REINHOLD ENVIRONMENTAL Ltd.

2011 APC Round Table
& Expo Presentation

July 11-12, 2011, in Cleveland, OH / Hosted by FirstEnergy

Improvements in Waste Water Treatment
APC/PCUG Conference – Cleveland, OH

Philip Elliott
July 11, 2011

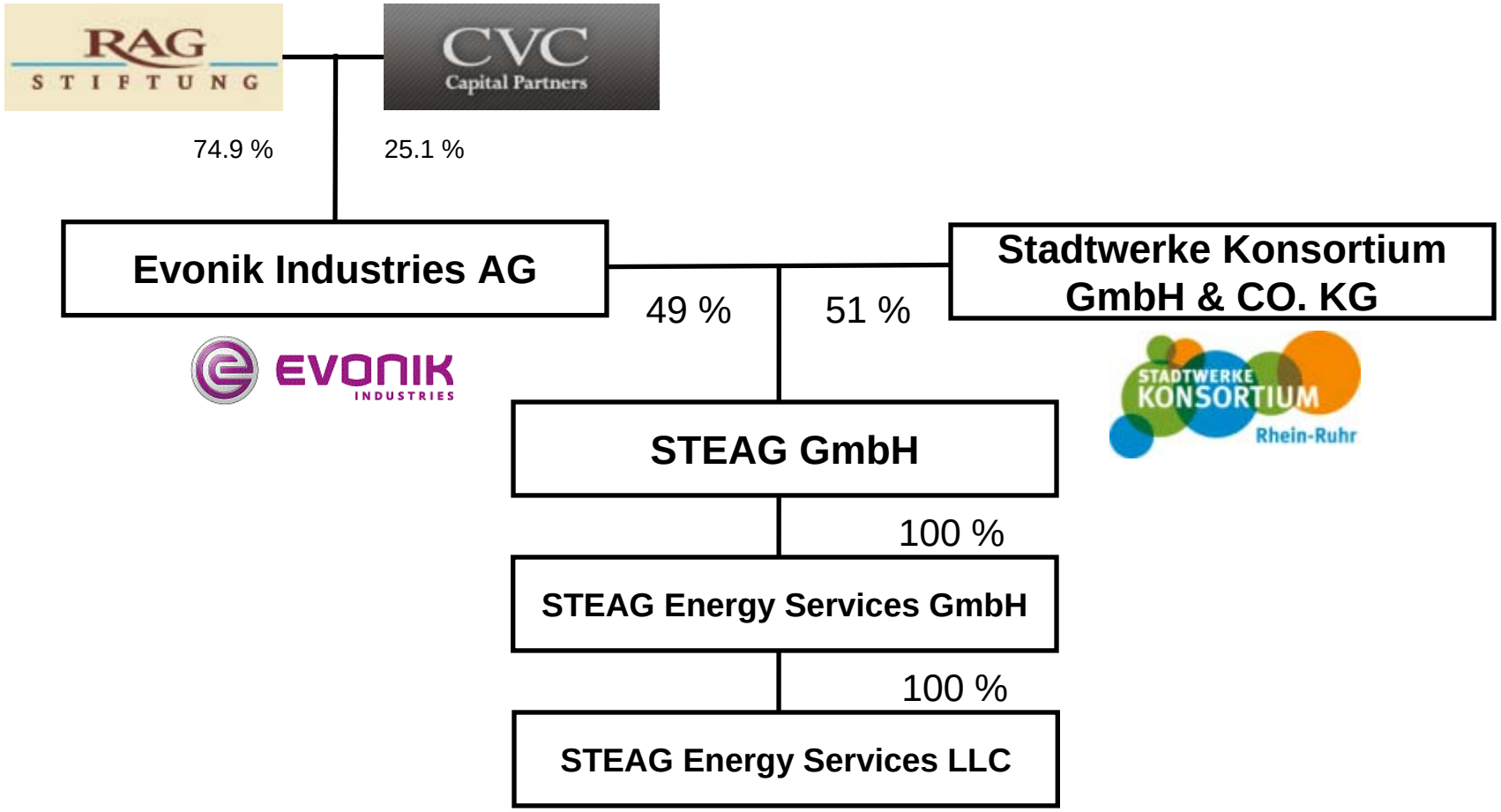
steag

Agenda

- Evonik to Steag
- Waste Water Treatment History
- Waste Water Treatment Advancements

