Impact Analysis of the Proposed TDS Strategy on the Industry Sector Group

Presented to the PADEP WRAC TDS Subcommittee

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Objective – Assess the Economic and Environmental Impacts of Proposed TDS Standards on the Industry Sector

- Determine how New Industry would comply with standard
- Determine treatment options, costs and timeframe for implementation, costs for continual operation, costs for disposal
- Determine environmental impacts and unintended consequences
- Develop clear definition of what is a new discharge

Background

- Industry Sector Group contains 13 different Industrial Categories
- Categories combine to total over 900 companies in Pennsylvania
- Less than 1% companies represented in study due to timeframe

Survey

- Survey sent to members of the PA Chamber of Commerce, PCIC, and Allegheny Conference
  - Discharge Rates, Chloride Loading, Sulfate Loading, Treatment Types and Costs
- Costs are approximate
  - Some Vendors of treatment equipment would not provide cost estimations based on limited information

Types of Discharges

Wastewater Volume Mgal/yr	TDS Concentration mg/L	Chlorides Concentration mg/L	Sulfates Concentration mg/L	TDS Loading Lb/day
30	11,000			7,500
38	8,000	1,000		7,000
158	8,000			28,800
15-70	2,500-18,000			855 - 29,000
219	4,600			23,000
438	8,000			80,000
146	1,000			3,300
55	10,000			12,500

Pharmaceutical Industry

- Discharge Information:
  - Effluent TDS: 1560 mg/l average, 2000 mg/l max.
  - Effluent Flow: 1.5 million gpd
- Sources of TDS
  - Cooling tower blowdown
  - Neutralized acids and bases due to FDA cleaning requirements
- Reverse Osmosis Treatment to 500 mg/l effluent TDS

TDS Treatment System

- Microfiltration – Removal of TSS
- Granular Activated Carbon Adsorption – Removal of TOC to protect RO membrane
  - Three (3) month bed life
- Reverse Osmosis System
- Brine Concentrator and Crystallizer

Costs

- Installation and Start up Capital Cost: $13.2 million
- Annual Operating Cost (excluding electricity): $5.4 million
  - Solid waste disposal cost component: $1,250 per day, $456,000 per year
- Annual Electricity Cost: $400,000
- Total Annual Operating Cost: $5.8 million

Chemical Industry (Batch Operation)

- Discharge Information
  - Effluent TDS: 2,500 to18,000 mg/l
  - Effluent Flow: 40,000 gpd to 190,000
- Treatment to lower TDS to 9,500 mg/l
  - If treatment to 500 mg/l – costs assume to at least double

TDS Treatment System

- Reverse Osmosis with High Efficiency Evaporator Units and a Ultrafiltration setup
- Reverse Osmosis – 82% efficiency with 18% reject stream
- Site already runs and maintains a significant pretreatment unit. (Sites without this may have significantly higher costs than shown)

Costs

- Capital Cost to treat 50 gpm stream with 60 gpm untreated blend to 9,500 mg/L: $2.11 million
- Annual Operating Cost: $126 K
- Solid waste disposal costs: $340 K - $1.04 million
- Option for reducing waste by 60-70%
  - Increase capital costs by $500 K - $1Million
  - Increase O&M costs by $300K – 600K (includes significant increase in energy cost)

