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MARCELLUS SHALE COALITION

June 15, 2010

VIA ELECTRONIC MAIL
The Honorable John Hanger
Secretary, Pennsylvania Department of Environmental Protection
Chairperson, Pennsylvania Environmental Quality Board
Rachel Carson State Office Building, 16th Floor
400 Market Street, Harrisburg, Pennsylvania 17101-2301

Re: Proposed Amendments to 25 Pa Code § 93.7 – Ambient Water Quality Criteria for Chloride

Dear Secretary Hanger:

On May 1, 2010, the Pennsylvania Environmental Quality Board ("EQB") published in the Pennsylvania Bulletin proposed amendments to 25 Pa. Code § 93.7 (Table 3) developed by the Pennsylvania Department of Environmental Protection ("PADEP"). See 40 Pa. Bull. 2264 (May 1, 2010). The proposed amendments contain new ambient water quality criteria for chloride. Specifically, the proposed regulations include a four-day average standard for chloride of 230 mg/l and a one-hour average standard of 860 mg/l. Under the terms of the proposed regulations, these criteria apply to protect water uses for cold water fishes, warm water fishes, migratory fishes and trout stocking. Publication of the proposed regulations triggered a 45-day public comment period regarding the new water quality standards for chloride.

The Marcellus Shale Coalition ("MSC") has reviewed the proposed water quality standards and the explanation of need offered by PADEP for these standards. The MSC believes that the proposed water quality standards are based on out-dated scientific studies and that no compelling need has been identified for the regulation. While the MSC fully supports the goal of protecting the quality of Pennsylvania's many rivers and streams, the MSC believes that establishing standards to achieve that goal must be rooted in sound science and not impose unnecessary costs on the regulated community. Because the proposed water quality standards do not meet these objectives, the MSC respectfully requests that the EQB suspend the rule-making process at this time to allow PADEP to conduct the type of thorough and objective evaluation necessary to serve as a predicate for any new water quality standard.

1. Background

The MSC was founded in 2008 and is an organization committed to the responsible development of natural gas from the Marcellus Shale geologic formation which underlies much of northern and western Pennsylvania. Its members include a broad spectrum of gas producing companies that are active in Pennsylvania. The natural gas reserves in the Marcellus Shale formation are quite significant and represent a major economic driver for

Pennsylvania, both at the present time and potentially in the years to come. For example, by the end of 2010, Penn State researchers estimate that 88,000 new jobs will have been created in the Commonwealth through the development of the Marcellus Shale (T. Considine, et al., "The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update," Pennsylvania State University, May 24, 2010, p. 19). By 2020, Marcellus Shale development is expected to result in nearly 212,000 jobs. The Penn State researchers offer a cautionary warning, however, that future growth depends on Pennsylvania maintaining its competitive position. An imposition of increased regulation could "induce a redirection of investment flows to other shale plays [outside Pennsylvania]." (Id. at p. 3).

Pursuant to Section 303(c)(1) of the federal Clean Water Act, states are required at least every three years to review and revise, as appropriate, their water quality standards. Pennsylvania recently completed its triennial review of state water quality standards, adopting revisions to state water quality standards that were published in the Pennsylvania Bulletin on May 16, 2009. See 39 Pa. Bull. 2523 (May 16, 2009). Notwithstanding the fact that Pennsylvania updated its water quality standards only a year ago, the EQB is now proposing to make further changes by adding new water quality standards for chloride. [1]

According to the preamble of the proposed regulations, the authority to develop the proposed regulations derives from Section 5 of the Pennsylvania Clean Streams Law ("CSL"). This provision states in relevant part as follows:

> The department, in adopting rules and regulations, in establishing policy and priorities, in issuing orders or permits, and in taking any other action pursuant to this act, shall, in the exercise of sound judgment and discretion, and for the purpose of implementing the declaration of policy set forth in section 4 of this act, consider, where applicable, the following:
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> (1) Water quality management and pollution control in the watershed as a whole;
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> (2) The present and possible future uses of particular waters;
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> (3) The feasibility of combined or joint treatment facilities;
>
> (4) The state of scientific and technological knowledge;
>
> (5) The immediate and long-range economic impact upon the Commonwealth and its citizens.

