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TALEN ENERGY

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Independent Regulatory Review Commission

September 25, 2020

The Honorable Patrick McDonnell, Chairman
Environmental Quality Board
P.O. Box 8477
Harrisburg, PA 17105-8477

RE: Proposed Water Quality Standard for Manganese & Implementation, 25 Pa. Code Chapters 93 and 96

Dear Chairman McDonnell,

The Pennsylvania Mines, LLC, Rushton AMD Treatment Plant (Plant) is located Centre County, PA and discharges into the Moshannon Creek between Osceola Mills and Phillipsburg. This Plant treats pumped water from a flooded underground deep mine complex to maintain groundwater levels and prevent breakout of mine water at multiple locations throughout the watershed. The underground coal mine is closed and ceased producing coal in 1992. Despite being an inactive facility, owned by a company with no coal mining interests, Rushton continuously treats of up to 5,000 gpm of mine pool water under permits with PA Department of Environmental Protection. If the Department were to establish the more stringent manganese limit of 0.3 mg/l at the discharge point, that limit would be 10 times lower than the manganese concentration which is typically found in the receiving stream (Moshannon Creek) resulting from upstream, untreated abandoned mine sources. So, such a requirement would cause Rushton to incur extremely higher costs to implement new treatment systems ($10s million) and to operating the systems with no measurable improvement to the water quality in the receiving stream, let alone improvement to quality of any downstream surface water intakes.

Our comments and concerns regarding of the Pennsylvania Department of Environmental Protection (DEP) proposed Water Quality Standard for Manganese (WQS-Mn) are specific to the Rushton AMD Treatment Plant (Plant) and generally to its state-wide implementation. Our comments and concerns include:

- DEP has not identified the necessity for the proposed WQS-Mn by evaluating the current human health concerns to the public and the actual risk associated with incidental and voluntary consumption of "untreated" surface waters containing manganese.
- Studies have not been conducted by DEP in Moshannon Creek or state-wide surface waters to determine the manganese concentrations (dissolved and total) found in surface waters, sources of this manganese, and the waters that will be affected by implementation of this statewide WQS-Mn.

- DEP has not determined the basic aqueous chemistry of manganese (dissolved versus total) nor manganese fate & transport in surface waters.
- DEP has chosen to apply a Human Health-based WQS-Mn for the protection of all designated surface water uses, which is contrary to decades of the balanced environmental protection of PA surface waters.
- DEP has not determined the implications of manganese treatment at coal mine discharges, or any other of industry/activity in the state, that includes treatment technologies and costs associated to achieve compliance concentrations.
- DEP has identified this WQS-Mn is needed for the protection of Public Water Supplies but has conducted no studies assessing manganese (dissolved and total) concentrations at these existing and potential water supplies.
- Related to the last two items, DEP has not conducted any treatment cost analysis for either the discharges or the potable water suppliers to demonstrate the benefits versus the costs of the proposed WQS-Mn.

The following provides additional information related to the above issues.

Risk Evaluation

The approach of forcing discharges to meet a 0.3 mg/L manganese concentration when potable water treatment is required to meet a much lower 0.05 mg/L manganese concentration appears to have a disconnect between water quality that is required for the protection of surface water uses versus potable water supplies. This indicates there is minimal to no public human health risk of instream manganese because water treatment requirements will have to meet a much lower manganese concentration than the proposed manganese standard. While many surface waters have elevated manganese, it is very unlikely that a person of the public would routinely use an untreated surface water, due to disease related health risks in the water and not manganese, and therefore there is at minimal risk to elevated manganese in surface waters. In fact, the entire approach of achieving and declaring a surface water as a safe drinking water for manganese may endanger the public by a false sense of security, when in fact surface waters are not safe to drink without treatment due to the bacterial disease risk associated with the water.

Manganese Sources

The instream manganese concentration in Moshannon Creek upstream of Rushton AMD Treatment Plant (Plant) was found to be 3.0 mg/L and 3.4 mg/L on August 4, 2015 and August 25, 2015, respectively. At the time of this sampling, the Rushton AMD treatment Plant was discharging less than 1.0 mg/L of manganese. It is also unlikely the upstream concentrations of manganese have changed significantly since this sampling. As indicated in the 2009 TMDL there are a large number of coal mine water sources contributing to the impairment of Moshannon Creek for pH, iron, aluminum and manganese. These included:

1. Title IV Abandoned Mined Land (AML) surface and deep coal mines from the late 1800's through the 1960's located throughout the watershed and contributing acid mine drainage (AMD) and high concentrations of manganese.
2. Regulated coal mine discharges through the NPDES program with TMDL maximum instantaneous effluent limits of 1.0 mg/L, that would also be required to neutralize acidity and remove iron and aluminum from the AMD.
3. Bankruptcy and bond forfeiture (legacy) coal mining discharges with minimal treatment.

