

REINHOLD ENVIRONMENTAL Ltd.



**2018 APC & Wastewater Round Table
& Expo Presentation**

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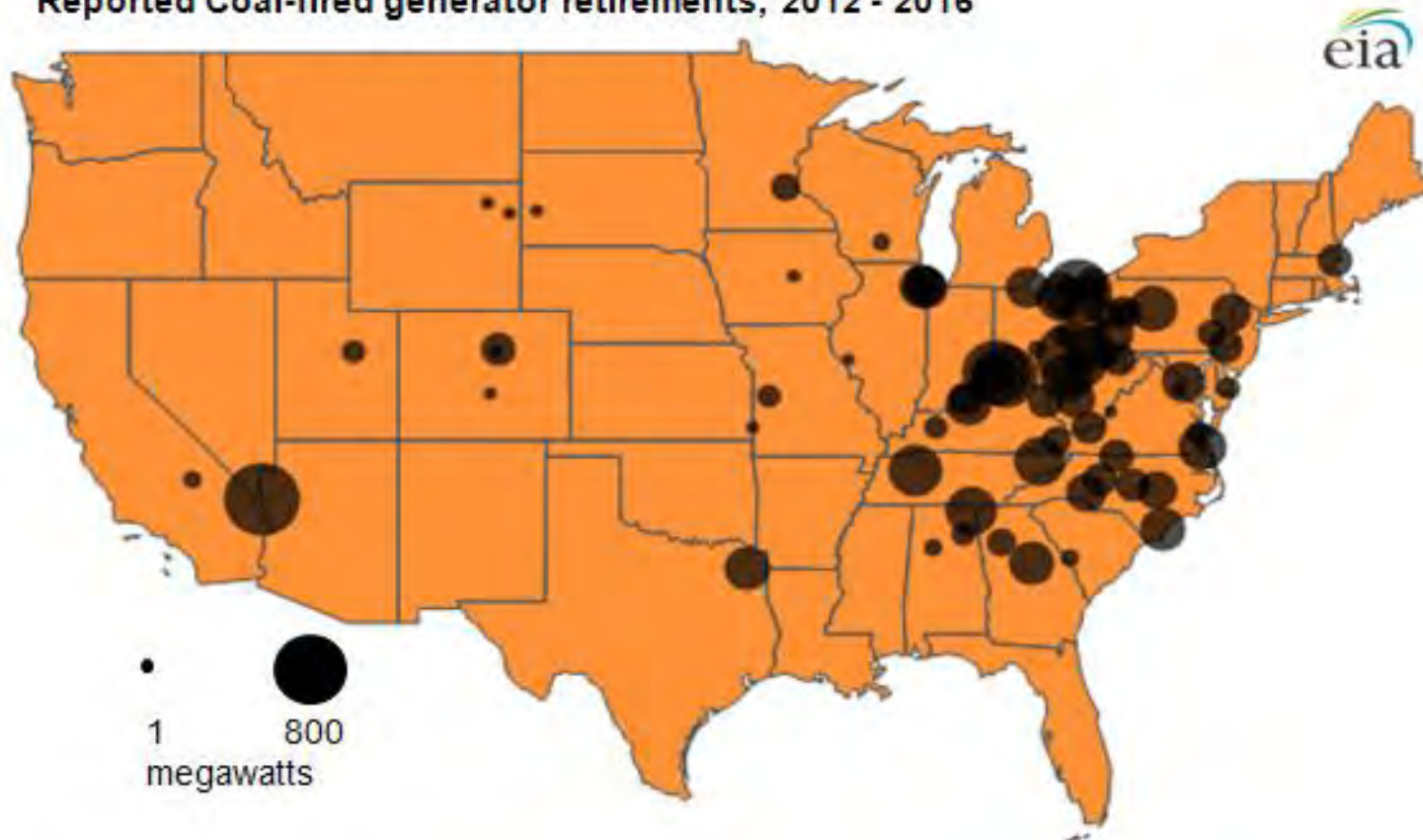
Post Retirement Water Management

Outline

- Industry Trend: Coal Station Retirements
- Why is this happening?
- What does this mean from a water perspective?
- Water Management Issues
- Alternatives
- Questions / Discussion