[1] In what is presumably an oversight, the proposed regulatory package uses an incorrect chemical symbol for the chloride anion instead of the correct symbol which is Cl.

35 P.S. § 691.5(a).

As discussed below, the proposed regulations do not comport with the foregoing requirements.

2. No Compelling Need Has Been Identified to Justify the Proposed Regulations

In the preamble to the proposed regulations, PADEP proffers two reasons for advancing the proposed new water quality standards for chloride. The MSC does not believe that either of these reasons justifies the burdens that the proposed regulations will place on the regulated community.

First, PADEP cites to "increasing concerns about the Statewide impact of natural gas extraction from the Marcellus Shale formation" as the impetus for the proposed new water quality standards for chloride. 40 Pa. Bull. 2264, 2265 (May 1, 2010). While wastewater from oil and gas production activities can be a source of chloride, PADEP has expressly acknowledged that chloride is ubiquitous in the environment, both from geologic formations through which rivers and streams travel and from anthropogenic sources such as road deicing, urban and agricultural runoff, discharges from active and abandoned mines, industrial wastewater discharges from multiple industries, drinking water supplies that have been treated using water softeners, and discharges from publicly owned treatment works ("POTWs"). *Id.* Whatever generic concerns PADEP may have with development of the Marcellus Shale, the oil and gas industry contributes only a small part of the overall wastewater discharges containing chloride in Pennsylvania.

PADEP invokes the foregoing rationale as well in the document entitled *Evaluation of Water Quality Criteria for Aquatic Life Use Protection,* dated January 2010, which the EQB submitted to the Independent Regulatory Review Commission ("IRRC") to describe the basis for the proposed regulatory amendments. PADEP included in that document the following discussion of water quality that was observed in the Monongahela River basin during the fall of 2008:

> While river flows reached seasonal lows, the concentrations of TDS and sulfates in the river increased to historic highs, exceeding the water quality standards at all of the seventeen Potable Water Supply (PWS) intakes from the border with West Virginia to Pittsburgh. Violations of water quality standards for TDS [total dissolved solids] and Sulfates persisted in the river through November and December 2008. Elevated Chloride levels were also observed in the Monongahela and at least one major tributary – South Fork Tenmile Creek. This sequence of events identifies a need to establish a chloride criterion for the protection of aquatic life at all locations on Pennsylvania surface waters. (Emphasis added).[2]

[2] It is unclear what standard for comparison PADEP used to justify its assertion that "elevated" chloride levels were observed in the Monongahela River basin during the fall of 2008. Based on a review of 22

However, a detailed study conducted by Tetra Tech NUS, Inc. ("Tetra Tech") and described in a report entitled, *Evaluation of High TDS Concentrations in the Monongahela River, January 2009,* identified a number of important discrepancies between PADEP's analysis of conditions in the Monongahela River basin and the purported causes identified by PADEP. The study found that drought conditions in the Monongahela River basin in 2008 decreased the amount of water and increased concentrations of total dissolved solids ("TDS"). The study also found that TDS concentrations in the Monongahela River were at or near the water quality standards upon entering Pennsylvania from West Virginia thereby indicating that the sources of TDS affecting downstream water intakes were not from within Pennsylvania; that the percentage of chlorides in TDS, typically present in oil and gas wastewaters, did not change significantly after the wastewater discharges associated with oil and gas exploration and production had been significantly reduced; and that, instead, the primary chemical constituent detected in the elevated TDS concentrations was sulfate, a known constituent associated with acid mine drainage ("AMD") which is a wide-spread contributor to water quality impacts in both West Virginia and Pennsylvania.[3] Additionally, a long-term statistical trend analysis has indicated that there has been no statistically significant difference in the mass loadings of TDS in the Monongahela River over the last seven years. Nevertheless, PADEP has seized on what occurred in the Monongahela River during a limited period of drought conditions in 2008, incorrectly linked it to development of the Marcellus Shale formation, and used that conclusion as a basis for seeking to impose a "one-size-fits-all" set of water quality standards for chloride that will apply across the Commonwealth.[4]