Of the three types of coal mine discharge in Moshannon Creek the Title IV AML AMD are the largest source of manganese and are the cause of the manganese impairment and in the watershed. The Title IV AML sites and associated AMD fall under the jurisdiction of DEP, Bureau of Abandoned Mine Reclamation (BAMR). BAMR uses limited funding (public and coal tax) to reclaim AML sites and treat AMD from these areas. These efforts typically do not address manganese due to the high costs and minimal benefit on watershed restoration.

An additional source of coal mine discharges causing impairment to Moshannon Creek are the bankruptcy and bond forfeiture sites. The bankruptcy and bond forfeiture sites fall under the jurisdiction of DEP, Bureau of Mining (BOM). Typically, funds are limited and treatment, where it does occur, is minimal and does not meet established TMDL limits due to high costs. While these are regulatory mine sites, BOM does not generally impose NPDES effluent limits at these discharges but only establishes treatment objectives. Treatment typically does not include manganese to TMDL effluent limits established for regulatory coal mine and other discharges.

Finally, the TMDL lists the publicly owned and operated Moshannon Joint Sewer Authority as a source of manganese to Moshannon Creek. It is likely this plant has levels of manganese in its raw water and discharge from source waters related to infiltration/inflow, industry, and dietary supplements. This municipal wastewater treatment plant could receive effluent limits that require additional treatment costs that would be placed on increases rates to the public.

It is likely Moshannon Creek is representative of the majority of AMD impaired waters in Pennsylvania where the NPDES treated coal mine discharges achieve better water quality than the receiving stream and are not major contributors to the surface water manganese concentrations. It is more likely, if there are manganese issues, the elevated stream manganese concentrations are caused by Title IV AML AMD and bankruptcy/forfeiture (legacy) sources.

Based on the above, DEP has not adequately assessed the various sources of manganese within the Moshannon Creek or other mining impacted watersheds in Pennsylvania as part of this rulemaking. As conditions at the Moshannon Creek demonstrate there is little likelihood the largest sources of manganese from Title IV AMD sources will be addressed any time in the near future, indicating there is little likelihood this or any other mining-related surface water will achieve a "drinkable" condition, except directly in the discharge and outfall of the NPDES treated mine discharges. This demonstrates there will be no benefit to promulgating the proposed standard at the Rushton Plant or most other treated discharges. It also raises suspect whether there will be any benefit of the new water quality standard in improving drinking water supplies where there are upstream Title IV mine-related impacts.

There is also the issue of equitable application of the proposed manganese water quality standard across all regulatory coal mining discharges, specifically equal application at bond forfeiture and bankruptcy (legacy) discharges under the jurisdiction and responsibility of the BOM. While a number of these discharges are treated, none have NPDES permits nor is manganese considered in the treatment goals established by BOM for treatment. This demonstrates two aspects. First, the environmental regulations and NPDES requirements under the Clean Water Act are not equally and fairly applied in Pennsylvania. Second, we understand that not all BOM managed sites treat for manganese likely due to the high cost of such treatment. So if these even lower manganese discharge standards are applied equitably to all former mine site discharges, the increased cost of treating these legacy site would be an extremely high burden to Pennsylvanian taxpayers.

Manganese Chemistry

Manganese is a transition metal that can be found in aqueous solution (dissolved) principally as manganous ion (Mn^{2+}), which is the reduced form of manganese, but other oxidation states of manganese found in aqueous environments under natural conditions, including Mn^{3+} and Mn^{4+}. Both of these oxidation states are more common in oxygenated environments, such as surface waters, and both have very low solubility at pH greater than 4. As a result, concentrations of soluble or dissolved manganese in natural surface waters are typically not found except in close proximity to the source of the dissolved manganese.

Dissolved manganese, the reduced form of manganese, in surface waters with circumneutral pH is highly unstable. This is because the reduced form is subject to natural oxidation process to insoluble oxidized forms, thereby forming insoluble oxyhydroxide precipitates. These precipitates become a relatively small component of the surface water sediment load, or bed load. Transport or suspension of this bed load occurs but only as part of the natural stream and river transport processes associated with high storm event flows.