Environmental Costs/Impacts

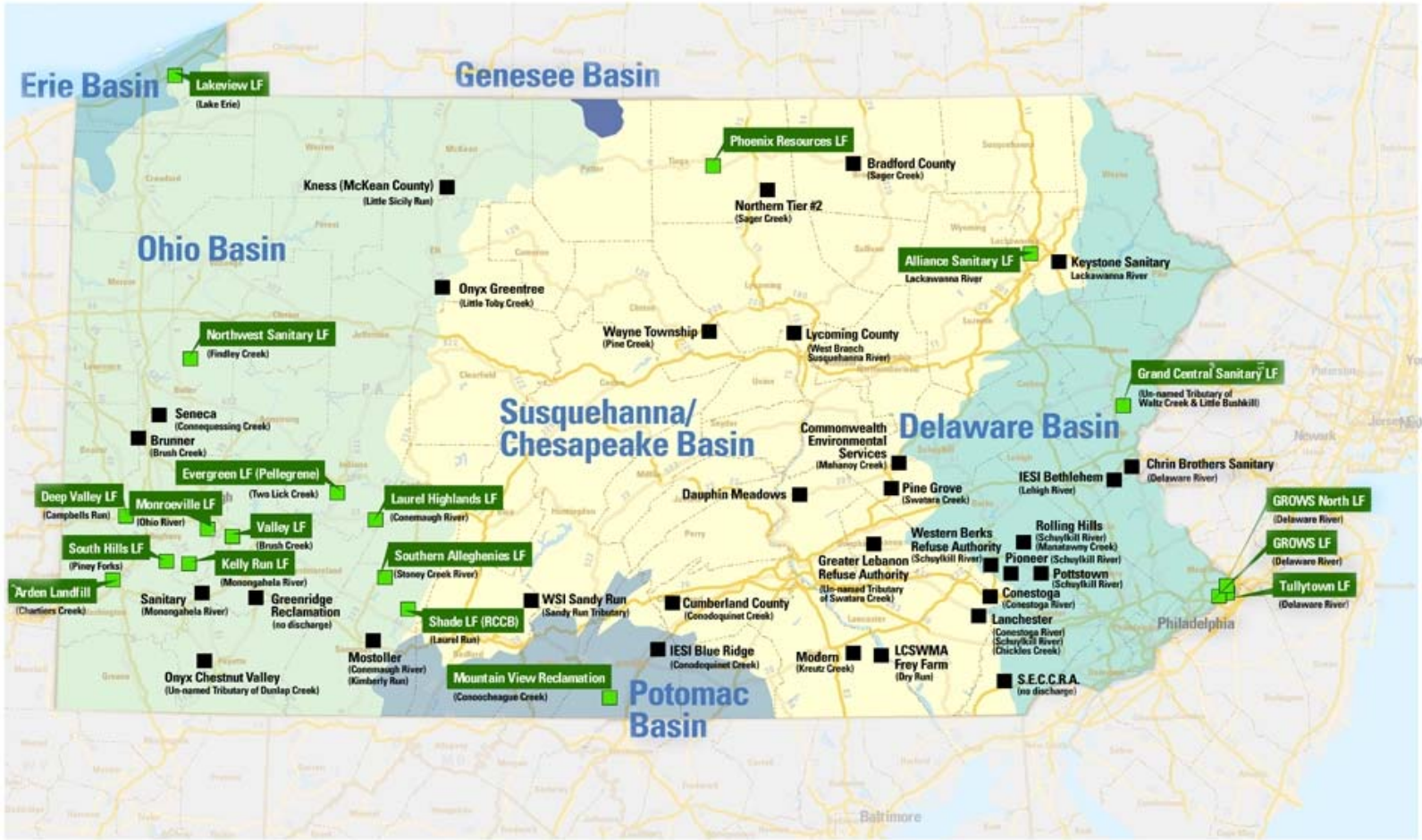
- Solid Waste Generation and Disposal – 7.2 tons (~6 cubic yards) per day of brine at 10% moisture content
- Increased electrical use: 7.3 million kw-hrs/year
- Air emissions from increased electrical use:
  - NOx: 5,000 pounds (2.5 tons) per year
  - CO2: 2,000 tons per year
- Increased Truck traffic to haul brine waste:
  - One truck per day
  - Travels 80 miles per day at 5 to 10 miles per gallon
  - Increased fuel consumption of 8 to 16 gallons per day, 3,000 to 6,000 gallons per year
  - Air Emissions from Increased Truck hauling
    - NOx: 3,625 pounds (1.8 tons) per year
    - CO2: 67 tons per year

PA Waste Industry Overview

- Industry contributes $3 billion/yr to PA economy
- Industry accounts for 31,500 jobs
- $904 million in annual employee earnings
- In addition: $131.2 million in state refuse taxes and $48.9 million in municipal host payments
  - $2/ton for recycling
  - $4.25/ton for Growing Greener
  - ~$2.33/ton for host municipal fees