Second, PADEP suggests that the proposed new water quality standards for chloride are needed as a matter of administrative convenience to protect aquatic life. Specifically, PADEP acknowledges that existing regulations contain a water quality standard for osmotic pressure ("OP") of 50 milliosmoles per kilogram ("mOsm/kg") which was

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pages of water quality sampling data posted on PADEP's website describing conditions at multiple monitoring points in the Monongahela River basin during the fall of 2008 and certain periods thereafter, the highest level of chloride that was detected was 64.9 mg/l, less than 30% of the proposed four-day average water quality standard for chloride of 230 mg/l. Nonetheless, PADEP expressly asserts that these results are sufficient to establish the need for promulgating water quality standards for chloride applicable across the Commonwealth. The data files can be found at http://files.dep.state.pa.us/RegionalResources/SWRO/SWROPortalfiles/monongahelarivertdschlorideandsulfatesamplingresults.pdf.

[3] AMD is a national problem that is particularly prevalent in Pennsylvania. According to a report prepared by PADEP, approximately one-third of waters impacted by AMD degradation are located in Pennsylvania. PADEP, Bureau of Abandoned Mine Reclamation , *The Science of Acid Mine Drainage and Passive Treatment.* (1999).
AMD is Pennsylvania's most significant water pollutant, impacting 2,500 miles of streams. Id.

[4] A close examination of the data and information used by PADEP demonstrates that chloride was not even a significant issue in the Monongahela River during the fall of 2008.

developed "to protect aquatic life from the adverse effects of [chloride, TDS and sulfate] throughout the waterbody." 40 Pa. Bull. at 2265. While the water quality standard for OP will be retained and will continue to regulate the effects of chloride on aquatic life, PADEP is proposing to add new and additional water quality standards for chloride to achieve the same objective of protecting aquatic life,[5] because such new, additional standards "would circumvent the difficulties associated with the implementation of the current osmotic pressure (OP) criterion." *Id.* The "difficulties" enumerated by PADEP consist of the fact that OP is not well-suited for using mass-balance concepts to calculate water quality-based effluent limitations ("WQBELs"), OP is evaluated at single discharge points, and not all laboratories are able to analyze for OP. These difficulties are not significant enough for PADEP to eliminate the water quality standard for OP,[6] but apparently are sufficient, in PADEP's view, to justify a new layer of water quality standards for chloride designed to achieve the very same objectives as the existing water quality standard for OP. PADEP's claims regarding the administrative "difficulties" posed by the water quality standard for osmotic pressure, however, are belied by the fact that no changes are proposed to that water quality standard.

It is wholly unclear why a second set of water quality standards for chloride is necessary to protect aquatic life when such protection is already provided by the water quality standard for osmotic pressure. Indeed, in the comment and response document that PADEP recently prepared in connection with new regulations that PADEP is advocating to regulate wastewater discharges containing TDS, PADEP rejected certain comments urging that even more restrictive standards for TDS be adopted to protect aquatic life, expressly stating that "[t]he Department has reviewed the relevant data and determined that the current osmotic pressure criterion in water quality standards regulations provide[s] protection for aquatic life at the point of discharge." *Comment and Response Document for Wastewater Treatment Requirements (25 Pa. Code Chapter 95)* at p. 35 (emphasis added).

3. The Proposed Water Quality Standards Lack a Sound Scientific Basis

PADEP's scientific evaluation of the proposed water quality standards for chloride was limited to its endorsement of numerical standards contained in a document published by the United States Environmental Protection Agency ("EPA") in February 1988 entitled *Ambient Water Quality Criteria for Chloride – 1988* (EPA 440/5-88-001) (referred to hereinafter as the *1988 Chloride Guidance*). PADEP's position is captured in a single

[5] Both the preamble to the proposed regulations and the supporting document entitled Evaluation of Water Quality Criteria for Aquatic Life Use Protection dated January 2010 make clear that the proposed water quality standards for chloride are intended to protect aquatic life in surface water bodies. Public water supply uses are not a consideration because water quality standards for chloride already exist to protect such uses.