Industry Trend: Coal Plant Retirements

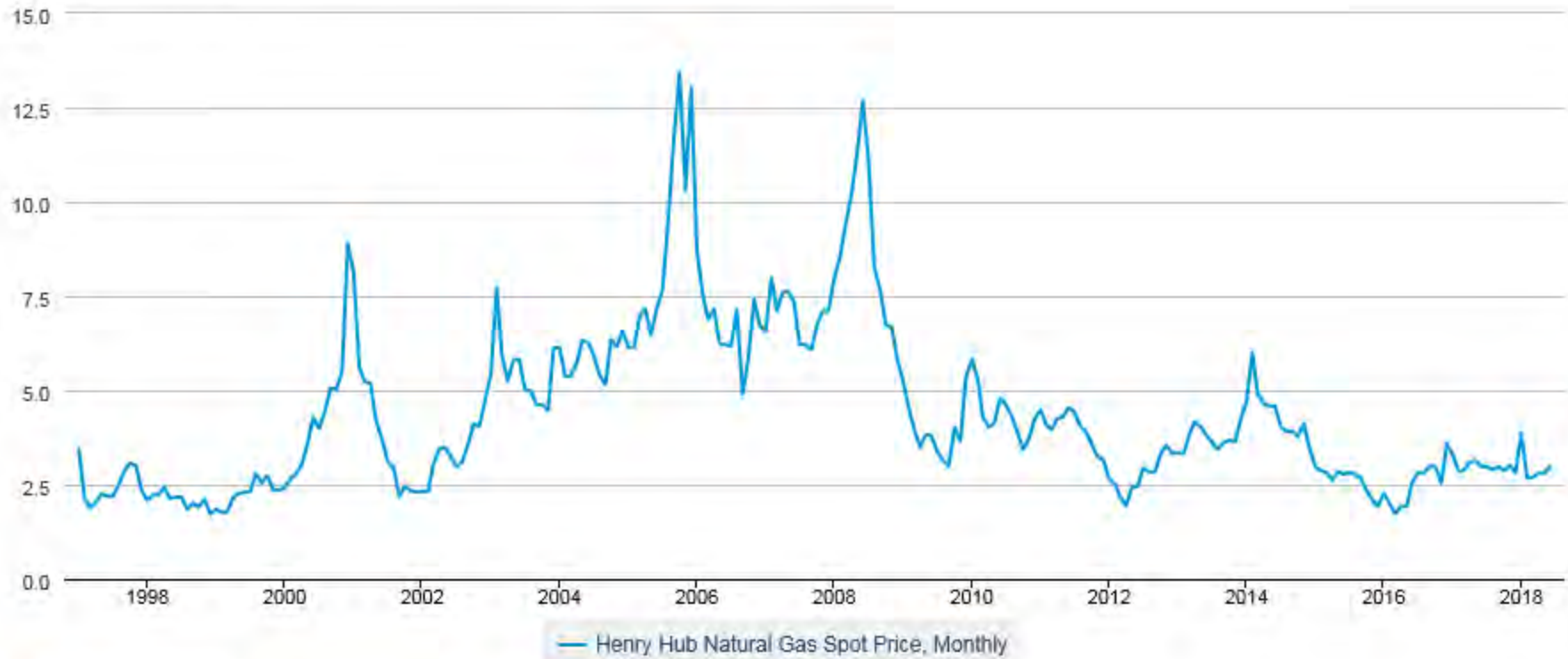
Reported Coal-fired generator retirements, 2012 - 2016



Why is this happening?