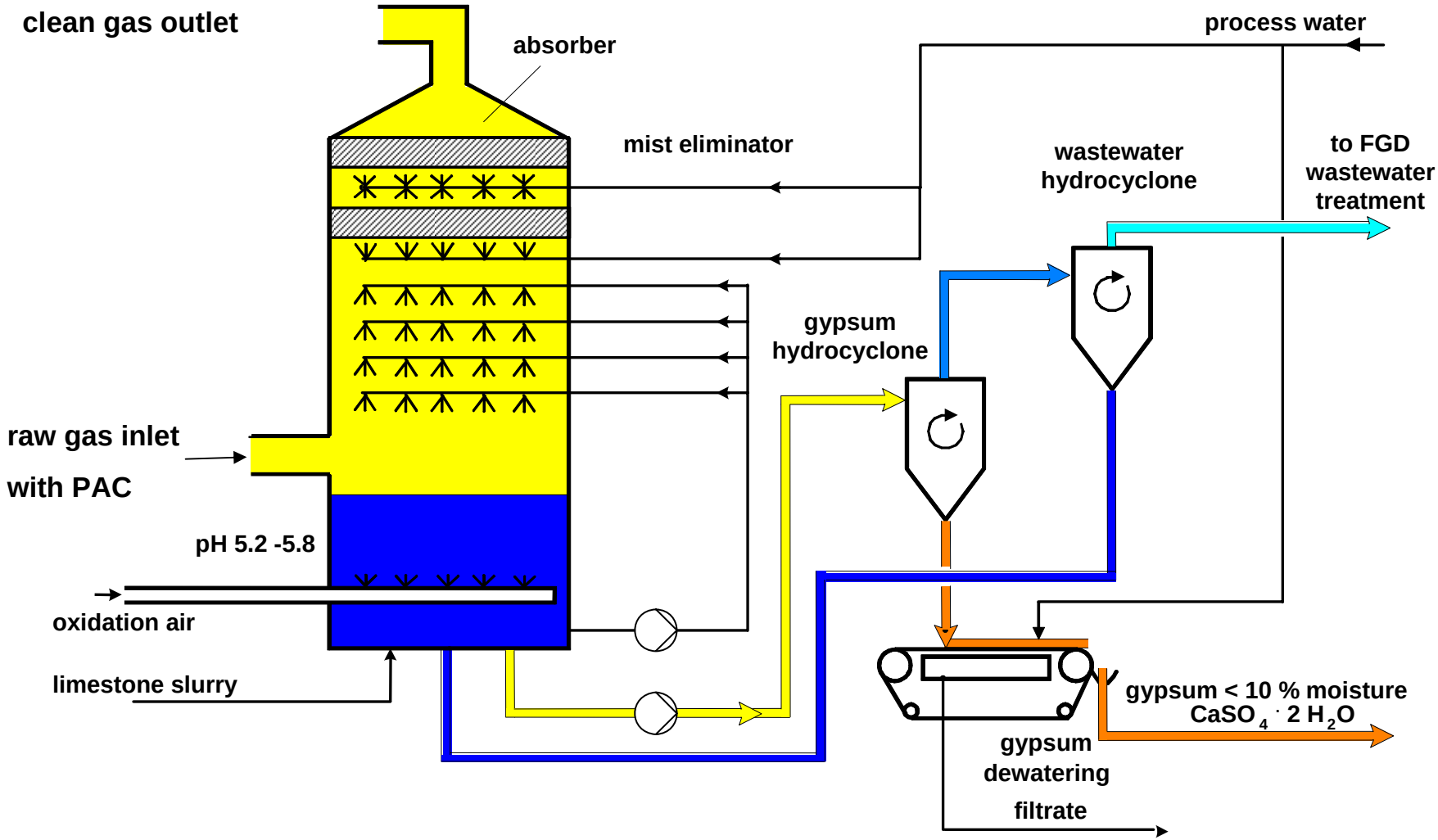
From Evonik June 2011 → Steag

steag



Typical Modern Wet Limestone Forced Oxidation FGD Process

steag



Why Wastewater Treatment?

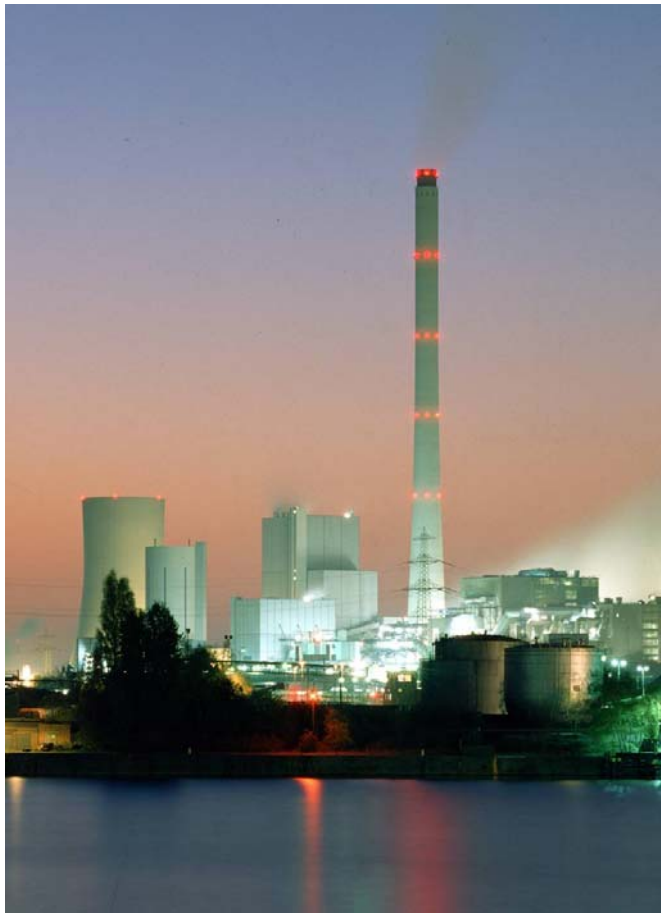
Remove Solids and Metals from Blowdown Sources

Waste Water History

- Solid and Heavy Metal Removal
- Separation for Heavy Metals for Cost Savings
- Final Removal of Mercury and Selenium Compounds