[6] It is important to note that the proposed regulations do not eliminate the water quality standard for osmotic pressure. The regulated community will continue to be required to comply with that standard, PADEP will continue to administer that standard and aquatic life will continue to be protected by that standard.

sentence in the preamble to the proposed regulations which states that "[t]he Department has reviewed the EPA ambient water quality criteria development document for chloride [the *1988 Chloride Guidance*] and agrees with the data analysis, interpretation and methods used to develop the criteria." 40 Pa. Bull. at 2265.

The *1988 Chloride Guidance*, however, was based on limited toxicity data from toxicity studies conducted between 1946 and 1987. A total of eight acute studies using sodium chloride were used to derive the chloride criteria contained in the *1988 Chloride Guidance*. Only twelve freshwater species were evaluated in the eight selected studies. Moreover, the concentrations for chloride contained in the *1988 Chloride Guidance* do not represent national criteria but are simply guidelines that are not binding on Pennsylvania or any other state.

Moreover, since the *1988 Chloride Guidance* was issued, EPA has recognized that many of the aquatic life criteria have not been updated. As EPA highlighted in its 1998 *Water Quality Criteria and Standard Plan*, it is imperative that the base water program keep pace with advancing science and incorporate new approaches and insights.[7] More relevant, higher quality toxicity information is now available and has been considered by other states, including information pertaining to aquatic species that were not considered as part of the *1988 Chloride Guidance*. EPA and its Office of Science and Technology has acknowledged that the methodology for development of numeric water quality standards is antiquated, and that advances in aquatic fate and transport modeling, and improved knowledge of modes of action of many chemicals, need to be accounted for in the development of numeric water quality standards.[8] EPA has established an aquatic life guidelines revision work group of agency scientists to identify, review, evaluate, and revise existing guidelines for protection of aquatic life, based on substantial scientific advancements in aquatic toxicology, aquatic biology, fate, transport, and effects modeling, and ecological risk assessment. Such advancements, coupled with increasing complexity of water quality impairment issues, require criteria derivation approaches beyond the existing guideline methods and certainly beyond the methods that were used in preparing the *1988 Chloride Guidance*.

Many of the flaws and limitations associated with the *1988 Chloride Guidance* were highlighted in recent proceedings in Iowa relating to Iowa's consideration of new water quality standards for chloride.[9] As a result of these proceedings, the Iowa Department of Natural Resources ("IDNR") in conjunction with EPA has developed new water quality criteria for chloride in the State of Iowa. These criteria were derived from an expanded and more current data base (i.e., expanded from the 12 genera used to generate the

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[7] *Water Quality Criteria and Standards Plan - - Priorities for the Future.*

[8] Id.

[9] See, e.g., Iowa Department of Natural Resources, *Water Quality Standards Review: Chloride, Sulfate, and Total Dissolved Solids Consultation Package* (February 9, 2009, updated March 2, 2009)

chloride concentrations in the *1988 Chloride Guidance* to 29 genera and incorporating data generated after 1987). The Iowa water quality criteria for chloride also account for the influence of hardness and sulfate concentrations on chloride toxicity which is not a component of the evaluation in the *1988 Chloride Guidance*. The influence of water hardness on toxicity is well established in the scientific literature for a number of constituents.

