Illinois Proposed Sulfate Standard: Industry Comments

The following comments are directed toward the Illinois Environmental Protection Agency's (IEPA) proposed sulfate standard and the corresponding documentation: Preliminary Technical Justification for Changing Water Quality Standards for Sulfate, Total Dissolved Solids and Mixing Zones and Concept Document Regarding Proposed Regulatory Amendments for Sulfate, TDS and Mixing Standards. While the proposed changes provide for a much more reasonable and scientific approach than currently exists, as will be noted, there are still some areas that should be addressed.

Illinois EPA has stated publicly that no harmful environmental effects are occurring as a result of modern mines in the State of Illinois. Studies that specifically targeted the effects of coal mines on aquatic life have shown healthy macroinvertebrate communities existing downstream of mine discharges (Soucek 2004, ILEPA 2004). Sulfate is not a conventional toxic chemical as compared to heavy metals, pesticides, or volatile organic compounds. Conversely, sulfate is a necessary nutrient for the normal functioning of cells and both plants and animals benefit from its availability. For vegetation, sulfate salts are essential to cation delivery, and sulfur increases the protein content of the plant, which are reasons that sulfate is commonly found in fertilizers. In animals, chrondroitin sulfate and glucosamine sulfate are beneficial to the longetivity and functioning of joints. Overall, the beneficial characteristics of sulfate and the fact that the US Environmental Protection Agency (USEPA) has no parallel standard, question the reasoning for imposing a sulfate standard altogether. Nevertheless, the following comments are directed towards the sulfate standard as it is proposed.

The proposed standard is based on the hardness and chloride concentrations downstream of the effluent. The equations used to derive a sulfate standard result in daily maximum concentrations between 500 mg/L and 2,600 mg/L. There are many coal mine effluent concentrations that regularly exceed these concentrations of sulfate. As identified in the State of Illinois 2005 economic impact analysis, a system designed to achieve a 2,000 mg/L effluent limit using excess lime and hydrochloric acid would have an annualized operating cost of $542,000 and an annualized capital cost of $471,500 for every 100 acres of drainage, resulting in a total cost of $10,953,000 projected over a ten year period (ICCI 2005). This will discourage potential and existing mine operators from mining or remining in Illinois due to the high cost that is associated with this and alternative methods of treatment (e.g. pipelines).

The consequences of implementing the proposed sulfate standard will directly affect the coal mining industry. The development of the proposed sulfate standard was contrary to the USEPA guidelines which state, "The development of such standards and limitations, however, might have to take into account such additional factors as social, legal, economic, and hydrological considerations, the environmental and analytical chemistry of the material, the extrapolation from laboratory data to field situations, and relationships between species for which data are available and species in the body of water of concern" (USEPA 1985). The Illinois EPA does not account for the social and

economic impacts that would result from the loss of jobs and state income that the coal mining industry provides to Illinois.

With regard to the proposed monthly average sulfate limit of 2,000 mg/L, a review of literature regarding the effects and tolerance of livestock from drinking water containing sulfate indicate that while short-term laxative responses may occur, a suggested safe tolerance limit can be up to 2,500 mg/L sulfate without long-term effects (Digesti and Weeth 1976, Louper and Waldner 2002, Embry et al. 1959, Anderson and Stothers 1978, Paterson et al. 1979, Gomez et al. 1995).

A specific tolerance level higher than 2,500 mg/L is dependent upon individual metabolic rates and total water intake factors. There are studies that indicate long-term effects may occur. These studies are inconclusive as to the appropriate sulfate concentration that causes long-term effects and conflict with a study that showed "no adverse effect" at a sulfate concentration of 7,000 mg/L. However, none of these studies cited lasting impacts at sulfate concentrations below 3,000 mg/L (Patterson et al. 2005, Zimmerman et al 2002, Weeth and Hunter 1971, Embry et al. 1959).

The data on effects of drinking water sulfate concentration on livestock support a level of 2,500 mg/L sulfate with no long-term effects or loss of performance. Therefore, the existing monthly average sulfate limit for livestock watering of 2,000 mg/L should be changed to a recommended upper sulfate limit of 2,500 mg/L.