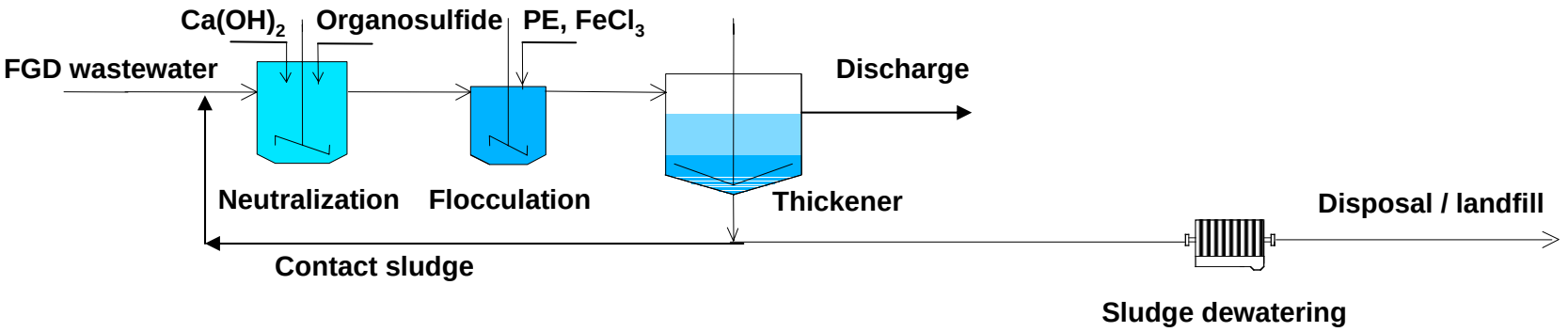
Herne Plant Information

- **Unit 4 – 550 MW**
  1. Bituminous coal, PC opposed wall fired, supercritical boiler
  2. High dust SCR
  3. Air heater, ESP
  4. Wet FGD – LSFO single loop open spray tower producing wallboard quality gypsum
  5. Single wet axial flow ID fan downstream of the FGD
  6. Approximately 1.8 MMacfm flue gas flow

