Survey, the Illinois EPA proposes that a concept similar to the commonly used and well understood 7Q10 flow be adopted to identify these streams. 'Small' may be equated with a stream's ability to maintain flow. Streams very high up in watersheds will typically dry up during periods of little rainfall and then fill with water again when rainfall returns. The more often a stream is dry, the more hostile that habitat will be to aquatic life. Streams losing all flow for at least a one week period nine out of ten years on average will present only a very limited habitat for aquatic life. This will consist of organisms that can live out their life cycles in a relatively short time and then survive dry conditions as eggs or dormant stages. Fish will use these headwater streams on a migratory basis, with a few pioneering species possibly using them only seasonally as spawning or feeding areas. Streams identified as 7Q1.1 zero flow are defined as having no flow for at least seven days in nine out of every ten years.

Under our proposal, wet weather discharges to streams determined to be 7Q1.1 zero flow will be allowed the entire stream volume for mixing. Aquatic life that may inhabit the stream at the time of discharge will be protected because an analysis of the effluent and the amount of flow expected in the stream during discharge events will be required in order to determine that the available mixing will reduce effluent concentrations to below water quality standards. For streams that have been determined to have adequate dilution potential for a given discharge, the force present in these storm water driven effluents will be sufficient to cause near instant mixing to occur. Therefore, aquatic life will not be exposed to concentrations over the water quality standards. Fish will be able to migrate through the area of mixing with no ill effects.

35 Ill. Adm. Code 302.102(b)(8):

The other change to mixing zone regulations is to delete the statement in 35 IAC 302.102(b)(8) that prohibits mixing in streams that have a 7Q10 flow of zero. The storm water mixing I just described depends on this change as well as non-storm water discharges that have unique characteristics. The existing definition of Dilution Ratio at 35 IAC 301.270 states that dilution ratio is to be determined from the 7Q10 stream flow or the lowest flow that is present when discharge occurs, whichever is greater. This implies that for non-continuous dischargers, the allowed stream flow to be used in the mixing based permit limit calculation is the flow expected when the discharge occurs. Under our proposal, these flows must allow for a zone of passage, which is 75% of the stream flow if the dilution ratio is 3:1 or greater and the stream 7Q1.1 is greater than zero. Many effluents are continuously discharged and consequently the default stream flow for calculating dilution is 7Q10. These would include sewage treatment plants, power plants and most industrial discharges. However, some facilities outside these

general categories produce effluent only periodically, and where it can be demonstrated that effluent will only be discharged at times and in quantities that will be sufficiently diluted by the stream flow present at the time of discharge, that stream flow may be used for the mixing granted. Deleting the sentence 'Mixing is not allowed in receiving waters which have a zero minimum seven day low flow which occurs once in ten years' enables the definition of dilution ratio to guide the Illinois EPA in granting mixing. Discharges that can be withheld until sufficient stream flow exists, or naturally are only produced in tandem with higher stream flows, will benefit from this clarification.

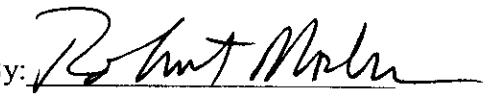
It is important to note that all other aspects of the mixing zone regulation, and for that matter all other water regulations, are still in force and work together with the changes proposed. Especially important is the reference to the provisions of 35 IAC 304.102 which stipulates that the best degree of treatment must be provided to effluents before mixing may be allowed.

Changes to Subtitle D of the Board Regulations:

With the changes proposed for sulfate and TDS, and the deletion of Subtitle D mine exemptions to water quality standards, Illinois EPA is proposing to regulate all types of discharges in an equitable manner. Water quality based permit limit decisions will now be required in lieu of the special exemptions formerly allowed for mines. Additionally, as a housekeeping measure, an outdated portion of Subtitle D unrelated to water quality standards will also be deleted.

The changes to standards proposed in the Illinois EPA's petition are based on sound science and assure the protection of designated uses of waters of the state. These modernized standards will benefit mines and other dischargers of sulfate and other dissolved salts that are not amenable to treatment. Permit limits issued using the new

sulfate and mixing regulations will be protective, yet not overly so, and will cause no unnecessary burden on economic activity. The Agency requests that the Board adopt this proposal.

