

# **Comments on the Proposed Chapter 93 Criterion for Manganese (0.3 mg/L)**

**Submitted by**

The Pennsylvania Coal Alliance  
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**Presented by**

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# Comments Related to Sources of Dissolved & Total Manganese In Surface Waters

(at concentrations exceeding 0.3 mg/L)

- **Coal Mining:**
  - Produced from pyritic material oxidation and chemical reactions with contact minerals.
  - Manganese discharges from regulated mines are controlled by the industry BAT limit of 2.0 mg/L.
- **Non-Coal Mining:**
  - Elevated manganese can be found in surficial/bedrock materials exposed during aggregate mining.
  - Erosion of manganese containing materials during mining may release elevated manganese to surface waters.
- **Non-Regulated Mine Water Sources:**
  - Title IV Abandoned Mined Lands, Surface & Deep Coal Mines and Coal Refuse Areas.
  - Non-permitted Surface and Deep Coal Mines, Bond Forfeiture & Bankruptcy Trust Sites.
- **Earth Disturbance Activities (Road Construction, Development Activities, Urban Runoff, & Agriculture):**
  - Elevated concentrations of manganese can be found in surficial materials and bedrock in areas of Pennsylvania.
  - Mineral exposure and erosion can result in discharge of total/dissolved manganese to surface waters.
- **Other Industrial/Municipal Activities:**
  - Power Industry -
    - Cooling water discharges concentrate manganese due to evaporation from surface water sources
    - Site/Stockpile runoff.
  - Municipal Wastewater Treatment -
    - Human supplement consumption, Infiltration/Inflow of surface/groundwater. & Industrial and municipal inputs.
  - Municipal Potable Water Treatment -
    - Surface discharges associated treatment processes and sludge handling.

# Comments Related to Fate & Transport of Dissolved & Total Manganese

- **Fate of Manganese discharged:**
  - DEP assumes mining regulated (NPDES) manganese discharged behaves like Sodium and Chloride (i.e., conservative).
  - The regulated mine manganese discharged is removed from surface waters through natural oxidation and sedimentation processes.
- **Transport of Manganese discharged:**
  - DEP assumes no dilution of mining regulated (NPDES) discharged manganese.
  - The regulated mine manganese discharged is diluted once it is in the receiving stream.
- **Analysis of mining regulated (NPDES) discharged manganese (at a BAT Limit of 2.0 mg/L of total/dissolved manganese):**
  - Low flow (surface coal mine) manganese discharged would likely be nearly removed to low concentrations within ½ mile of the discharge location.
  - High flow (deep coal mine) manganese discharged would likely be removed to low concentrations within 1 mile of the discharge location.

# Comments Related to Mine Water Treatment Costs

- **Neutralization (Active) is Most Common Regulated Mine Water Treatment:**
  - Neutralization Chemicals – Lime, Sodium Hydroxide, Soda Ash.
  - Used to Raise the water pH to > 8 and neutralize acidity.
  - Precipitates iron, aluminum, and manganese.
  - Aeration may be included to oxidize soluble ferrous to insoluble ferric iron.
  - Metals & secondary precipitates are removed through Sedimentation.
- **Removal of Manganese through Neutralization:**
  - Removes manganese based on solubility.
  - BAT of 2.0 mg/L is achieved at pH 8.5 to 9.0.
  - Achieving a 1.0 mg/L (pH 9.5 to 10.0) increases neutralization chemicals and costs by 25 to 50%.
  - Achieving a 0.3 mg/L (pH 10.5 to 11.0) doubles (100%) neutralization chemicals and costs.
  - Sludge volumes would also nearly double from secondary precipitates (calcite and brucite).
- **Post Neutralization pH Adjustment:**
  - Effluent must be lowered to pH 6 to 9 versus neutralization pH > 10 needed to achieve 0.3 mg/L.
  - pH adjustment required using additional treatment (sulfuric acid, citric acid, or aeration).
- **Complication (Manganese vs. Aluminum Effluent Limits):**
  - New or Two-Stage Treatment Required due to resolubilization of aluminum at high pH.
  - Land availability and site constraints.
- **Estimated Increase in Treatment Costs**
  - **Capital Costs - > \$200 million.**
  - **Operating Costs - \$44 to \$88 million annually.**

# Comments Related to Aquatic Life Toxicity Manganese

- **DEP Assumptions:**

- DEP indicates manganese aquatic life toxicological data is inadequate to develop an Aquatic Life Standard.
- DEP then assumes a Human Health Standard will protect Aquatic Life.
- This contradicts most other Water Quality Standards that are developed for Human Health and Aquatic Life and apply the standards to the designated uses of the surface water.

- **Available Aquatic Life Toxicity Information for Manganese:**

- There is acute toxicity information for **12 individual species** that are either present in Pennsylvania waters or congeners for Pennsylvania species.
  - Acute Toxicity Range: 8.6 to 1389 mg/L.
  - Studies indicate toxicity is hardness dependent.
- There is chronic toxicity information for **7 individual species** that are either present in Pennsylvania waters or congeners for Pennsylvania species.
  - Chronic Toxicity Range: 6.9 to 20.7 mg/L.
  - Studies indicate toxicity is hardness dependent.

- **Manganese toxicity data appears to be adequate to meet EPA Guidelines for developing Criterion Maximum Concentration (CMC) and Criterion Continuous Concentrations (CCC):**

- Expected Range of CMC: 5.0 to 10 mg/L at 100 mg/L Hardness.
- Expected Range of CCC: 2.5 to 5.0 mg/L at 100 mg/L Hardness.

# Comments Related to Potable Water Treatment

- **EPA Surface Water Treatment Rules:**

- Provide Public Protection to prevent microbial disease.
  - Bacteria, Viruses, Protozoa Cysts/Oocysts.
  - Size – 0.1 to 10  $\mu\text{M}$ .
- Disinfection and Filtration Required for microorganism inactivation and removal.
- EPA defined treatment as Conventional Surface Water Treatment.

- **American Water Works Association:**

- 1999 Water Quality & Treatment: A Handbook of Community Water Supplies (5<sup>th</sup> edition).
- Indicates Conventional Surface Water Treatment as:

**Screening → Disinfection/Oxidant → Coagulation/Flocculation → Sedimentation → Filtration → Final Disinfection**

- **Potable Water Treatment - Manganese Removal (Example):**

→ Oxidant → Coagulation/Sedimentation or Filtration →

- **1979 1.0 mg/L Manganese Development Information:**

- Mr. Reginald Adams, an experienced water supply manager from the Wilkinsburg Joint Water Authority. Mr. Adams stated that an “average up-to-date water plant can probably handle soluble manganese concentrations without too much difficulty. A well-designed plant can handle 1.5 to 2 parts per million...”.
- From PA DEP, Bureau of Clean Water, Rational: Development of the Human Health Criterion for Manganese.

*Thank You*

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