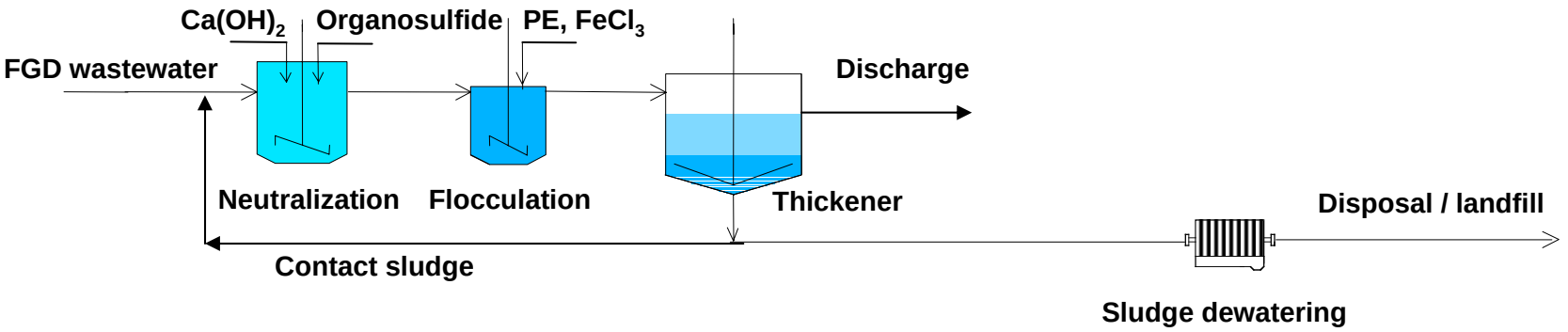


Waste Water History

First Step – One Stage



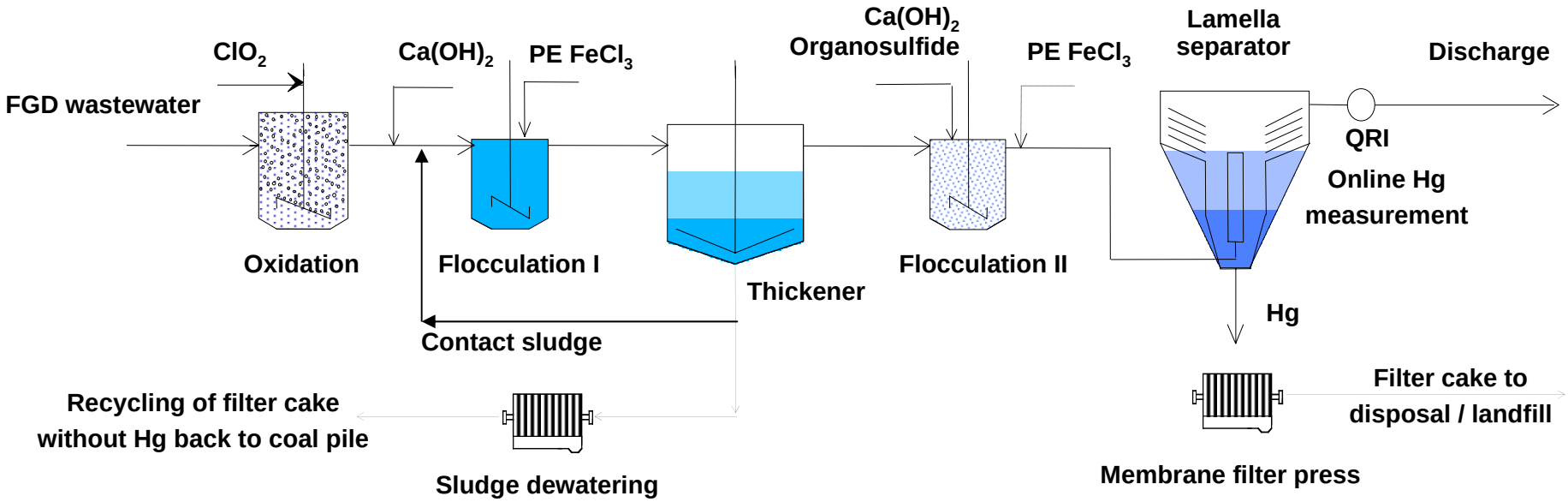
First Step – One Stage



Expensive to Dispose of Sludge
Limited (if any) Removal of Mercury and Selenium

Waste Water History

Second Step – Two Stage

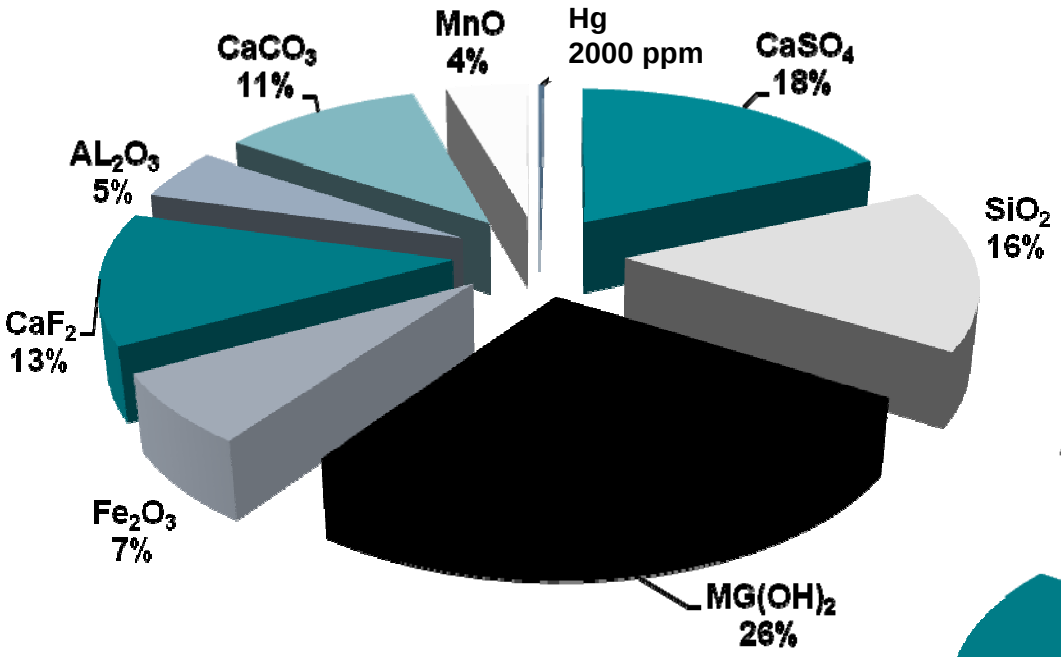


Waste Water History

Herne 4: FGD waste water treatment system with metals precipitation tank and clarifier (right) , Hg-free (left) and Hg-laden filter press (center).