The monthly maximum sulfate standard is being applied to all discharges into waters of the state. There are numerous cases where the discharge will be episodic and result only as a consequence of precipitation events. The sulfate derivation method used by the Illinois EPA was based on 96-hour toxicity tests, whereas episodic flow as a result of a precipitation event is often of shorter duration than 96-hours. The conclusions drawn from 96-hour toxicity tests will not be applicable to flows that result in shorter exposure periods to the aquatic organisms. Similarly, many smaller order receiving streams only flow as a result of stormwater runoff and in these cases aquatic life is probably not present in the receiving stream. Imposing a standard for a designated use that does not exist in the receiving stream is erroneous in itself. Alternatively, the sulfate standard and/or mixing calculations should be imposed only on receiving streams which warrant an aquatic life designated use.

The sulfate aquatic life water quality standard proposed by Illinois EPA is based on data from recent studies that found associations between the chloride concentration and hardness of water, and the osmotic imbalance toxic effect on aquatic organisms from sulfate. The data used to establish the Illinois proposed sulfate water quality standard were based on two test species that are commonly used for laboratory toxicity testing. The two species, *Ceriodaphnia* (water flea) and *Hyalella* (scud), were also selected because these organisms were known to be less tolerant (more sensitive) to sulfate exposure than other tested aquatic biota including fish, clams, mussels, and other benthic macroinvertebrates. These two species do not necessarily inhabit every type of Illinois surface water, but are historically used by USEPA to derive water quality criteria. However, the USEPA protocols used to derive water quality criteria recommend toxicity

data for aquatic biota from 8 different taxonomic families be generated, from which toxicity data for the most sensitive 4-5 organisms are most often used to derive the water quality criteria. Use of the two organisms most sensitive to sulfate in the derivation of an Illinois water quality standard for sulfate, while a policy decision at the time of consideration, provides a higher margin of safety to accommodate resident aquatic biota in lakes and streams than would otherwise be provided using EPA methods. While the inclusion of additional species will likely not alter the slope of the equation, the intercept point of the regression would increase and result in less stringent numerical standards for the same hardness and chloride characteristics than the current equation provides.

In certain cases, *H. azteca* has been found by the Illinois EPA monitoring network in waters with sulfate concentrations above 2000 mg/L and in waters with low chloride concentrations, both of which were identified as waters that *H.* azteca would be intolerant of. The fact that *H. azteca* is found in natural waters with sulfate and chloride levels that contradict those determined to be "toxic" through the development process, questions the application of the standard as proposed at these sites.

Another issue with the proposed standard involves the range of values over which it is valid. The proposed standard provides equations based on hardness and chloride when hardness is between 100 and 500 mg/L and chloride is between 5 and 500 mg/L. If these ranges are exceeded, the sulfate standard is limited to 2000 mg/L. However, if hardness were set equal to 500 mg/L, and chloride were varied between 5 and 500 mg/L, the range of returned values for the sulfate standard is between 2020 and 2720 mg/L. Once the range is exceeded however, the standard is reduced to 2000 mg/L. This arbitrary reduction in the sulfate limit when the range of values is exceeded is unsupported. Instead, the sulfate limit should be set equal to the limit obtained directly prior to exceeding the range.

In addition to the proposed sulfate standard, there are proposed changes to the mixing zone methodology. The changes will directly affect the dilution ratio that is used in mixing zone calculations. The dilution ratio that a mixing zone is allotted is based on the 7Q1.1 flow of the receiving stream, which is the low-flow statistic that is being used to describe "small headwater streams". There are several methods of calculating the 7Q1.1 value on receiving streams at a point of discharge. It is suggested that the regulation allow for use of the method that best fits the particular watershed situation.

Lastly, if this standard is adopted as proposed, it will be applied retroactively, meaning it will be applied to all NPDES permit holders disregarding when the permit was originally obtained. This policy presents a barrier to all active and future holders of NPDES permits in the state of Illinois. When an operation is in its initial planning stage, there is no reasonable way to account for the cost associated with future regulations. On the contrary, the success of the business must be based on the cost of complying with present rules and regulations. Expecting a business to achieve standards retroactively, that were not and could not be accounted for in the original operational plan, is unjustified.