Henry Hub Natural Gas Spot Price, Monthly

Dollars per Million Btu

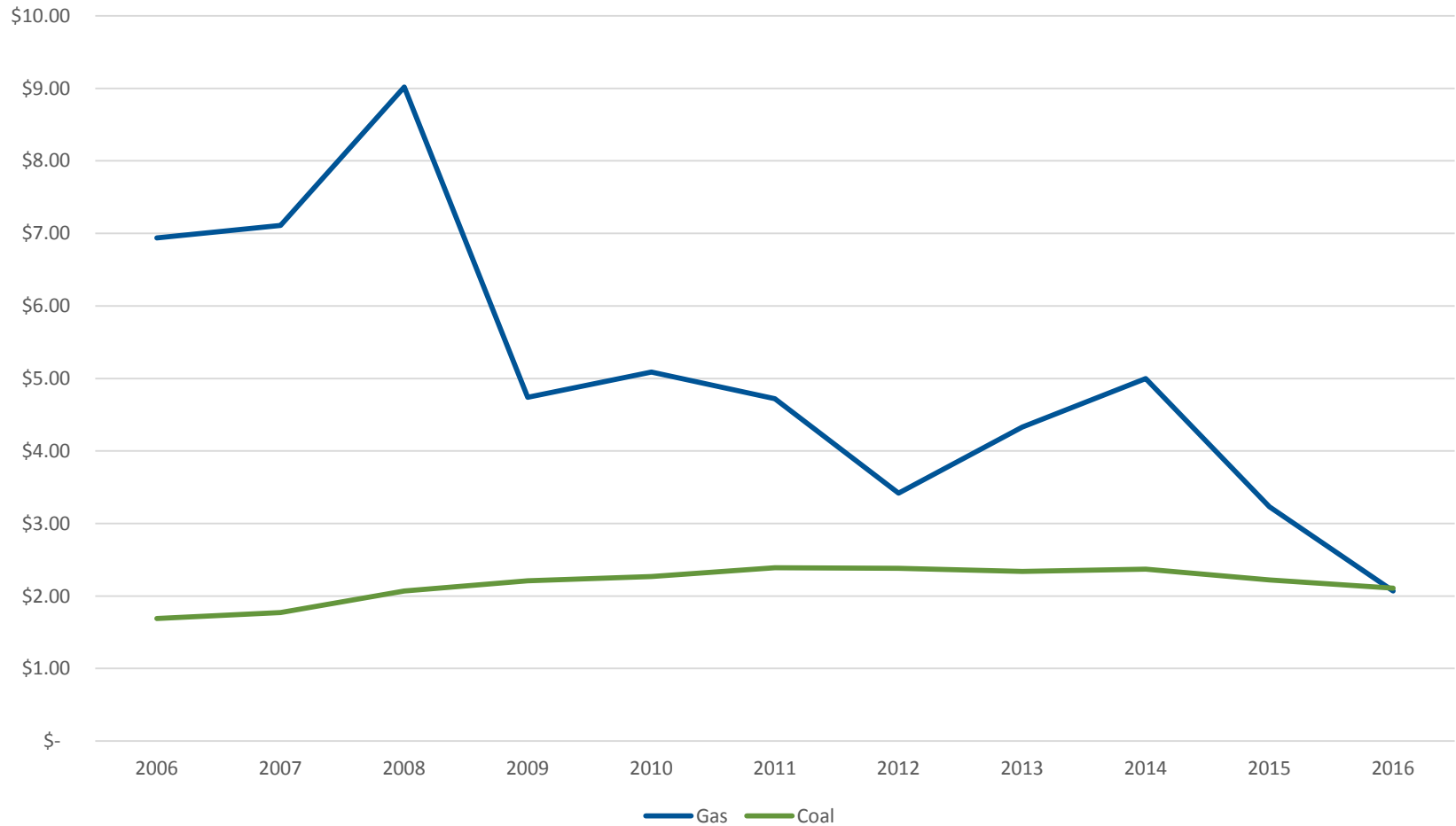


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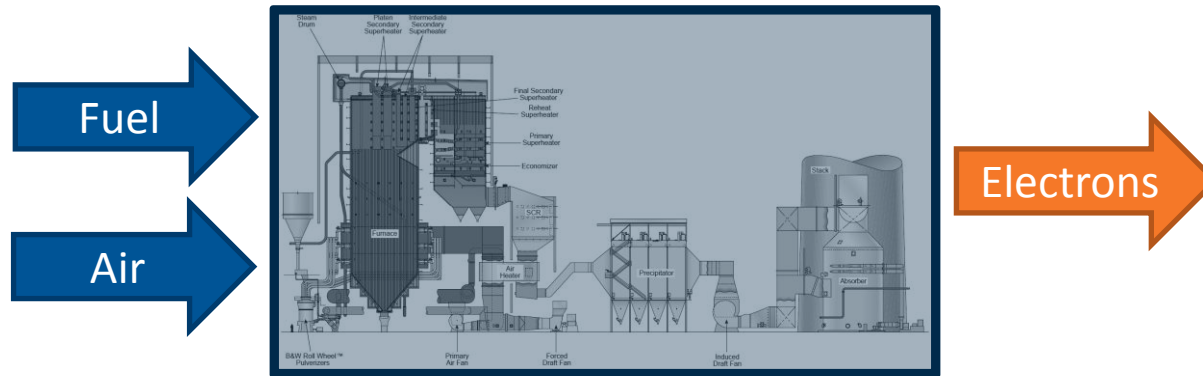
Source: [U.S. Energy Information Administration](#)

Coal vs Gas Pricing

Natural Gas vs. Coal Pricing (\$/MMBtu)