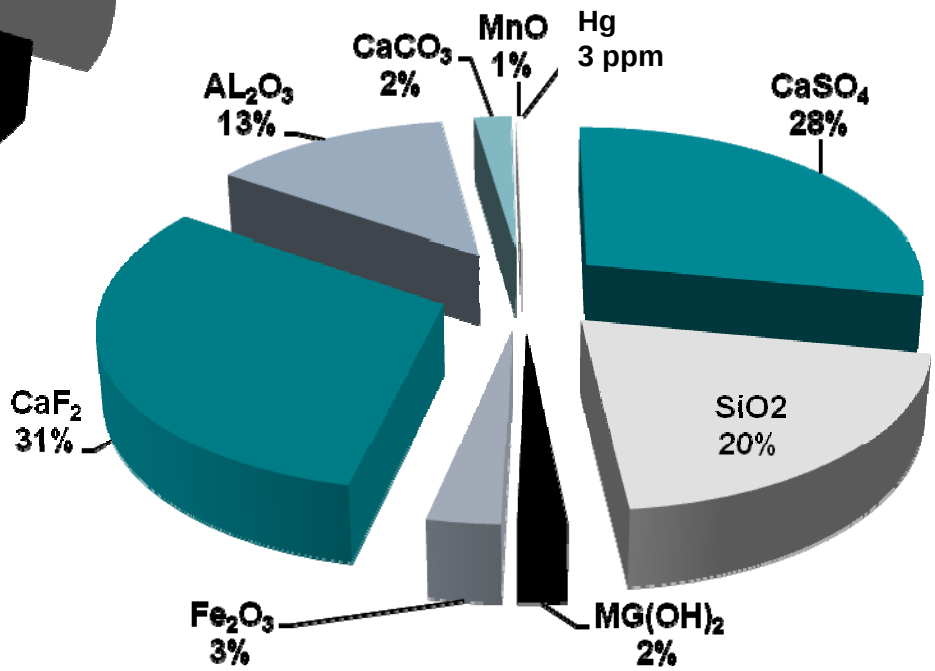
Waste Characterization

Waste minimization



Hg- containing sludge to landfill

<5%

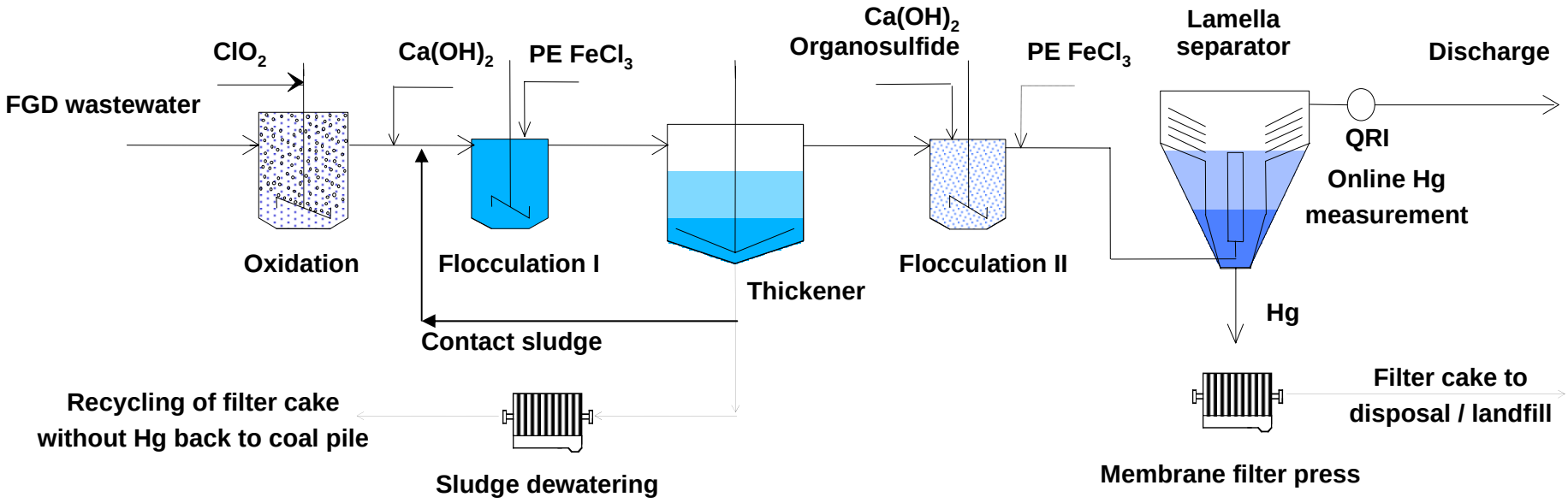


Hg- free sludge to combustion

>95%

Issues

Second Step – Two Stage



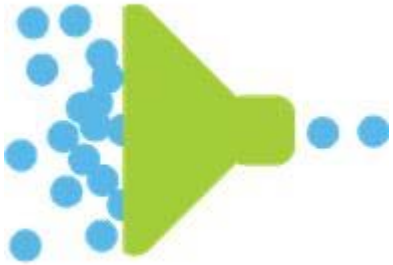
Reduced Disposal Costs by ~ 90%
Mercury and Selenium in Wastewater Discharge