See December 2007 Econsult Corporation Report, available at www.pawasteindustries.org/pdf/PWIA_Final_Report_12-18-2007.pdf

PA Landfills and Watersheds



Landfill TDS, Chloride and Concentrations and Loadings

- Pa. Landfill leachate values often exceed PADEP proposed concentration based thresholds.
  - Range of Concentrations (mg/L)= 437-13,900 (TDS); 11-5245 (chlorides); 0-995 (sulfates)
  - Median Concentrations (mg/L)= 4,595 (TDS); 977 (chlorides); 95 (sulfates)

    Note: One sulfate value was an outlier and was disregarded.
- Landfill loadings are generally very small. Our survey of 28 landfills (19 WM) showed:
  - Combined discharge flows in 2008 were approximately 1.22 MGD or 852 GPM
  - TDS Average loadings for each site is **2,013 lbs/day**
    - even the combined total in all surface waters is only 54351 lbs/day
  - Chloride average loadings for each site is **630 lbs/day**
    - Even the combined total in all surface waters is only 17650 lbs/day
  - Sulfate average loadings for each site is **52 lbs/day**
    - Even the combined total in all surface waters is only 1423 lbs/day/site

Comparison of Landfill Values to Orphan Mine Discharge Sites

- We examined data from a mine pool in (Tioga County): 2,520,000 gallons/day at 31,233 lbs TDS/day (treated).
- We then considered the states orphan mine discharge data for 323 larger sites (obviously, there are many other AMD locations). http://www.depweb.state.pa.us/abandonedminerec/lib/abandonedminerec/Orphan_Mine_Discharges/Orphan_Mine_Discharge.xls
  - For 323 sites, PADEP reported flows of 525,078 gpm or 756 MGD
  - TDS concentrations (for 96 sites) ranged for 30 mg/L to 3,486 mg/L
  - Assuming an average concentration of 1,087 mg/L, total daily loads were **6,853,578 lbs TDS/day.**
- This compares to landfill loads of 54,351 lbs/day for 28 sites for which we have data.
- Landfills are neither the source of nor the fix to the TDS issues that may exist in select surface waters.

Some Eastern PA Landfill Dilution Examples

(Does not include POTW Flow)

Landfill	Name of Receiving Stream	Stream Flow Data at PWS Intake (gpd)	Landfill Leachate Discharge (gpd)	Dilution Factor1
2 Bucks County Landfills combined	Delaware River Estuary	3,987,195,910	300,000	13291
Montgomery County	Schuylkill River	652,685,230	150,000	4351
Lackawanna County	Lackawanna River	3,179,417,160	50,000	63588
Northampton County	Unnamed Trib of Waltz Creek	2,475,034,090	100,000	24750
	Unnamed Trib of Little Bushkill	3,896,724,690	100,000	38967
Schuylkill County	Swatara Creek	100,810,788	30,000	3360

RO Treatment Cost Estimate Vendor's Estimate

- Reverse Osmosis (RO) cost estimates were obtained for various flows
- 0.025 MGD:
  - Capital $1,422,000
  - Annual O&M of $258,800
- 0.050 MGD:
  - Capital $2,234,000
  - annual O&M of $428,400
- 0.10 MGD:
  - Capital $3,097,000 with annual O&M of $665,020
- Costs do not reflect treatment or disposal of concentrate.

RO Actual Treatment Costs and Concerns Case Example

- Case Example
  - RO System cost = $3.4 million
  - O&M = $1.9 million (this includes reject disposal via POTW)
- Concerns:
  - 40% reject rate
  - RO Concentrate Is Currently Hauled to POTW; New rule would require out of state hauling or evaporation
  - Evaporation imposes huge energy and cost issues

Evaporation Option

- High Cost – Capital Cost for 20,000 gpd = $2,000,000
- LFG May Not Be Available Due to Existing Contracts for Renewable Energy Projects
  - Alternative Energy Portfolio Standards
- Energy and Cost Impacts (Natural Gas)
  - Advanced System: .33 mcf of natural gas to evaporate 20,000 gallons of water/day = $2666 day = $973,090/yr
  - Traditional System – three times amount of natural gas.
- Air Impacts
  - Boiler Emissions of Conventional Pollutants and GHGs
- Our best estimate is that adding evaporation and/or crystallization doubles the capital cost of the RO unit.