EPA has long recognized that when water quality characteristics are shown to influence toxicity of a particular constituent in two or more species, then the influence of those water quality characteristics should be accounted for in the derivation of water quality criteria. This approach is described in technical guidance issued by EPA entitled *Guidelines for Deriving National Numerical Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (EPA PB85-226049). In addition, this technical guidance manual specifically provides for procedures to make hardness dependent adjustments in the development of water quality standards. Recent studies conducted in support of Iowa's chloride criteria showed increased water hardness to significantly decrease the toxicity of chloride with respect to three of four species evaluated (i.e., chloride was 1.4 to 1.7 times less toxic at 200 mg/l hardness as compared to 50 mg/l hardness).[10] The species evaluated in these studies included two of the most sensitive species tested to date for chloride toxicity, the fingernail clam (*Sphaerium simile*) and the water flea (*Ceriodaphnia dubia*). These same studies showed that increasing sulfate concentrations resulted in a subtle negative effect on chloride toxicity (e.g., increasing sulfate concentration from 50 to 200 mg/L lowered *C. dubia* 48 LC50 values for chloride by about 5-10%).

As part of the Iowa process, the *1988 Chloride Guidance* came under significant scrutiny. In a paper entitled *Chloride and TDS Water Quality Standards Update* (January 15, 2008) regarding the development of water quality standards for chloride in Iowa, Gregory L. Sindt, P.E. noted that "[t]he USEPA 1988 national guideline criteria for chloride toxicity are considered by IDNR and many USEPA staff as too stringent." Even PADEP has acknowledged that "[s]cientists at the US EPA are currently conducting research to determine if the national criterion for chloride should be updated."[11]

In order for PADEP to provide a scientifically sound, defensible basis for any new water quality standard for chloride, it is crucial for PADEP to implement its own studies that incorporate these recent developments and assess chloride toxicity using watershed and ecological risk based assessment tools for establishing water quality standards in lieu of simply relying on the existing, outdated *1988 Chloride Guidance*. This effort should include a review of known macrofaunal assemblages for the Allegheny, Susquehanna,

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[10] Iowa Department of Natural Resources, *Water Quality Standards Review: Chloride, Sulfate, and Total Dissolved Solids Consultation Package* (February 9, 2009, updated March 2, 2009).

[11] *Evaluation of Water Quality Criteria for Aquatic Life Use Protection* (January 2010) at p. 6.

Ohio, Delaware, Potomac and other river basins in Pennsylvania to ensure that species used in the derivation of state water quality criteria are relevant and to provide for adequate protection of native aquatic species. Organisms not indigenous to Pennsylvania should be excluded from data used to derive state water quality criteria and, if necessary, additional species (native to Pennsylvania) should be evaluated in laboratory toxicity tests to ensure adequate protection of native populations. Furthermore, the influence of water quality characteristics such as hardness and sulfates should be evaluated in this assessment to establish the relative influence of these parameters on chloride toxicity in native species.

Such studies can be performed without risk to aquatic life in Pennsylvania's streams and rivers in the interim because, as discussed above, the water quality standard for osmotic pressure remains in place and serves to protect aquatic life from risks potentially posed by the presence of chloride in the water column. Even if PADEP is unwilling or unable to commission studies that examine the characteristics of Pennsylvania's surface waters and the potential impacts posed by chloride to aquatic life in such waters, PADEP needs to thoroughly evaluate the work that has been done by other states to assess appropriate chloride water quality standards and the scientific developments that have taken place since the *1988 Chloride Guidance* was issued more than 20 years ago.[12]

If PADEP and the EQB continue to press forward with efforts to impose the new water quality standards for chloride that are proposed, it is critical that members of the regulated community be able to develop and use alternative site-specific criteria for chloride. Pennsylvania's regulations already contain procedures authorizing PADEP to consider requests for site-specific water quality criteria. *See* 25 Pa. Code § 93.8d. Such requests may be made when "[t]here exist site-specific biological or chemical conditions of receiving waters which differ from conditions upon which the water quality criteria were based." 25 Pa. Code § 93.8d(a)(1). Given PADEP's exclusive reliance on the *1988 Chloride Guidance* to support the proposed water quality standards for chloride, this condition will be met in virtually all circumstances. National ambient water quality criteria are established on basis of laboratory tests conducted using water sources that are highly polished (i.e., essentially free of normally occurring, freely suspended particulate matter and dissolved total organic carbon) and at a specified hardness (e.g., usually moderately hard). The interaction of these naturally occurring components is known to affect the potential toxicity for a number of constituents including chloride. Moreover, national ambient water quality criteria are developed using species that may or may not be representative of resident species for the receiving waters of concern.[13]

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[12] According to a presentation on 19 April 2010 at the 2010 North America Snow Conference sponsored by the American Public Works Association by Morton Satin, Director of Technical and Regulatory Affairs for the Salt Institute and Scott Hall, a Senior Manager with ENVIRON, Kansas, Missouri, Kentucky and Indiana are considering adopting the water quality standards for chloride developed by Iowa. EPA is also advising other states to consider the Iowa standards.