By: 

Robert Mosher

February 1, 2007

Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

5350 Richland Road
Pleasant Plains, Illinois 62677

Phone 217-785-3950
E-mail Bob.Mosher@Illinois.gov

Robert G. Mosher

Education

Eastern Illinois University — Charleston, Illinois

BS Environmental Biology and Zoology 1977

MS Zoology 1979

Professional experience

1988 - Present Illinois Environmental Protection Agency

Supervisor, Water Quality Standards Unit, Bureau of Water

Supervision of 3-5 profession employees of the Unit, consisting of engineers, toxicologists and environmental biologists.

1. **Implementation of water quality standards.**

   Work extensively with Permit Section staff to incorporate water quality based effluent limits in NPDES permits for metals, ammonia, chlorine and other parameters. Coordinate the Agency's whole effluent biomonitoring program including review of bioassays conducted by the Agency laboratory, private consulting laboratories and permittees. Recommend permit actions related to whole effluent biomonitoring such as monitoring requirements and limits. Evaluate Illinois Pollution Control Board (IPCB) nondegradation standard for new or expanding discharges, explore alternatives to increasing pollutant load increases and work with municipal and industrial dischargers to seek less polluting solutions under the nondegradation regulation. Provide expert witness testimony at IPCB hearings and appeals related to NPDES permits.

2. **Coordination of Special Rulemakings.**

   Work with Division of Legal Council staff concerning petitions submitted by dischargers to the IPCB. Review petitions for Adjusted Standards, Variances and Site-specific changes to the water quality standards from dischargers based on unique needs. Recommend Agency position on such relief based on federal regulations and compatibility with protection of the waters of the state. Provide expert witness testimony at IPCB hearings related to special relief.

3. **Development of water quality standards regulations.**

   Develop water quality standards suitable for use in Illinois using information obtained from USEPA and the scientific literature. Work with Agency legal staff and the IPCB in the adoption of these standards into Illinois Administrative Code. Coordinate and participate in stakeholders workgroups to explain new standards and obtain public participation in standards initiatives. Participated as a lead worker or primary manager of many standards rulemakings including Disinfection Exemptions (1988), Toxics Control (1990), Ammonia (1996), Great Lakes Initiative (1997) Dissolved Metals Update and Nutrient Standards (2002) and currently, Sulfate and Mixing Zones. Provide expert witness testimony at hearings.

4. **Other Duties.**

   Speak at three to five professional organization conferences (such as Water Environment Federation) each year on water quality initiatives and Agency programs. ORSANCO subcommittee member. ASIWPCA subcommittee member.

1985 - 1988 Illinois Environmental Protection Agency

Data Management Unit, Planning Section, Division of Water Pollution Control

Managed Ambient Water Quality Monitoring Network data through the USEPA STORET system. Lead worker in compilation of the 1988 Illinois Water Quality Report. Performed quality assurance work for Agency water quality data.

1982 - 1985 Monsanto Company, St. Louis, Missouri

Contract Worker

Performed aquatic life bioassays in Monsanto's Environmental Sciences Center. Developed Standard Operating Procedures for several aquatic life bioassays. Traveled to Monsanto plant sites across the country collecting samples and conducting stream biosurveys. Used a mobile aquatic bioassay laboratory at some of these sites to perform whole effluent bioassays.

1981 - 1985 Belleville Area College, Belleville &Granite City, Illinois

Instructor of Biology

Instructed Community College courses in introductory biology and human anatomy and physiology on a full to part time basis. Member of the Charter Staff at the Granite City Campus.

1980 - 1981 Environmental Science & Engineering, Inc., St. Louis MO

Aquatic Biologist

Performed surveys of fishes and macroinvertebrates in large rivers and small streams for power plant location feasibility studies.