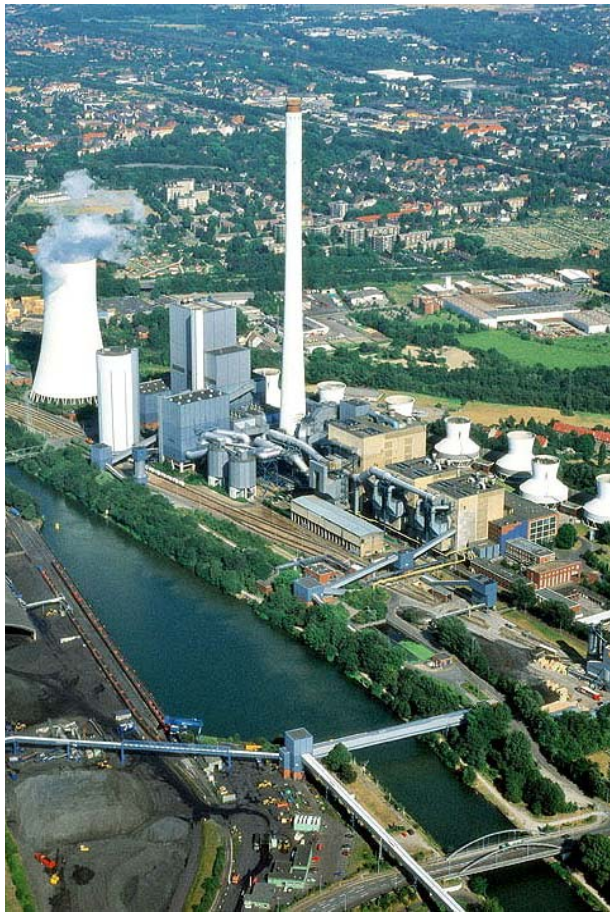
Advancements in Waste Water Technology

Improve Mercury and Selenium Removal

- **Selenium (Selenate form) is Extremely Water Soluble**

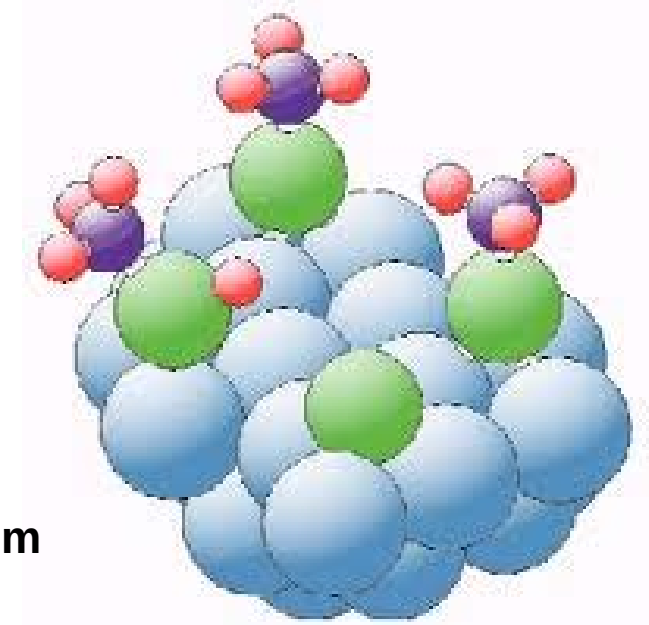
- **Mercury is Too Fine**



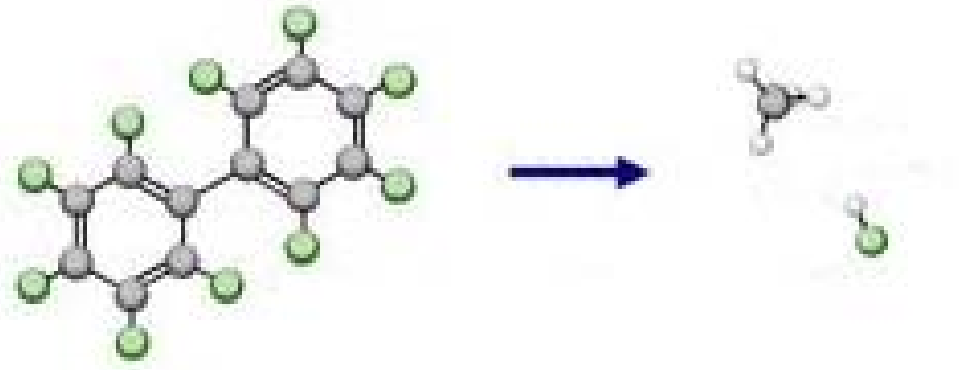


How to Treat Selenium

- **Adsorption**
  - **Selenium on Surfaces of Compounds**



- **Reduction Process**
  - **Reduce the Selenate, Selenite to Elemental Selenium**

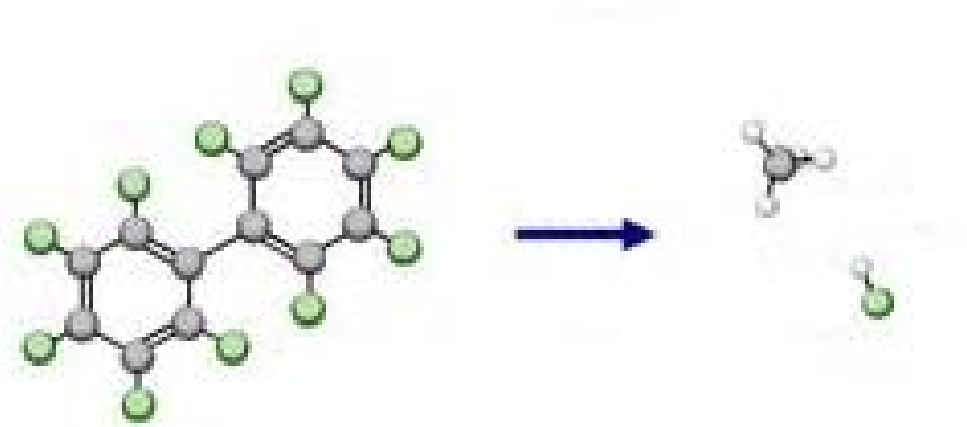


Adsorption Methods

- **Use of Various Products:**
  - **Ferrihydrite**
  - **Aluminum Hydroxide**
  - **Activated Carbon**