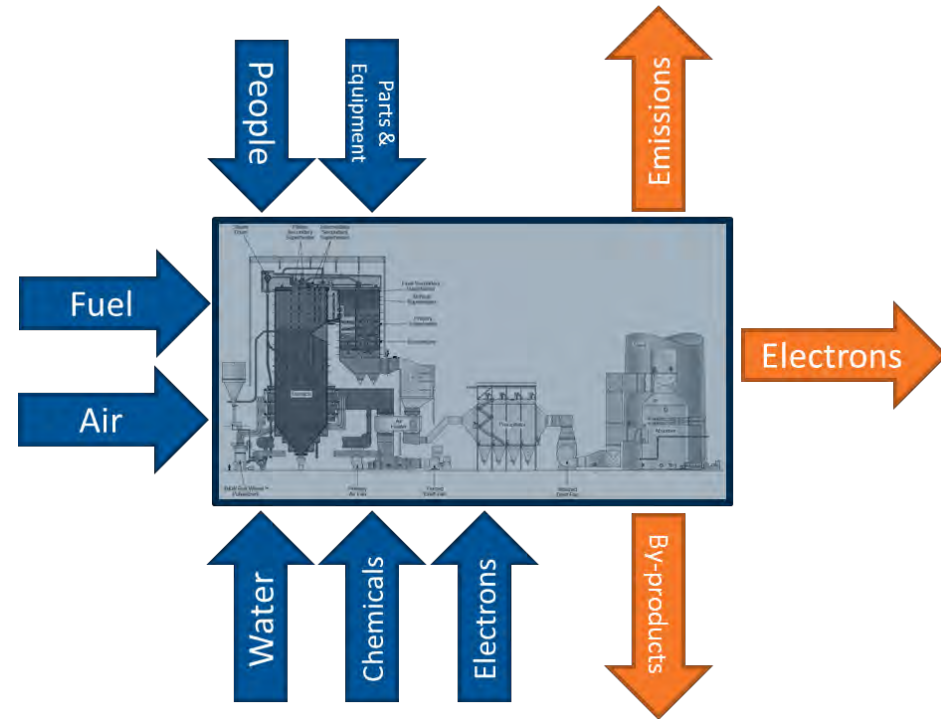
The True Comparison - \$/MWh



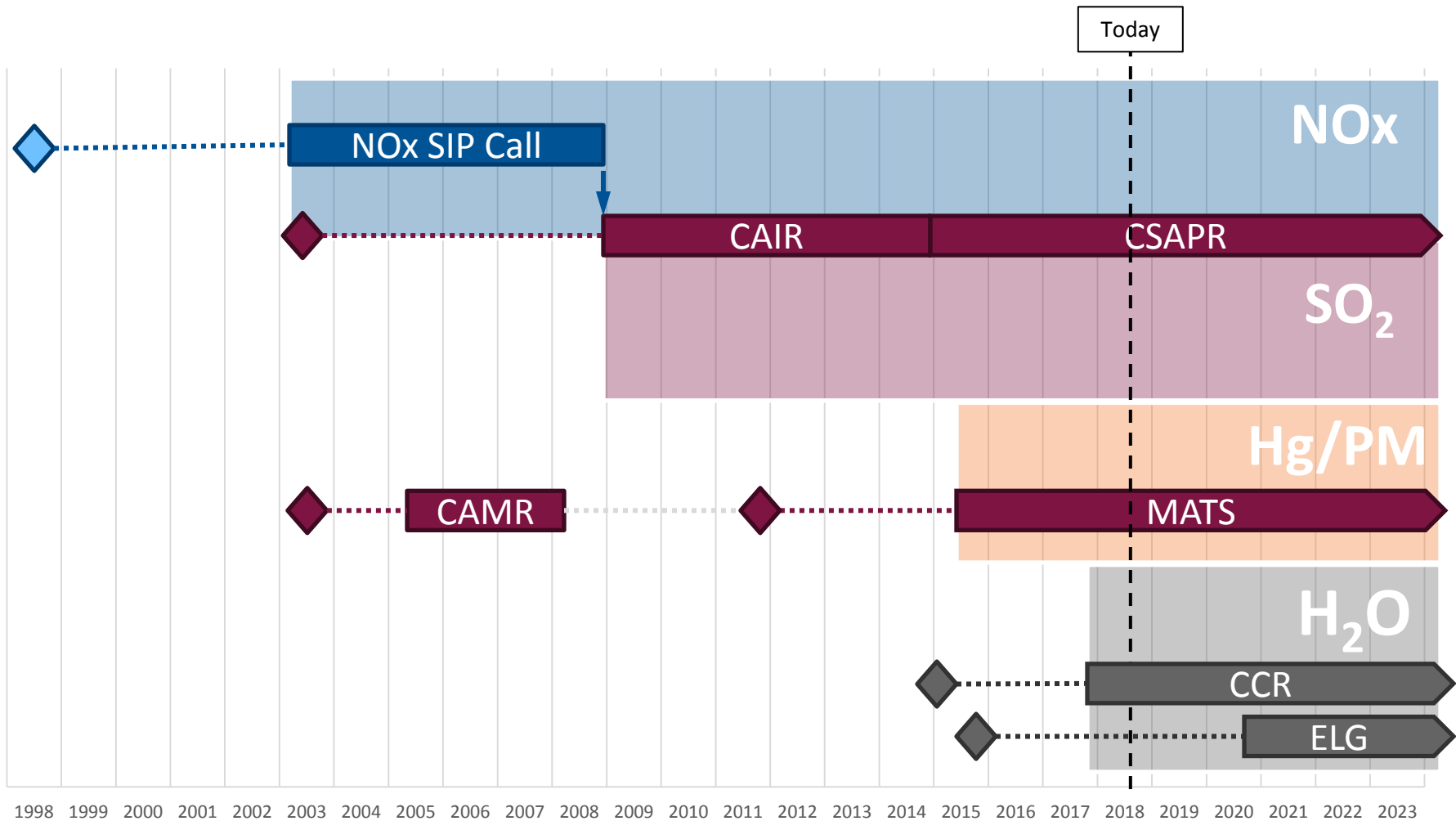
	\$/ton	HHV (btu/lb)	\$/Mmbtu	Unit Heat Rate (btu/kWh)	Variable fuel cost (\$/MWh)
Gas			\$ 2.97	7,000	\$ 20.79
Coal (Bituminous)	\$ 51.20	11,500	\$ 2.23	10,000	\$ 22.26

Comprehensive Retirement Analysis

- Cost to the market
(Variable Cost)
 - Fuel and reagents
 - Auxiliary Power (Efficiency)
 - By-product disposal and/or sale
 - Wear and tear of equipment
- Cost to be in the market
(Fixed Cost)
 - Labor (People)
 - Investment (Current & Future)