Community activities

- Tutor, Washington Street Mission, Springfield
- Coach, Boys Baseball and Girls Softball, Pleasant Plains Junior Athletic Association
- Deacon Board Member, Cherry Hills Baptist Church, Springfield

Awards received

Illinois EPA Employee of the Month, February 1995

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO:	)	
35 Ill. Adm. Code 302.102(b)(6), 302.102(b)(8)	)	R07-09
302.102(b)(10), 302.208(g), 309.103(c)(3),	)	(Rulemaking - Water)
405.109(b)(2)(A), 405.109(b)(2)(B), 406.100(d);	)	
REPEALED 35 Ill. Adm. Code 406.203, PART 407; and	)	
PROPOSED NEW 35 Ill. Adm. Code 302.208(h)	)	

TESTIMONY OF BRIAN KOCH

Qualifications/Introduction

My name is Brian Koch and I have been employed by the Illinois Environmental Protection Agency ("Illinois EPA or "Agency") for over one year. I work as a toxicologist in the Water Quality Standards section of the Division of Water Pollution Control. I have a B.A. and M.S. in Zoology from Southern Illinois University Carbondale, with specialization in fisheries ecology and aquatic toxicology, respectively. My primary responsibility at the Agency is to derive water quality standards and criteria through the implementation of USEPA and Illinois EPA methodologies. My testimony will discuss procedures utilized in the derivation of new sulfate water quality standards for two designated uses, aquatic life use and livestock watering.

Water Quality Standard Derivation Process

My employment with Illinois EPA began in January 2006, whereupon I was immediately assigned to become familiar with the procedures utilized in the derivation of updated sulfate standards. Prior to my employment, personnel from Illinois EPA, USEPA, and Illinois Natural History Survey spent several years reviewing literature and

conducting research in support of standards derivation. Critical issues such as data selection and statistical analyses had already been completed, thereby providing a foundation for the new standards. It has been my responsibility to obtain a complete understanding of the formal guidelines Illinois EPA used to derive the proposed aquatic life standards, as described by the USEPA document entitled *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, 1985 ("the Guidelines", Exhibit L of the Agency's Proposal). The Guidelines are followed in standards development by USEPA and other states, and are also used as a basis for procedures in 35 Ill. Adm. Code Part 302 Subpart E and Subpart F used in deriving water quality criteria.

Aquatic Life: A key component in standards derivation is the gathering and assessing available toxicity data for the substance of interest. Given that sodium is the predominant cation in Illinois waters, the Agency searched for Na_2SO_4 aquatic life toxicity data that was reputable and representative of Illinois fauna. The Agency searched the USEPA AQUIRE database as well as other sources and compiled a database of toxicity values. Upon consultation with USEPA and ADVENT-ENVIRON (a consultant employed by the Illinois Coal Association), several of the studies were deemed unacceptable for use in standards derivation. An explanation for the approval or rejection of each study is provided in the justification document (Exhibit K of the Agency's Proposal). Dr. Charles Stephan, the primary author of the Guidelines document, took precedence in this evaluation of toxicity data, and compiled a final list of values considered valid for sulfate standards derivation (Exhibit M of the Agency's Proposal). Upon review of acceptable data, it was apparent that fish are quite tolerant of

sulfate, while invertebrates are much more sensitive due to problems in maintaining osmotic balance. Of all tested species, the amphipod *Hyalella azteca* was most sensitive to sulfate. However, data on this species was limited and warranted further research to determine the extent of sulfate toxicity. At this time, it was also noted that sulfate toxicity to invertebrates may be dependent on water chemistry. In order to supplement knowledge of sulfate toxicity, Dr. David Soucek of the Illinois Natural History Survey was contracted to conduct laboratory toxicity testing on multiple invertebrate species exposed to sodium sulfate at various concentrations of hardness and chloride. Detailed reports of Dr. Soucek's research, as well as additional toxicity values generated from this research, have been provided in the justification document (Exhibits P-U of the Agency's Proposal).

Dr. Soucek's research was instrumental in the derivation of new sulfate aquatic life standards, as it verified that sulfate toxicity to aquatic invertebrates is dependent on hardness and chloride concentrations of water. Additionally, the research characterized sulfate toxicity to previously untested invertebrates, thereby increasing the data set and providing a more accurate estimation of sulfate toxicity to sensitive species. A fortunate byproduct of Dr. Soucek's research was the finding that chronic exposures of sulfate to the water flea, *Ceriodaphnia dubia*, did not result in reduced survival compared to acute exposures. Because sulfate toxicity is exerted through the inability of an invertebrate to maintain osmotic balance with surrounding water, it is believed that sulfate does not exhibit traditional chronic toxicity similar to substances such as heavy metals or pesticides. Whereas chronic effects of other substances typically occur at concentrations a factor lower than acute thresholds, Dr. Soucek has self-sustaining *Ceriodaphnia dubia*

cultures inhabiting water with sulfate concentrations that are one-half to one-third of acute thresholds. The unique toxicodynamics of sulfate therefore required a sulfate-specific adjustment factor when converting from the LC50 level of effect, which is the concentration lethal to 50% of tested organisms, to the protective level of effect, a procedure to be further described in my testimony.