[13] The MSC believes that it is far preferable for PADEP to develop an approach for establishing water quality standards for chloride that reflect the variability among surface waters in Pennsylvania than to adopt

Finally, if PADEP and the EQB continue to press forward with efforts to impose the water quality standards for chloride that are proposed, flexibility to adjust discharge limits for chloride reflecting real time stream flow data should be provided. Discharge limits are typically conservatively based on low flow data (Q7-10) for surface water bodies. Such an approach does not account for the additional assimilative capacity that exists during periods of more robust flows.

4. The Proposed Regulations Are Not Economically Justified

Neither the preamble to the proposed regulations nor the supporting documents provided to IRRC contain any type of detailed analysis of the costs that the proposed regulations will impose on the regulated community. For example, the preamble simply states that "[t]he proposed amendment to Chapter 93 may impose additional compliance costs on the regulated community." 40 Pa. Bull. at 2265 (emphasis added.) In the Regulatory Analysis Form submitted to IRRC, PADEP has stated that costs and revenue losses associated with the proposed regulations are "[n]ot measurable." If this is really the case, PADEP is proceeding to add significant new layers of regulations with no idea of what the economic consequences will be. Moreover, the Regulatory Analysis Form indicates that only persons "proposing new or expanded activities or projects which result in discharges of chloride to waters of this Commonwealth may be adversely affected by the proposed regulations," and that only those same persons will be required to comply with the proposed regulations. As discussed below, these statements are not correct.

If the proposed water quality standards for chloride are finalized, both existing and new dischargers of wastewater will be required to meet the new water quality standards. For existing dischargers, the best case scenario is that they will be able to comply with new discharge limits in their permits issued under the National Pollutant Discharge Elimination System ("NPDES") program by utilizing additional monitoring equipment and methods. In other instances, however, existing water treatment facilities will need to significantly change their operations or install new and very expensive treatment technology in order to comply with the new water quality standards. New dischargers also are likely to face the prospect of installing such advanced treatment technology. Indirect dischargers will also be affected as POTWs face new and restrictive permit limits in their NPDES permits and adjust their pretreatment requirements accordingly.

Traditional wastewater treatment alternatives such as pH control, flocculation, coagulation, activated sludge, and filtration are not designed to reduce concentrations of chlorides in wastewater. In some cases, traditional wastewater treatment processes may even increase levels of chlorides that are present. The primary mechanism for meeting chloride standards has been the use of dilution to achieve water quality standards, taking into account the assimilative capacity of the receiving waters.

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the proposed water quality standards, leaving the regulated community and PADEP's regional offices with the challenge of developing alternative standards on a case-by-case.

Critically important challenges of a technical and economic nature are presented in the treatment of chloride in wastewater. The technologies typically utilized to remove chloride from wastewaters are state-of-the-art and are capital, energy, and operationally intensive. In addition, residuals (i.e., salt or brine solutions) are generated from these advanced treatment technologies and need to be managed in accordance with applicable environmental requirements. The management of residuals must be factored into any analysis of the feasibility of using advanced treatment technologies.

State-of-the-art advanced treatment alternatives for removing chlorides from wastewaters are limited and include reverse osmosis ("RO"), evaporation, and evaporation with crystallization. Each of these alternatives is discussed below.