These instream manganese removal processes are documented in the literature (Hem, J.D. 1981. Rates of manganese oxidation in aqueous systems. Geochimica et Cosmochimica Acta Vol. 45 pp. 1369-1374; and Scott, D.T., D.M. McKnight, B.M Voekler, and D.C. Hrncir. 2002. Manganese Fate and Transport in a Mountain Stream. Environ. Sci. Technol., Vol. 36, pp.453-459.), and are important natural process that remove natural and anthropogenic dissolved manganese from surface waters. Based on these instream mechanisms, dissolved and suspended manganese in stream waters would be short-lived. Manganese would likely be lowered from the water a short distance from the discharge (typically less than 1 mile), as long as the stream meets all other surface water quality standards (specifically $pH > 6$).

It appears DEP has assumed manganese is conservative in the stream similar to parameters like sodium and chloride. DEP has not conducted any modeling to evaluate the fate and transport of manganese to determine the length of stream or surface water that is affected by the discharge of dissolved or total manganese at the mining BAT limits, TMDL limits, or the proposed rulemaking. Nor has DEP determined whether dissolved manganese (the form of concern to water purveyors) is currently or can potentially reach a potable water supply intake at various discharge effluent limits. The proposed rulemaking should be withdrawn until DEP uses known information to properly assess the potential impacts (lengths and conditions) of discharged manganese (total and dissolved) and determine the concentrations of dissolved manganese that may reach downstream potable intakes.

Mine Drainage Treatment for Manganese

The Rushton AMD Treatment Plant uses neutralization in combination with large settling ponds to treat the pumped deep mine water to achieve effluent limits. This industry-wide and accepted treatment (Design Manual: Neutralization of Acid Mine Drainage – U.S. EPA: EPA-600/2-83-001) is the established best available technology (BAT) for coal mine discharge treatment. The Rushton AMD Treatment Plant has successfully achieved a high-quality effluent from treatment of up to 5,000 gpd mine pool flow achieving low metals concentrations for decades. The facility has been in continuous compliance until recently when the combination of lower effluent limits for manganese (1.0 mg/L), iron (1.5 mg/L) and aluminum (0.75 mg/L) were imposed in renewed NPDES permits. While generally meeting these new and more stringent effluent limits, operation of the treatment plant and compliance with the effluent limits has become of a delicate balance, and at times during abnormally high precipitation periods, the treatment is easily upset resulting in exceedances of effluent limits for either manganese or aluminum. Overall, the treatment plant has added additional pre-aeration treatment and has had increased operational costs due to greater lime use, greater solids production and associated management, and increased operational labor to maintain these current effluent limits.

The delicate operational balance is created by the conflicts in treatment of the lower manganese and lower aluminum effluent limits. The lower 1.0 mg/L manganese can usually be met but this requires increasing the neutralization pH from the upper 8's of historic operation to the mid- to upper 9's, thereby increasing the lime use, and sludge production. Sludge production is increased from precipitation of calcium and magnesium (a process known as cold water softening) and not manganese precipitation. This increase in neutralization pH for manganese removal conflicts with aluminum removal because aluminum is effectively removed between pH 7 and 8 but removal decreases, due to hydroxide solubility, as the pH is increased to greater than 9. As pH is increased to greater than 9, aluminum solubility increases to where 0.75 mg/L effluent limit for aluminum is approached and exceeded. The conflict between the two effluent limits becomes apparent and the plant is easily upset to a non-compliance condition with a shift in neutralization pH by as little as 0.1 units.

Lowering the effluent further to meet the proposed 0.3 mg/L manganese discharge standard would only exacerbate the pH neutralization conflict between manganese and aluminum. Neutralization pH would need to be increased to greater than 10 to consistently achieve the 0.3 mg/L manganese effluent limit. Lime for the neutralization would be expected to increase by between 50 and 100% and a corresponding increase in sludge volumes would occur, again from the precipitation of calcium and magnesium and not manganese. However, at this elevated pH the aluminum solubility would increase to well above the 0.75 mg/L effluent limit. In addition, the neutralization pH for manganese removal would necessitate post-neutralization pH adjustment to lower the pH to between 6 and 9, likely using costly sulfuric acid. While the pH adjustment would lower the solubility of aluminum, removal of the particulate aluminum would be an unlikely endeavor in the current treatment plant because the aluminum solids would settle slowly, if at all, in any existing settling pond at the treatment plant. It becomes clear that new treatment facilities and operations would be needed to comply with the proposed manganese water quality standard at the discharge point, and may not even be reasonably available treatment technology for such a large mine water flow.