All aspects of Dr. Soucek's research, as well as acceptable data from other sources, were used to derive the new acute sulfate standards. As previously stated, the procedures used in deriving numerical standards are described in the Guidelines document. A detailed account of the data and equations used in the derivation of sulfate standards can be found in Attachment I of the Agency's Proposal(pages 9–15).

When data is available to show that acute toxicity to two or more species is related to a water quality characteristic, a Final Acute Equation must be calculated in order to describe the relationship. Such was the case with sulfate, where sulfate toxicity to *Hyalella azteca* and *Ceriodaphnia dubia* was quantified in respect to hardness and chloride concentrations of test water. Sulfate LC50 values for the two species were measured or estimated at various concentrations of hardness and chloride and were then transformed into equations with hardness and chloride-specific slopes accounting for these relationships. Two separate equations were required due to the finding that sulfate was increasingly toxic at low chloride concentrations, but decreasingly toxic at concentrations intermediate and higher, therefore requiring different slopes. With the two equations in place, LC50 values for all valid tests within the database were then normalized at specified concentrations of hardness and chloride, whereupon GMAVs (Genus Mean Acute Values) and FAVs (Final Acute Values) were then calculated. The

FAVs are the values that each equation solves to when the normalized hardness and chloride concentrations are entered into the final equations. Two critical components of the sulfate standards derivation warrant further discussion, the FAV equations that account for hardness and chloride concentrations, and the adjustment factor that the FAV equation is multiplied by in order to reach a protective effect level. By definition, the FAV is the value protective of at least 95% of the species at the LC50 level of effect. Because sulfate toxicity is dependent on water chemistry, the FAVs are expressed in the form of two equations accounting for different ranges of hardness and chloride. An important concept to grasp is that a standard can not be set at the FAV effect level, as this concentration would result in at least 50% mortality in highly sensitive species, as well as lesser mortality in more tolerant species. To achieve a sufficient level of protection, an FAV or FAV equation is multiplied by an adjustment factor that translates the LC50-based FAV into a value that is representative of a no observable effect concentration (NOEC), which is the test concentration that did not result in mortality greater than that observed in the control. The default adjustment factor value of 0.5 is used when insufficient data is available for a substance. This default factor was derived by taking the geometric mean of the NOEC to LC50 ratios of over two hundred tests on various toxicants. In the instance of a substance with atypical toxicity, such as sulfate, a pollutant-specific adjustment factor may be calculated if the data set is of sufficient quantity and quality and includes results from sensitive test species. The pollutant-specific adjustment factor for sulfate was derived by taking the geometric mean of NOEC to LC50 ratios from the two most sensitive species, *Hyalella azteca* and *Ceriodaphnia dubia*. The analyses resulted in an adjustment factor of 0.65, which is of greater

specificity and accuracy for sulfate toxicity than the general multiplier of 0.5. The sulfate-specific adjustment factor was incorporated into both standards and serves to assure that an appropriate amount of protection is provided to aquatic life.

The outcome of the Agency's efforts with sulfate was the development of two acute aquatic toxicity criterion equations for sulfate at specified ranges of hardness and chloride. The adoption of these equations will allow for the calculation of site-specific sulfate standards that are dependent on water quality characteristics. By entering hardness and chloride measurements from a specific site into the appropriate equation, the resulting value will be the protective concentration of sulfate at that specific site under those water quality characteristics. The calculated aquatic life standards are not to be exceeded at any time, but may be superseded by the livestock watering standard if applicable.