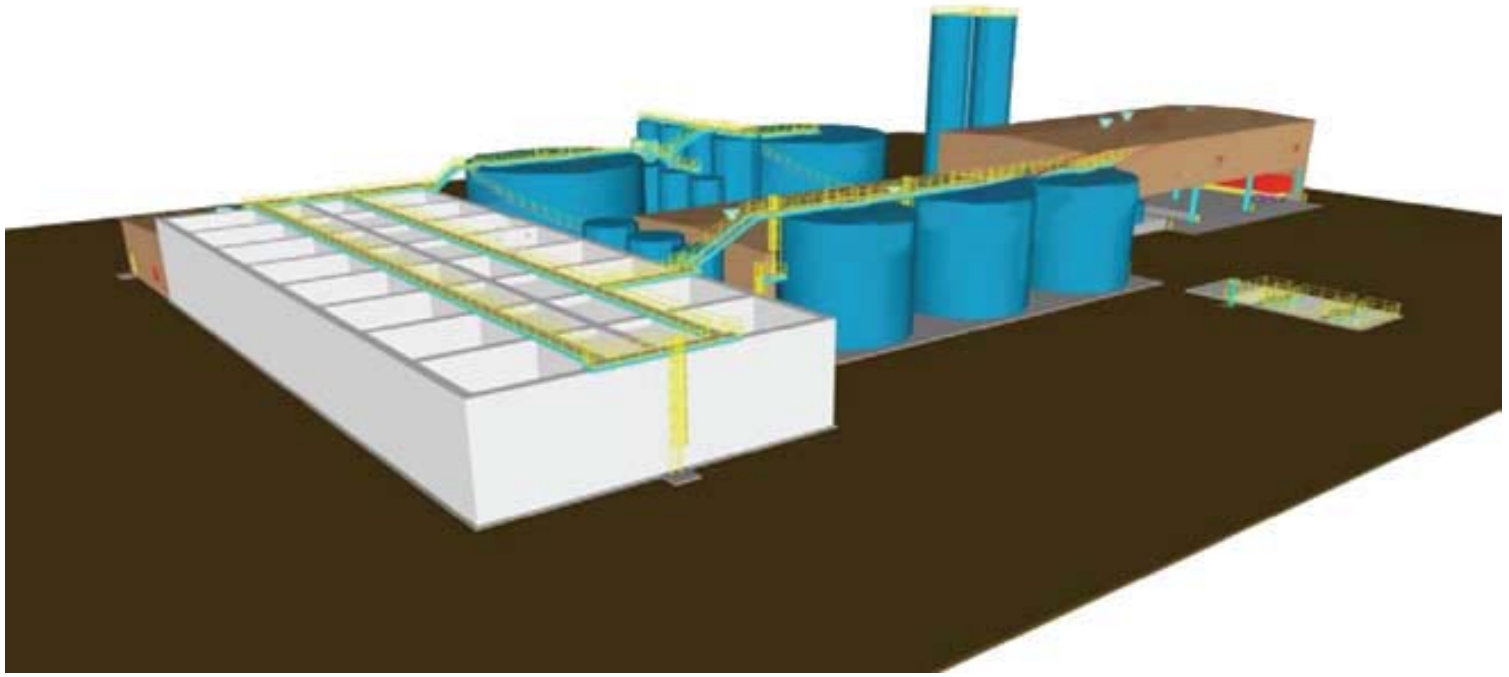
Reduction Methods

- **Reduce the Selenate**
- **$SeO_4^{2-} \longrightarrow SeO_3^{2-}$**
- **SeO_3^{2-} removal easier**