While we have not developed designs for a new system, a conceptual approach would entail replacing the settling ponds with clarifiers to develop a first stage high pH neutralization treatment, followed by pH adjustment (decrease) to between 8 and 9 and filtration (micro to ultra) to capture fine aluminum particles. Estimates for the new clarifiers could exceed $9 million and microfiltration for a 7 million gallon per day flow could likely exceed $20 million. Overall capital expenditures to comply with the proposed manganese water quality standard, if applied at the discharge, could be approximately $30 million. In addition, annual operating costs for chemicals, electricity, sludge disposal and manpower could be expected to double, with annual costs potentially exceeding $2 million annually. At these potential increases in capital and operating costs continued treatment of the Rushton AMD Treatment Plant will be challenged to obtain the necessary funding for this operation, and which, as noted earlier, would have no measurable improvement to the water quality of the receiving stream nor any improvement to the quality of the intake water of the nearest downstream water supply, which is over 100 miles downstream on the Susquehanna River.

With these potential treatment challenges and significant cost implications at just one AMD treatment plant, it becomes evident that DEP has not thoroughly evaluated the overall cost implications of the proposed water quality standard for the coal mining sector and other industrial/municipal discharge sectors. The proposed manganese water quality standard should be withdrawn until such time as DEP has conducted a cost to benefit analysis of the standard and its various options.

Potable Water

There are no potable source waters in Moshannon Creek downstream of the Rushton AMD Treatment Plant and, as noted above, the closest downstream water intake is over 100 miles away. It becomes difficult to understand the purpose of applying the proposed 0.3 mg/L manganese standard to a surface water of such poor quality as Moshannon Creek and that does not serve as a potable water supply. It also becomes highly unlikely whether any person would consider using the Moshannon Creek as a potable water, intentionally or unintentionally, which raises concerns as to the purpose of implementing the proposed 0.3 mg/L manganese standard uniformly either at all discharges or in all streams, particularly where upstream background manganese concentrations are far in excess of the proposed standard.

With respect to surface water potable treatment, the U.S. EPA has developed Surface Water Treatment Rules that generally require minimum levels treatment (conventional) that involve filtration to protect the public from microbial pathogens known to be contained in surface waters. This pathogen content in surface waters again raises a concern of risk and why a surface water should be drinkable for manganese when it is not drinkable based on pathogen risk. With respect to potable water treatment, conventional treatment described by the American Water Works Association includes screening, primary oxidant/disinfectant, coagulation/flocculation, sedimentation, and filtration before a final disinfectant is added for distribution of the water to the public. This conventional process train would easily capture particulate manganese that is in the surface water sediment load (e.g., total suspended solids) with no additional costs or operational requirements. In addition, dissolved manganese, at concentrations less than 2.0 mg/L (BAT limit for the coal mining industry), can be removed in conventional treatment with primary oxidants forming particulate manganese that will be captured in the subsequent treatment processes.

There are two important conclusions based on the above considerations for surface waters potable water treatment. First, if the manganese in the surface water reaches the potable water intake as a particulate form with other suspended solids, there is no implication on the water treatment plant operation as this manganese would be captured as part or required treatment of the Surface Water Treatment Rules. Second, if the manganese reaches the treatment plant intake as dissolved manganese, which can be no more than 1.0 mg/L under current TMDL effluent limits and 2.0 mg/L under BAT limits, the conventional treatment will be able to remove this manganese through slight increases in primary oxidant, with subsequent removal similar to capturing of particulate manganese discussed above. Therefore, the current BAT limit for manganese, if achieved across all discharges, would be sufficient for potable water treatment.

Our final comment on potable water treatment is that it is likely that there will be major cost increases at potable water treatment systems will not be the treatment of water for potable water but instead will be for treatment of various waste water streams (e.g., filter backwash and sludge decant) that may contain "captured" particulate manganese that originate from surface waters withdrawn. Treatment of these flows to comply with the proposed regulation are likely and could be a significant increase in capital and operating costs for the surface water potable water treatment plant.

DEP should withdraw the proposed manganese water quality standard until such time that they have evaluated total and dissolved manganese in surface water potable water supplies. This is needed for DEP to better understand the cost implications of manganese and its removal in surface potable water supplies and treatment plants. DEP should also conduct cost evaluations to determine the costs of treatment at the potable water supplies versus the costs of treatment at the private and public sector discharges, including implications on discharges from potable water treatment plants.

Thank you for consideration of Pennsylvania Mines, LLC comments on the proposed manganese Water Quality Standard. Additionally, Pennsylvania Mines, LLC's parent company Talen Energy is a member of the PA Chamber of Business and Industry and supports the comments that they are providing on this proposed water quality standard. Specifically, as noted in the PA Chamber's comments, we are a member who does believe that the proposed approach to apply the standard at the discharge point has an outcome that is not equitable. And furthermore, such an approach does not comply with Act 40 of 2017 requiring the point of compliance to be applied at the point of withdrawal.

We would welcome further discussion with EQB and DEP on this matter.

Sincerely,

Craig S. Shamory

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