Livestock Watering: The existing General Use and Lake Michigan Basin aquatic life standard for sulfate was adopted in 1972. There is no existing livestock standard, but it is implied that the 500 mg/L aquatic life standard was thought to be protective of livestock, as the McKee and Wolf (1972) water quality criteria document used in support of standards adoption listed 500 mg/L as a concentration protective of livestock. Upon early stages of developing the newly proposed aquatic life standards, it was apparent that the higher aquatic life standards may conflict with the attainment of other designated uses such as livestock watering. At the onset of my employment, it was my responsibility to research the effects of sulfate on livestock watering to determine if the newly proposed aquatic life standards would threaten attainment of this use. ADVENT-ENVIRON also participated in literature review and supplemented the database. A listing of the toxicity

endpoints and respective studies that were considered are listed in Exhibit E of the Agency's Proposal. Additionally, full-text versions of studies integral to selection of the proposed livestock standard are attached in the justification document (Exhibits F-J of the Agency's Proposal).

A review of the literature found that livestock are acutely tolerant of sulfate within the range of calculable aquatic life sulfate standards. Acute exposure to concentrations within this range may result in cathartic effects for several days, but these effects will diminish as animals acclimate to elevated sulfates. Prolonged exposure to these same concentrations, however, would likely lead to adverse effects on livestock, as well as the economy of impacted livestock operations. Based from literature review, the Agency concluded that a chronic standard of 2,000 mg/L sulfate would be protective of livestock watering, as surface waters supporting this concentration would not lead to adverse effects on livestock or economic impacts to livestock operations. It must be emphasized that this standard is applicable only in areas where water is withdrawn or accessed for purposes of livestock watering. In many of these waters, aquatic life standards will require that sulfate concentrations are maintained below the 2,000 mg/L livestock standard. However, for livestock waters where the instantaneously applied aquatic life standard is calculated to be above 2,000 mg/L, a 30-day average sulfate standard of 2,000 mg/L will apply for protection of livestock. The 2,000 mg/L chronic standard was determined upon review of recent studies where cattle chronically exposed to drinking water showed increasingly deleterious effects at concentrations from 2,360 mg/L to 3,000 mg/L sulfate. At 2,360 mg/L sulfate, cattle have been shown to have decreased dress-out parameters, signifying that exposure to drinking water at this

concentration may result in economic losses to livestock operations. As concentrations reach 2,500 mg/L cattle have poor conception, and at 2,600 mg/L cattle have been found to have decreased weight and body condition. As sulfate concentrations approach 3,000 mg/L cattle drink less water and become more prone to polioencephalomalacia, a neurological disorder which leads to anorexia, blindness, seizures, and eventually death.

To verify the suitability of this proposed standard, Dr. Gavin Meerdink from the Department of Veterinary Medicine at University of Illinois Champaign-Urbana was contacted. Dr. Meerdink has performed consultations for livestock operations throughout the State and has often dealt with the issue of sulfate in livestock water and feed. Dr. Meerdink was supplied with all values collected from literature review and was informed of our plans of implementing 2,000 mg/L sulfate as a chronic, 30-day average standard. Dr. Meerdink questioned the validity of the older studies. He stated that much more has been learned regarding the complexity of sulfur compounds and ruminants over the last 30 years, and that the recent studies likely had better detail in experimental design. He stated that sulfur compounds within the ruminant are a complicated issue, as much variability can be attributed to the sulfur content of feed as well as the ability of rumen microbes to convert sulfur compounds into sulfides. Although limited animal taxa are represented in the literature, Dr. Meerdink acknowledged that cattle are a suitable study organism, as sulfur compounds in monogastric animals (pigs, rats, etc.) are much less of an issue. In summary, Dr. Meerdink stated that a 2,000 mg/L sulfate standard would adequately protect livestock. He related that unacclimated animals may exhibit diarrhea for several days immediately after initial exposure but will suffer no economically significant weight loss or other adverse condition. In his experience, livestock will soon

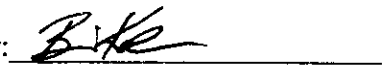
adapt to the higher sulfate water and the temporary symptoms will disappear. Dr. Meerdink also stated that he would feel uncomfortable setting a standard at concentrations significantly higher than 2,000 mg/L sulfate.