Reverse Osmosis

RO separation technology is used to remove dissolved impurities from wastewater through the use of a semi-permeable membrane. RO involves the reversal of flow through a membrane from a concentrated solution to a high purity (i.e., permeate) stream on the opposite side of the membrane. Pressure is used as the driving force for the separation and the applied pressure must be in excess of the osmotic pressure of the dissolved contaminants to allow flow across the membrane. Treated wastewater, or permeate, is processed through the RO system and re-used or discharged. The concentrated solutions of wastewater are then "rejected" by the RO system and are known as residuals or "brine" solutions.

It is necessary to establish pre-RO system wastewater quality guidelines to optimize system performance and prevent the three main problems associated with RO -- scaling, fouling, and degradation of RO membranes. These problems decrease system productivity because they reduce wastewater quality. Scaling occurs on RO membranes when the concentration of scale-forming species exceeds saturation, producing additional solids within the RO wastewater. Scalants include such chemical species as calcium carbonate, calcium sulfate, barium sulfate, strontium sulfate, and reactive silica. Since these species have very low solubilities, they are difficult to remove from RO membranes. Scaling decreases the effectiveness of the membranes in reducing the solids and causes more frequent cleanings.[14] Fouling occurs when suspended solids, microbes and organic material deposit on the surface of the membrane. Soluble heavy metals, such as iron, can be oxidized within membranes and foul the membranes. A final challenge with RO systems is membrane degradation. This occurs when the membranes are exposed to conditions that destroy the polymers used to create the membranes. Some membranes are susceptible to high and low pH, while others are degraded by exposure to oxidizers such as chlorine.

[14] Kucera, Jane. *Properly Apply Reverse Osmosis* Chemical Engineering Progress. February 1997. Pgs 54-61.

In order to minimize scaling, fouling, and degradation, pretreatment methods involving chemical processes, ion exchange, or ultrafiltration are often used in advance of RO systems. Pre-treatment methods remove scale-forming species from the RO wastewater, while chemical techniques change the characteristics of the RO wastewater influent so that crystal formation is not favored.

Evaporation

Evaporation technology is fairly straightforward as the evaporation process is driven by heat which converts evaporating wastewater into steam, leaving behind a concentrated solution high in chlorides. Essentially, the wastewater is "cooked" to boil off the water and leave behind a salt brine. The absorbed heat causes vaporization of the wastewater and an increase of chloride concentrations in the remaining brine. The resulting vapor may be vented to the atmosphere, or condensed for reuse. Mechanical evaporation is an energy-intensive way to concentrate liquids, and various economic challenges are presented when considering the use of fossil fuels for driving the heat transfer process.[15] Moreover, equipment must be fabricated from alloy steel components and pretreatment of the wastewater is typically necessary. Additionally, the management of concentrated residuals presents similar problems to RO systems.

Evaporation/Crystallization

Evaporation with crystallization includes the standard evaporation technology and also incorporates the use of additional evaporation of the concentrated residual brine solution resulting in a solid crystalline material (i.e., salt). The use of this type of tertiary style treatment system also presents extreme energy usage/consumption, air quality concerns, and economic hardship as large quantities of fossil fuels would be required for combustion resulting in degraded air quality and large operating expenses.

Additionally, wastewater evaporation/crystallization systems have not been demonstrated in Pennsylvania with the exception of a system developed by Hart Resource Technologies, Inc. ("HRT").[16] HRT is the only demonstrated commercial evaporation/crystallization system to treat high TDS wastewaters from the oil and gas industry in Pennsylvania. The HRT system produced an average of 15 tons per day of granular sodium chloride and 3,000 gallons per day of liquid calcium chloride. HRT's design, permitting, construction, and start-up of the crystallizer took over three years

[15] Solar evaporation ponds are another evaporation methodology and are popular systems when land availability, potential odor problems, and meteorologic and climatological conditions are not significant considerations. These types of systems are more typical of the western United States and are not common in Pennsylvania's climate.

[16] HRT's Senate Environmental Resources and Energy Committee, Public Hearing Comments on Marcellus Shale Natural Gas Wastewater Treatment Issues, January 27, 2010.

from conception to operation. Although HRT's crystallizer is considered to be small by industrial standards for wastewater treatment (0.03 million gallons per day ("MGD")), no other firm has installed an economically or technically viable system in Pennsylvania. HRT's crystallization unit was shut down in 1993 due to engineering problems and escalating costs of operation.