Reduction Methods

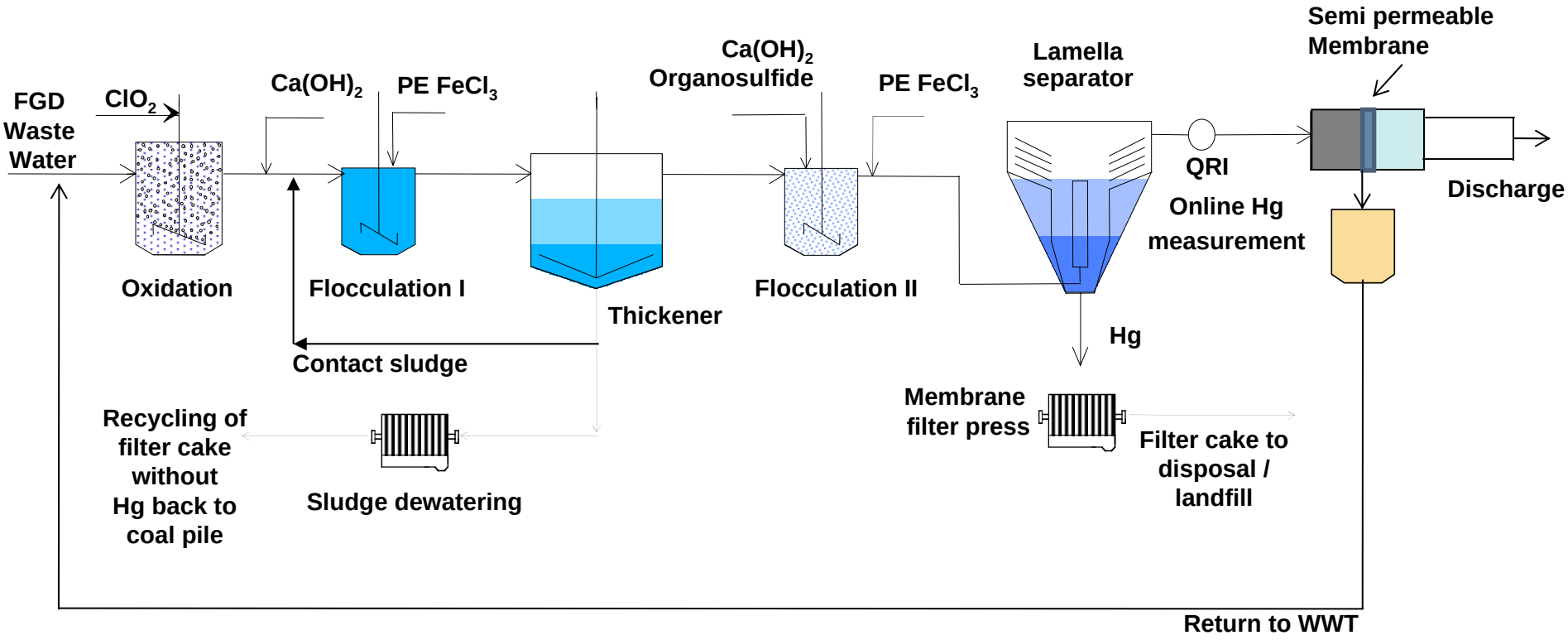
Bioreactor*



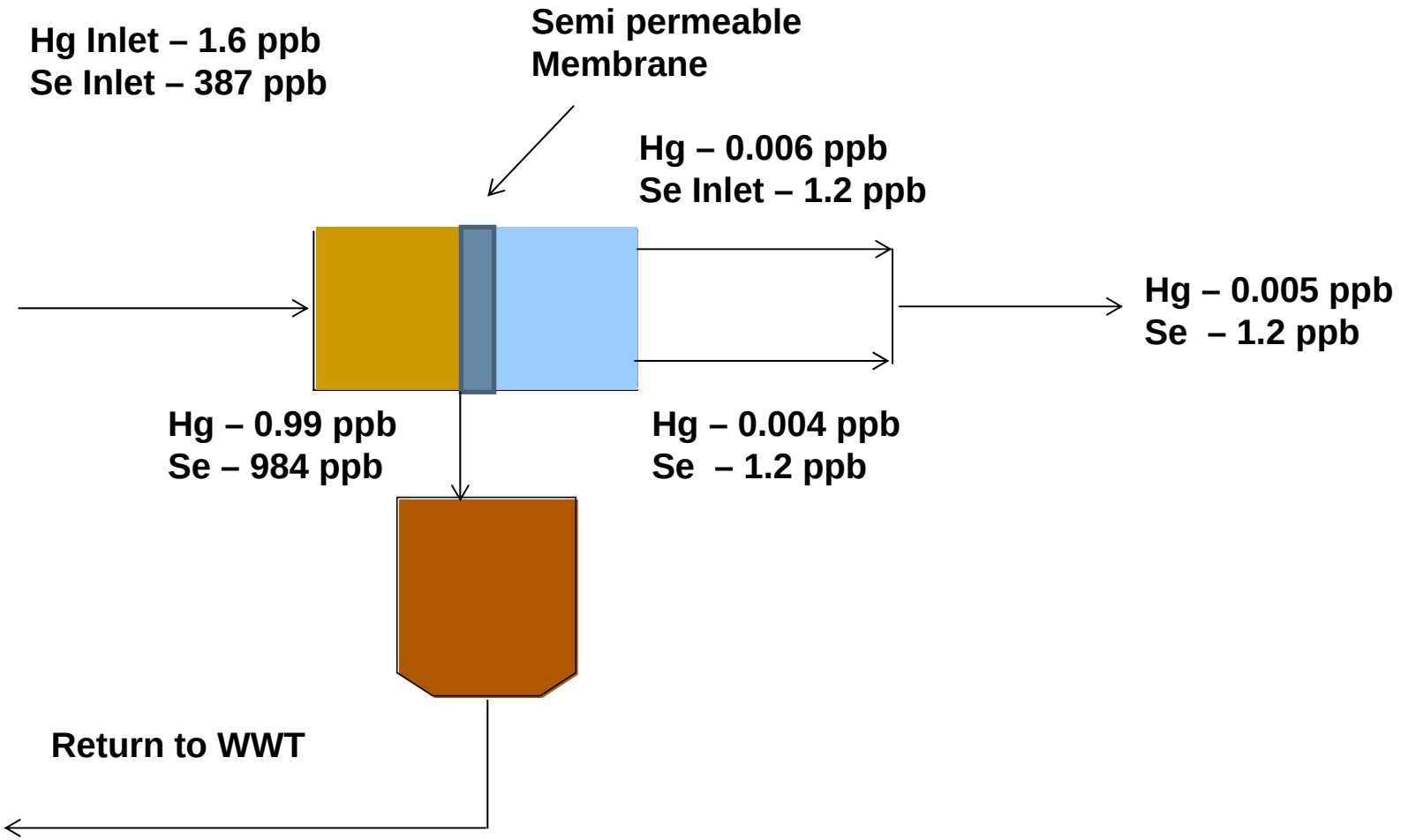
* Bioreactor from GE Website of Duke Energy Belews Creek Station

Waste Water Advancements

Third Step – Two Stage + Effluent Treatment



Waste Water Treatment for Mercury and Selenium (Advancements)



Future Progress

- **Continuing Trials of Membranes of Additional Membrane Material**
- **Continued Testing to Continually Achieve Results**

Questions?


steag