Section 302.208(h): The development of updated sulfate standards required modifications to the regulatory language in 302.208. The following is a summary of regulatory changes that reflect the updated sulfate standards for aquatic life and livestock watering. The previous numerical standards for sulfate and TDS have been stricken from 302.208(g). Sulfate regulations now exist in 302.208(h)(1)-(3), beginning with the livestock standard listed in 302.208(h)(1). The 2,000 mg/L livestock standard will be implemented as the concentration not to be exceeded over a 30-day period in waters that are withdrawn or accessed for purposes of livestock watering. Sulfate concentrations are allowed to instantaneously exceed 2,000 mg/L in these waters providing aquatic life standards are not exceeded and the 30-day average does not exceed 2,000 mg/L sulfate.

Water bodies not utilized for livestock watering are exempt from this standard but are regulated by sulfate aquatic life standards calculated in 302.208(h)(2)(A) or 302.208(h)(2)(B). The calculation of the standard is subject to use of a specific equation dependent on hardness and chloride concentrations within the water body. The equation in 302.208(h)(2)(A) calculates sulfate aquatic life standards for waters where hardness is between 100 and 500 mg/L and chloride between 25 and 500 mg/L. Upon entering hardness and chloride concentrations from the receiving water into the provided equation, the resulting value will be the sulfate concentration not to be exceeded at any time. Section 302.208(h)(2)(B) contains the equation that calculates sulfate standards when hardness is between 100 and 500 mg/L and chloride is greater than or equal to 5 mg/L but

less than 25 mg/L. Additionally, in the occasion that hardness and chloride concentrations are outside of the previously described ranges, the following sulfate standards must be met. Pursuant to Section 302.208(h)(3)(A), if the hardness concentration of waters is less than 100 mg/L or chloride concentration of waters is less than 5 mg/L, the sulfate standard is 500 mg/L. Pursuant to Section 302.208(h)(3)(B), if the hardness concentration of waters is greater than 500 mg/L and the chloride concentration of waters is 5 mg/L or greater, the sulfate standard is 2,000 mg/L. The Agency believes the proposed aquatic life and livestock standards are scientifically sound and will serve to effectively protect the environment from adverse amounts of sulfate.

This concludes my pre-filed testimony. I will be supplementing the testimony as needed during the hearing and would be happy to address any questions.

By: 

Brian Koch

February 1, 2007

Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

BRIAN T. KOCH

1021 N. Grand Ave. E, Springfield, IL 62794-9276 • (217) 558-2012 • brian.koch@illinois.gov

EDUCATION

M.S. ZOOLOGY — YEARS ATTENDED (2002-2005)
Southern Illinois University Carbondale — GPA: 3.86

B.A. ZOOLOGY — YEARS ATTENDED (1997-2001)
Southern Illinois University Carbondale — GPA: 3.13

EMPLOYMENT

ENVIRONMENTAL PROTECTION SPECIALIST II — DATES EMPLOYED (2006-PRESENT)
Illinois Environmental Protection Agency
1021 N. Grand Ave. E.
Springfield, IL 62794-9276
(217) 558-2012

Employed as a toxicologist/biologist in the Water Quality Standards section of the Division of Water Pollution Control. Derive water quality criteria for protection of aquatic life and human health, maintain database and quarterly Illinois Register publication of criteria. Conduct research towards the derivation of numeric water quality standards, provide support in adoption of standards before the Illinois Pollution Control Board. Present information to stakeholders or other entities interested in rulemakings, write justification documents, attend hearings. Evaluate environmental risk of water treatment additives used by NPDES facilities, work with permit writers to assure compliance with water quality standards/criteria. Act as the Agency expert in emerging water quality standard issues, conduct field sampling when necessary.

RESEARCH TECHNICIAN — DATES EMPLOYED (FALL 2005)
Southern Illinois University Carbondale
Fisheries and Illinois Aquaculture Center
1255 Lincoln Drive
Carbondale, IL 62901

Led telemetry research on the federally endangered pallid sturgeon, managed personnel and collection of data. Assessed seasonal habitat use and availability, characterized migratory movement and environmental cues, and assessed potential spawning grounds within the Middle Mississippi River (MMR). Compiled final report, currently completing manuscript for publication. Acquired experience with ArcMap 9.1.