Key Consideration - Environmental Regulations



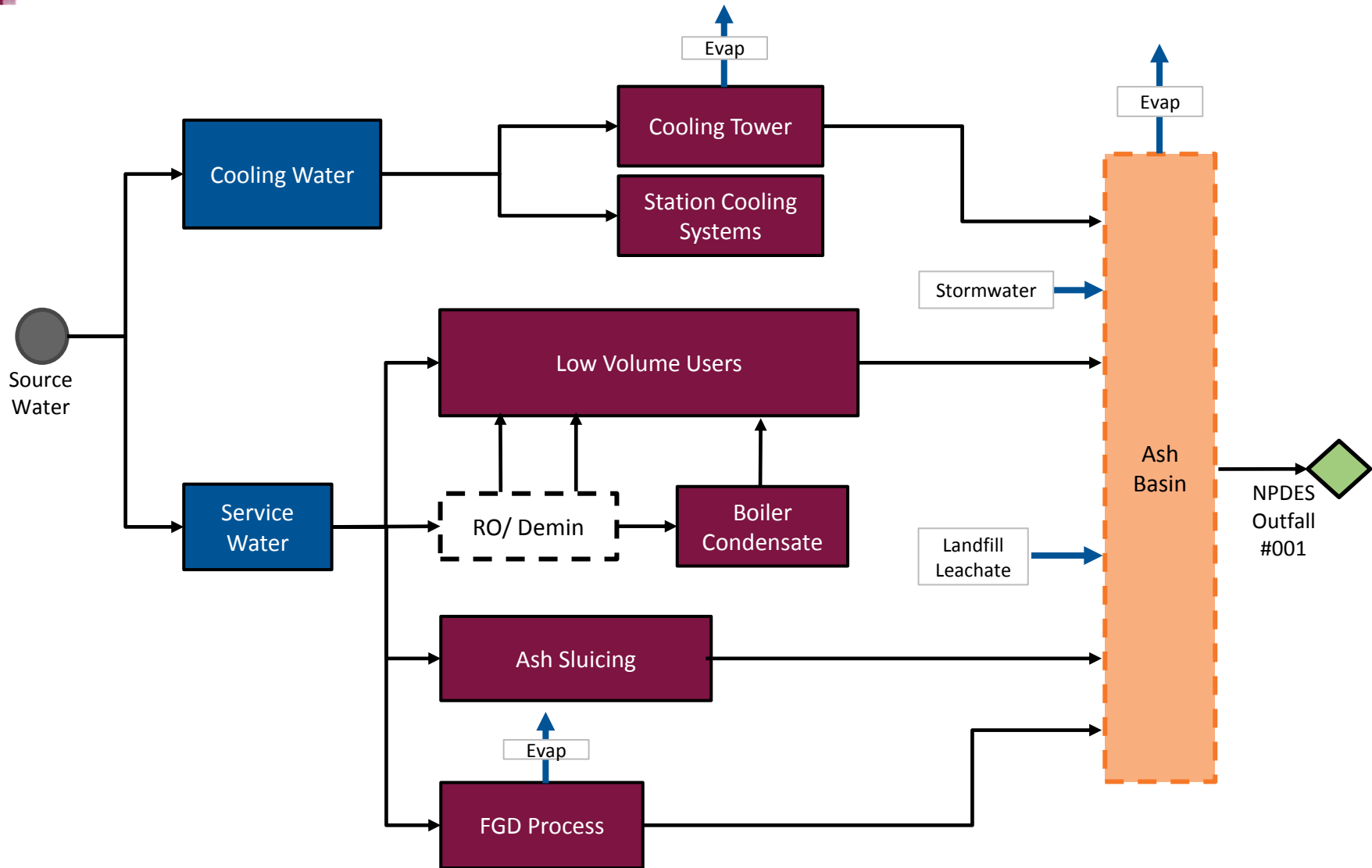
Clean Power Plan? Carbon Tax?

Comprehensive Retirement Analysis

- Regulated Model - Is your all-in cost of ownership over the remaining expected life better than the lowest cost alternative?
 - New generation – Combined Cycle build?
 - Market source – Long term power purchase agreement
- Non-regulated Model – Does your generated margin over the remaining expected life yield an expectable rate of return?
 - No obligation to serve for an independent power producer.

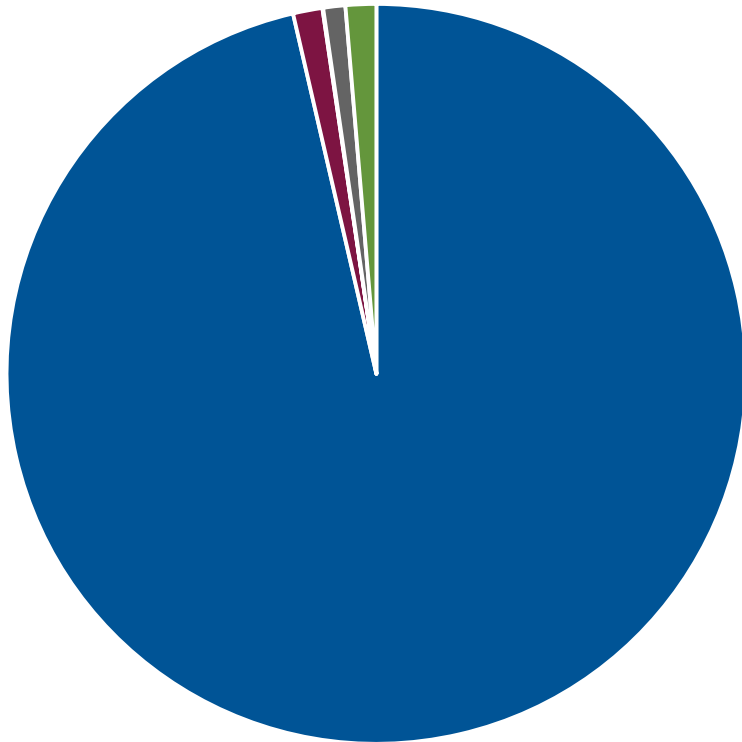


What does this mean from a water perspective?