Air Impacts

- Assume 0.33 mcf of natural gas used to evaporate 20,000 gpd of RO concentrate

Pollutant	Tons Per Year
NOx	6
CO	5
VOC	.33
SO2	.036
Methane	.139
Methane CO2e	3.463
Carbon Dioxide	7,227

Reference, AP-42 5th Edition, Section 1.4, Tables 1.4-1 and 1.4-2

Landfill ELGs, Pretreatment Standards and NSPS standards

- **Emission Limit Guidelines: 1/19/2000 Federal Register**
  - MSW Landfill TDS concentrations **"do not justify regulation."**
  - Reverse Osmosis is not considered viable option: "The small incremental removal of …pounds achieved … was not justified by the large cost."

- **EPA BAT Analysis on reverse osmosis for landfills**
  - Same as above –small removal amounts do not justify cost
  - Difficult to evaluate potential operating and associated cost of concentrate disposal problems and the associated potential increase in the cost of operating a reverse osmosis system at a landfill.
  - Development documents also note potential air and energy impacts.

Landfill Conclusions

- Exempt Landfills from Rules Based on EPA Rulemaking in January 2000 and Low Loadings
- Exempt Sources with Less than 100,000 pounds per day
- Develop Stream Specific Water Quality Limits
- Develop Strategy where discharges are limited during Q7-Q10 flows for streams that are impacted with TDS (i.e. as necessary)
  - Landfills have storage capacity for leachate and can haul in emergencies.

New and Existing Dischargers

- Define New and Existing Source Dischargers
  - Many Industrial Sector members operate campaign/batch processes
    - Flows and TDS discharges change based on campaign
    - Campaigns change based on customer needs
    - A new campaign which changes discharge rates could be required to comply with TDS limitations
  - Changing from POTW discharge to direct discharge considered a New Source
    - Eastman Chemical Company's NPDES Permit Amendment
      - Submitted August 2008
      - Issued Draft September 2009
      - TDS limits of 500 mg/l, Chlorides 250 mg/l

EPA's Effluent Limit Guidelines (Industry Sector)

- In ELG development process, EPA individually evaluated each point source discharge category to determine ELG for each category
- As part of the process ELG included an economic analysis of compliance costs and economic impacts resulting from implementing ELG for each point source discharge category
- For various industries whose ELG don't include limitations for TDS, Sulfates and/or Chlorides, EPA determined either
  - Treatment for TDS, Sulfates and/or Chlorides is not required for that point source category (based on the manufacturing process)
  - Treatment for TDS, Sulfates and/or Chlorides is cost prohibitive for that point source category

EPA's Emission Limit Guidelines (Industry Sector)

- By implementing technology based effluent limitations for TDS, Sulfates and/or Chlorides for industries already governed by ELGs – PADEP is disregarding industry specific evaluations of technology and process that is included in the economic feasibility of treatment conducted by EPA
- From 33 U.S.C.A §1316...ELG's have been developed *"as standards for the control of the discharge of pollutants which reflect the greatest degree of effluent reduction which the Administrator determines to be achievable through application of the best available demonstrated control technology, processes, operating methods, or other alternatives, including, where practicable, a standard permitting no discharge of pollutants"*
- Industry understands PADEP can override EPA's cost benefit analysis
- Industry Sector would like a cost benefit analysis conducted prior to finalized rule

Conclusions

- TDS limitations as currently written would be difficult for Industrial Sector members to comply with
  - Limited Technology
  - Cost Prohibitative
- Loading based limits are Preferred
  - Eliminate batch/campaign operation scenarios
  - Focus on Higher Loading Dischargers
- There is not a clear definition between New Discharge and Existing Discharge
- Industry Sector would like a cost benefit analysis conducted prior to finalized rule