GRADUATE RESEARCH ASSISTANT — DATES EMPLOYED (2002-2005)
Southern Illinois University Carbondale
Fisheries and Illinois Aquaculture Center
1255 Lincoln Drive
Carbondale, IL 62901

Sampled sturgeon populations throughout the MMR, collaborated with the Engineer Research and Development Center (U.S. Army Corps of Engineers) and Long Term Resource Monitoring (LTRM) facility. Operated boats, collected sturgeon with active and passive gears throughout all seasons.

Implanted external tags for demographics, surgically implanted ultrasonic tags internally within pallid sturgeon for telemetry, tracked fish. Collected diet samples, aged pallid and shovelnose sturgeon pectoral fin rays.

Thesis work examined body residues of endocrine-disrupting chemicals in MMR shovelnose sturgeon. Analyzed brains, gonads, and fillets with methods allowing for simultaneous determination of PCBs, organochlorine pesticides, and organophosphates. Performed analytical procedures with HPLC and GC-NPD/ECD. Assessed reproductive limitations and intersexuality in relation to body residues. Presented work at regional and national meetings, published research.

UNDERGRADUATE RESEARCH ASSISTANT DATES EMPLOYED (2000-2001)
Southern Illinois University Carbondale
Fisheries and Illinois Aquaculture Center
1255 Lincoln Drive
Carbondale, IL 62901

Primary duties pertained to culturing of crappie, bluegill, and hybrid sunfish. Assisted graduate researchers in completing grant work for muskellunge gynogenesis study and hybrid-striped bass aquaculture studies. Gained field and laboratory experience in shovelnose sturgeon age and mortality study, served as second reader for age validation.

FISH CULTURIST DATES EMPLOYED (SUMMER, 2000)
Logan Hollow Fish Farm
824 Stave Mill Road
Murphysboro, IL 62966

Assisted in culturing and rearing of food and sport fish. Maintained water quality of ponds, delivered fish.

ASSISTANT LAKE MANAGER DATES EMPLOYED (SUMMERS, 1997-1999)
Woodhaven Lakes Association
509 LaMoille Road
Sublette, IL 61367

Maintained aquatic vegetation through mechanical and chemical removal. Assisted lake manager in nature workshops, creel surveys, and fish stocking/sampling. Participated in Volunteer Lake Monitoring Program.

PUBLICATIONS

- Koch, B.T., J.E. Garvey, J. You, and M.J. Lydy. 2006. Elevated organochlorines in the brain-hypothalamic-pituitary complex of intersexual shovelnose sturgeon. *Environmental Toxicology and Chemistry* 25:1689-1697.

HONORS

- SETAC / EA Engineering Jeff Black Award
  SETAC Fourth World Congress, 25th Annual Meeting in North America
  Portland, Oregon, November 2004

Sonnenschein Nath & Rosenthal
7800 Sears Tower
233 South Wacker Drive
Chicago, IL 60606-6404

Katten, Muchin & Zavis
525 West Monroe
Suite 1600
Chicago, IL 60601-3693

U.S. Fish & Wildlife Service
4469-48th Avenue Court
Rock Island, IL 61201

Stateside Associates
2300 Clarendon Blvd.
Suite 407
Arlington, VA 22201

Illinois Environmental Regulatory Group
3150 Roland Avenue
Springfield, IL 62703

Caterpillar Inc.
100 N.E. Adams Street
Peoria, IL 61629

Illinois Municipal League
500 E. Capitol
P.O. Box 5180
Springfield, IL 62705

Abbott Laboratories
Dept. 590, Bldg. P-14
1401 Sheridan Road North
Chicago, IL 60064-4000

Goodwin & Broms, Inc.
400 Bruns Lane
Springfield, IL 62707

Dept. of Commerce & Economic Opportunity
Small Business Office
620 East Adams Street, Fifth Floor
Springfield, IL 62701

Barnes & Thornburg
1 North Wacker Drive
Suite 4400
Chicago,IL 60606

Thorn Creek Basin Sanitary District
700 West End Avenue
Chicago Heights,IL 60411

Exxon Mobile Oil Corporation
1-55 & Arsenal Road East
Channahon, IL 60410

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie
Chicago, IL 60611

Huff & Huff, Inc.
512 West Burlington Avenue
Suite 100
LaGrange, IL 60525

Admiral Environmental Services, Inc.
2025 South Arlington Heights Road
Suite 103
Arlington Heights, IL 60005-4141