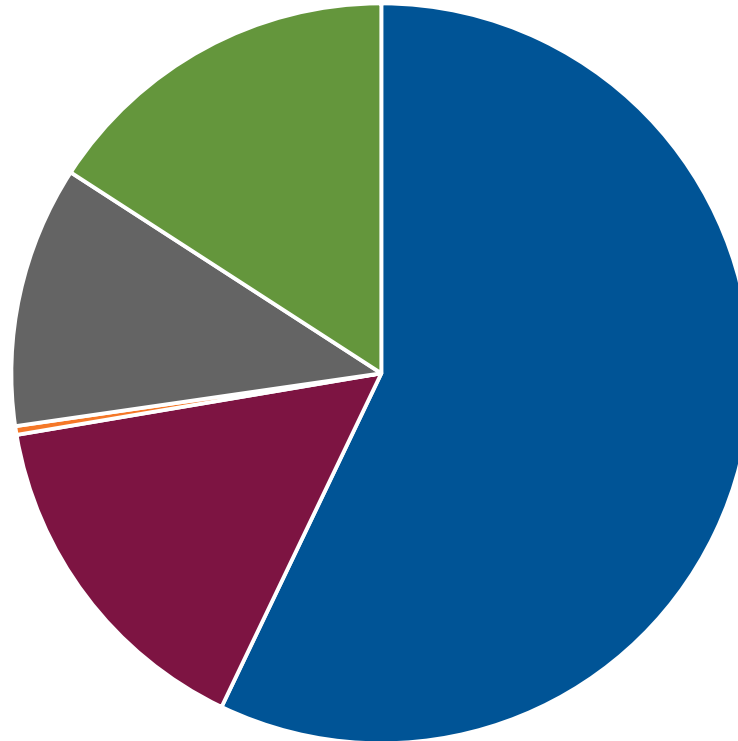


Coal Plant Water Use

Once Thru Cooling

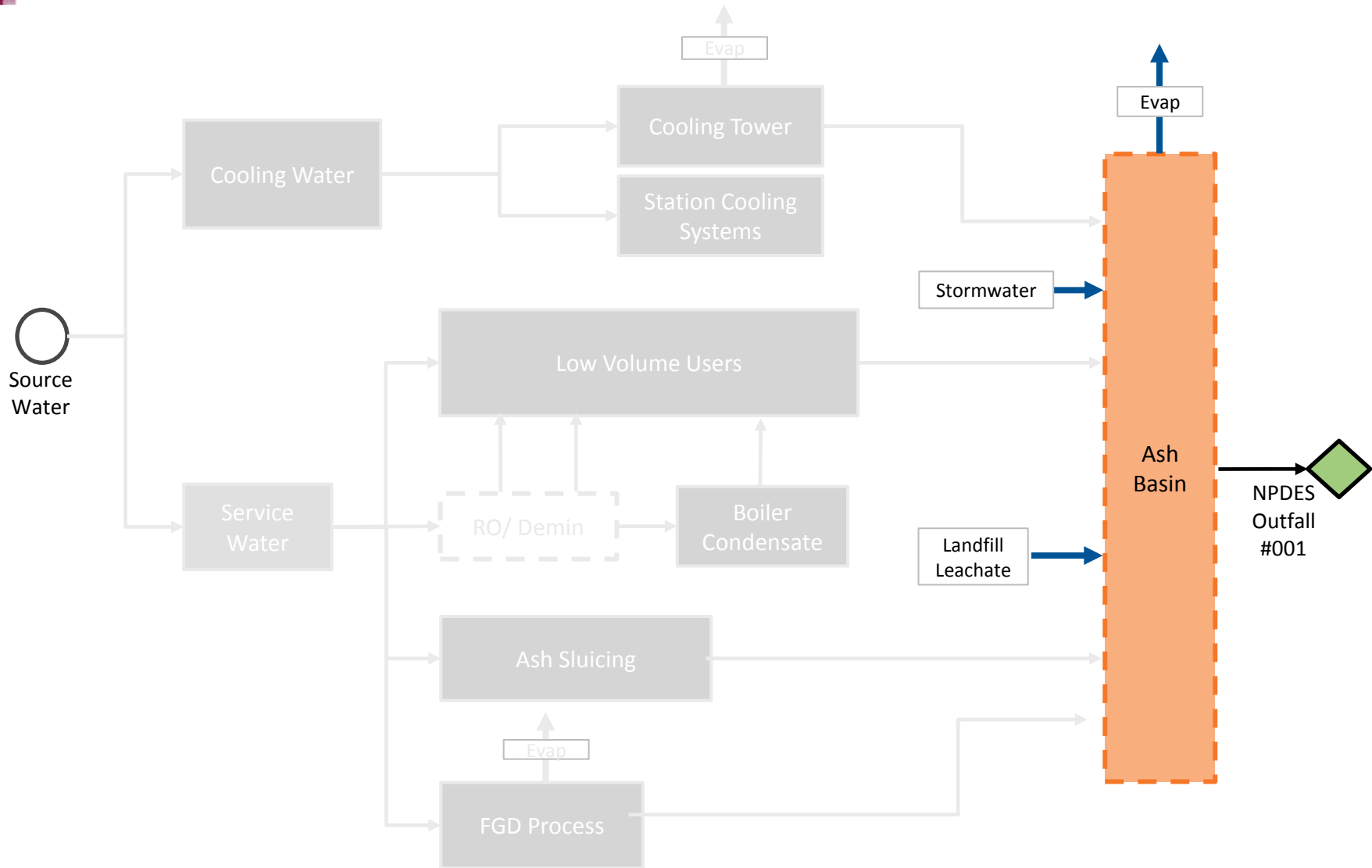


Closed Cycle Cooling



- Cooling Water
- Low Volume Users
- Boiler Condensate
- FGD
- Bottom Ash Sluice

What does this mean from a water perspective?



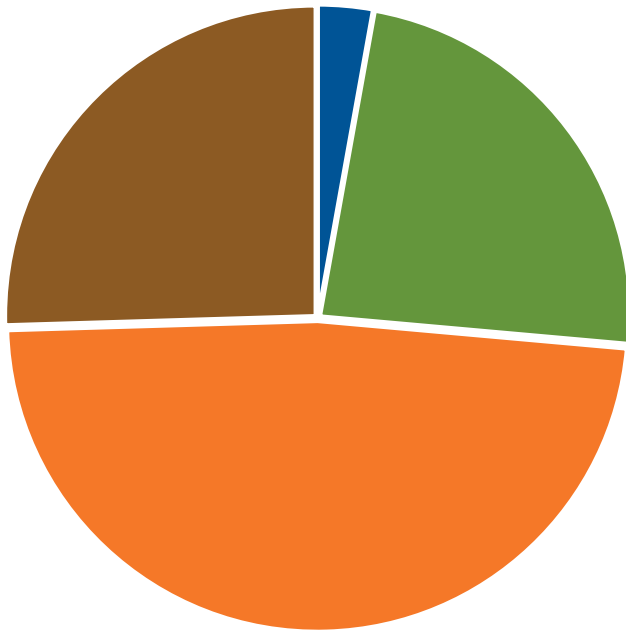
Phases of Post Retirement

1. Retirement – generation of electricity has ceased
2. Decommissioning – systems are being drained and shutdown entirely
3. Demolition – equipment and structures being demolished and/or removed from site