PADEP acknowledges that only the foregoing limited suite of treatment technologies exist that are capable of removing chloride from wastewater. PADEP also estimates that RO facilities "should produce satisfactory effluents" at a cost of less than $0.01 per gallon while evaporation or crystallization facilities may cost $0.25 per gallon to $0.50 per gallon to operate. The regulated community believes that actual costs will be significantly higher. Moreover, the capital costs to build advanced treatment facilities will be enormous and the lead time to complete the design, permitting and construction of such facilities will be substantial. Even if PADEP's cost estimates are close to the mark, the annual operating costs for a 2 MGD treatment facility to use reverse osmosis will be in excess of $7,000,000 (excluding installation costs and costs for managing the treatment residuals).

The impacts from the proposed regulations are well illustrated by an evaluation that HRT has performed in connection with three of its wastewater treatment facilities that process fluids from the oil and gas industry. If the proposed water quality standards for chloride are finalized and become effective, HRT and its associated companies will face the loss of approximately 30% of their available discharge capacity, which translates to a 50% loss in revenue, as well as a 31% loss in jobs. These losses will occur even though the discharges from these facilities have had no known adverse impact on water quality over the last 25 years that the facilities have been in operation.

Finally, as with proposed amendments to 25 Pa. Code Chapter 95 that PADEP is seeking to finalize, the proposed water quality standards for chloride have been developed without adequate consideration of the challenges that management of treatment residuals will pose. The advanced treatment processes discussed above do not destroy chloride but simply concentrate chloride in the form of a brine or a salt cake. Other than suggesting that the residuals should be used as road salt (which will largely be deposited into Pennsylvania's streams and rivers through runoff assuming that the composition of the salt produced by crystallization techniques can be used as road salt), the preamble to the proposed regulations is silent regarding this issue. Where are brines to go in order to be treated? Is the solution to ship the brines out-of-state where they are no longer a Pennsylvania problem but a problem for another state? Should brines be injected into deep wells across the Commonwealth (an approach that may have limited viability due to the characteristics of the geology underlying Pennsylvania)? If brines are further treated to form salt, where can the salt be disposed? Does Pennsylvania have the type of landfill capacity that could accommodate a new and very large waste stream? Can salts in large quantities be safely placed in landfills without overwhelming the capacity of leachate treatment systems to handle the issue that will necessarily follow as the salts dissolve in the presence of moisture?

It is clear from the foregoing that the economic impacts from the proposed water quality standards for chloride are extremely significant and have not been adequately considered by PADEP and the EQB. This factor alone is more than sufficient to justify suspending the rule-making process until PADEP can complete the type of evaluation that is mandated under the Clean Streams Law to support a proposed regulation. This factor in combination with the lack of a demonstrable need for the proposed water quality standards and the out-dated scientific basis that PADEP has used to establish the standards provides compelling grounds to suspend the rule-making process.

We very much appreciate the opportunity to provide comments on the proposed regulations and would welcome the opportunity to discuss them in more detail.

Respectfully submitted,

Kathryn Z. Klaber,
President and Executive Director

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From: Kathryn Klaber [kklaber@marcelluscoalition.org]
Sent: Tuesday, June 15, 2010 2:22 PM
To: EP, RegComments
Cc: Slagel, Gary; tgaudlip@rangeresources.com
Subject: Comments - Proposed amendments to 25 PA Code Chapter 93, Ambient Water Quality Criteria for Chloride
Attachments: MSC Comments to Chapter 93 proposed amendments.pdf

Please confirm receipt.

Kathryn Z. Klaber
President and Executive Director
4000 Town Center Boulevard, Suite 310
Canonsburg, PA 15317
office: 724.745.0100
cell: 412.897.1030
kklaber@marcelluscoalition.org

MARCELLUS
SHALE COALITION