American Bottoms RWTF
One American Bottoms Road
Sauget, IL 62201

Openlands Project
25 East Washington Street
Suite 1650
Chicago, IL 60602

Fox Metro Water Reclamation District
682 State Route 31
Oswego, IL 60543

Wheaton Sanitary District
P.O. Box 626
Wheaton, IL 60189

Ameren Services
One Ameren Plaza
PO Box 66149
St. Louis, MO 63166

August Mack Environmental, Inc.
8007 Castleton Road
Indianapolis, IN 46250

Prairie Rivers Network
809 South 5th Street
Champaign, IL 61820

Fox River WRD
P.O. Box 328
Elgin, IL 60121

Environmental Law & Policy Center
35 E. Wacker
Suite 1300 Chicago, IL 60601

Midwest Generation
440 S. LaSalle Street
Suite 3500
Chicago, IL 60605

ExxonMobil
PO Box 874
Joliet, IL 60410

ECT
3701 NW 98th street
Gainesville, FL 32606

Illinois Coal Association
1480 E. 1200th Street
Industry, IL 61440

Illinois-American Water Co.
123 S.W. Washington Street
Peoria, IL 61602-1317

Formosa Plastics
P.O. Box 27
Illiopolis, IL 62539

MRRI
P.O. Box 1642
Murphysboro, IL 62966

Illinois Association of Wastewater Agencies
241 N. Fifth Street
Springfield, IL 62701

Environmental Consulting and Technology
3701 NW 98th Street
Gainsville, FL 32606

Illinois Coal Association
P.O. Box 727
Harrisburg, IL 62946

Illinois Coal Association
8100 E. Main Street
Williamsville, IL 62693

Illinois Coal Association
212 S. Second St.
Springfield, IL 62701

Illinois Rural Water Association
P.O. Box 6049
Taylorville, IL 62568

U.S. EPA
Region 5 (WT-15J)
77 West Jackson Blvd.
Chicago, IL 60604

Citgo Petroleum
135th Street & New Ave.
Lemont, IL 60439-3569

Bolten & Menk, Inc.
2730 Ford Street
P.O. Box 668
Ames, IA 50010-0668

Illinois Natural History Survey
607 E. Peabody Drive
Champaign, IL 61820-6970

Rhodia Inc.
1101 Arnold Street
Chicago Heights, IL 60411

Akzo Nobel
8201 West 47th Street
P.O. Box 1569
McCook, IL 60525

Farmland Foods
1220 N. 6th Street Road
Monmouth, IL 61462

Farmland Foods
7501 N.W. Tiffany Springs Parkway
Kansas City, MO 64153

Viper Mine
8100 East Main Street
Williamsville, IL 62693

IDOT
2300 South Dirksen Parkway
Springfield, IL 62764

STATE OF ILLINOIS)
) **SS**
COUNTY OF SANGAMON)

PROOF OF SERVICE

I, the undersigned, on oath state that I have served the attached written testimony of Robert Mosher and Brian Koch upon the persons to whom it is directed, by placing a copy in an envelope addressed to:

Dorothy Gunn, Clerk
Pollution Control Board
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601
(OVERNIGHT MAIL)

Marie E. Tipsord
Hearing Officer
Illinois Pollution Control Board
100 West Randolph, Suite 11-500
Chicago, Illinois 60601
(OVERNIGHT MAIL)

Mathew Dunn
Illinois Attorney General's Office
Environmental Control Division
James R. Thompson Center
100 West Randolph Street
Chicago, Illinois 60601
(OVERNIGHT MAIL)

Jonathan Furr
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, Illinois 62702-1271

(OVERNIGHT MAIL)

ALSO SEE ATTACHED SERVICE LIST
(FIRST CLASS)

Meredith Kelly

SUBSCRIBED AND SWORN BEFORE ME
THIS 2nd DAY OF FEBRUARY 2007.

OFFICIAL SEAL
BRENDA BOEHNER
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 11-3-2009

Brenda Boehner