4. Post Remediation – demolition and remediation of the site is complete. Long term status achieved.

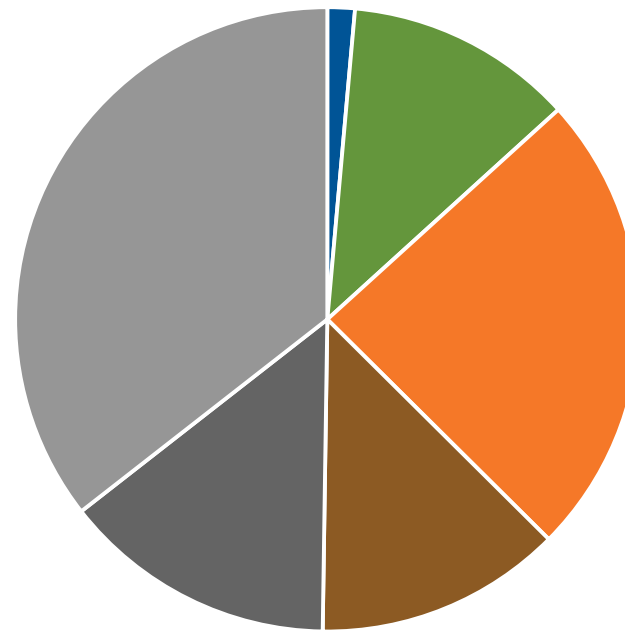


Post Retirement Water Use

Post Retirement



During Decommissioning & Demo



- Fire Protection System
- Truck Wash
- Low Volume Waste Flows
- Plant Area Contact Stormwater
- Demolition wash down
- Ash Pond Dewatering

Typical Analytical Approach

1. Characterize each wastewater stream to define a new combined waste stream
2. Perform a Reasonable Potential to Exceed (RPE) Analysis to calculate speculative NPDES limits
3. Identify and evaluate management alternatives

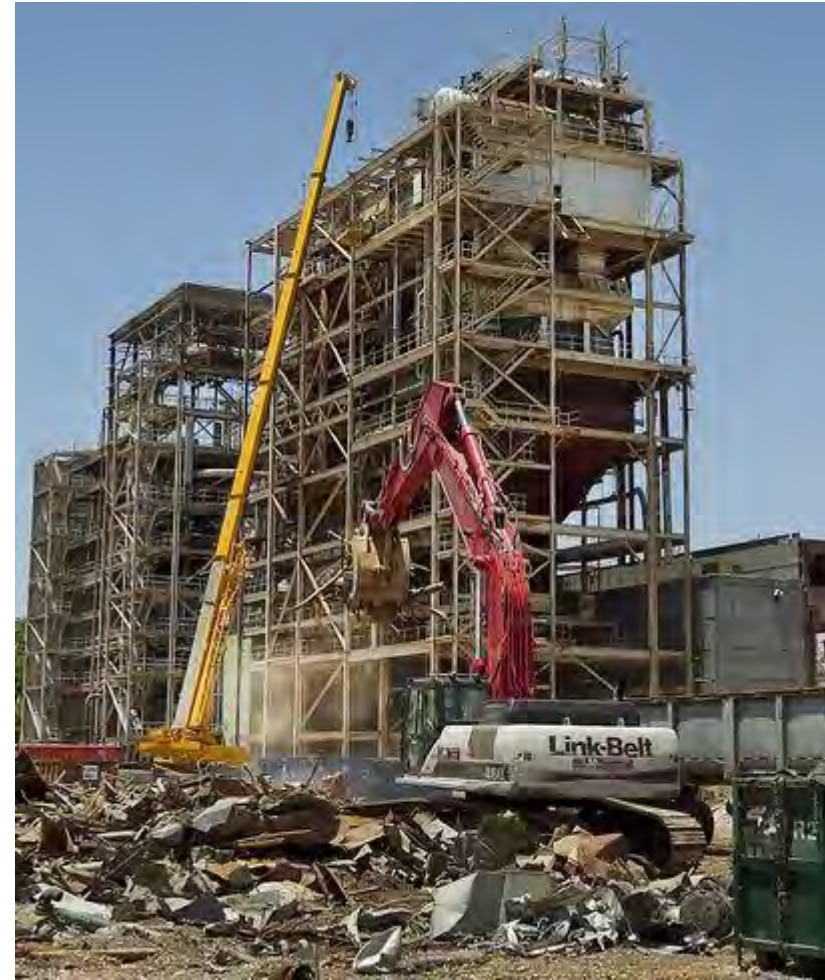
Concerns & Considerations

- Ash Pond Dewatering
 - Managed separately?
 - Special metals limits for dewatering (Hg, Se?)
 - Closure schedule
- Demolition method and schedule
 - Washdown approach
 - Explosive demolition
- Remaining site operations
 - Landfills
 - Other Industrial activities
- New generation on site?



“Typical” Water Quality Concerns

- Volume
- Total Suspended Solids
- Arsenic
- Molybdenum
- Mercury
- Selenium



Other Considerations

- Only required during decommissioning, demo, and if applicable ash pond closure (2 to 5 years)
- Looking to minimize cost capital cost
- Flow significantly impacted by rain events

Desired Characteristics of Management System

- Best economic choice considering limited operational window
- Sufficient holding capacity to manage rain events and minimize peak flow
- Solids removal and/or metals removal if required
- Ensure compliance (sufficient operational margin)

Management Alternatives

- Basin management (Existing)
- Basin management (Purpose built)
- Filtration
- Ballasted clarification
 - With and without Metals removal
 - Temporary or permanent
- Sewer Discharge via POTW issued pre-treatment permit
 - Direct connection
 - Pump & Haul

Basin Management



- Repurpose of existing basin or purpose built basin

Advantages

- Low capital cost / low operational cost
- Provide volume holding capacity
(**peak flow control**)
- No solids removal / dewatering

Limitations

- Solids removal and enhanced solid removal only
- Limited process control

Filtration

- Disc filter or stacked disc filtration
 - Temporary or permanent installation options



Advantages

- High solids removal efficiencies
- Simple process operation
- Can be used in conjunction with a basin

Limitations

- Pumping may be required increasing cost
- Backwashing may require basin

Ballasted Clarification

- Purpose build clarification system with dewatering
 - Temporary or permanent installation options
 - With dissolved metals removal if required



Advantages

- High Removal efficiencies including metals
- Temporary alternatives could minimize capital costs

Limitations

- High capital cost / high operational cost
- Complex process controls (Staffing)
- Dewatering operations requiring solids disposal

POTW Discharge

- Pre-treatment permit
 - \$/1000 gal fee
 - Permit limits dependent on requirements and remain mass allocation
 - Pump & Haul an option

Advantages

- Limited capital cost dependent on tie-in location
- Potentially no onsite treatment or control required



Limitations

- Total cost depends on proximity to infrastructure
- Depends on cooperation with local municipality

Qualitative Comparison

	Existing Basin	Purpose Built Basin	Filtration	Ballasted Clarification	POTW Pre-treatment Permit
Total Installed Cost	Base	+	+	+++	=
Operating Cost	Base	≈	+	+++	+
Operational Complexity	Base	=	+	++	-
Peak Flow Control	Yes	Yes	No	No	N/A
Solids Removal Effectiveness	Base	+	Particle size dependent	++	N/A
Dissolved Metals Removal?	No	No	No	Yes	No

Note: Typical qualitative comparison only. Permit requirements and site specific conditions play a major role in determining the best method for a site.

Conclusions

- Water management issues don't just disappear when a plant retires. They transform.
- Water characterization and analysis must be performed for each post retirement stage to ensure compliance
- Peak flow control may be sufficient alone, but can eliminate the need for dissolved metals removal.
- If treatment is required, POTW discharge can be a cost effective solution if there is access to sewer infrastructure and the municipality is reasonable.



Questions / Discussion

