REINHOLD ENVIRONMENTAL Ltd.

2010 APC Round Table
& Expo Presentation

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Mercury Control Strategy Utilizing Low Halogen Coal

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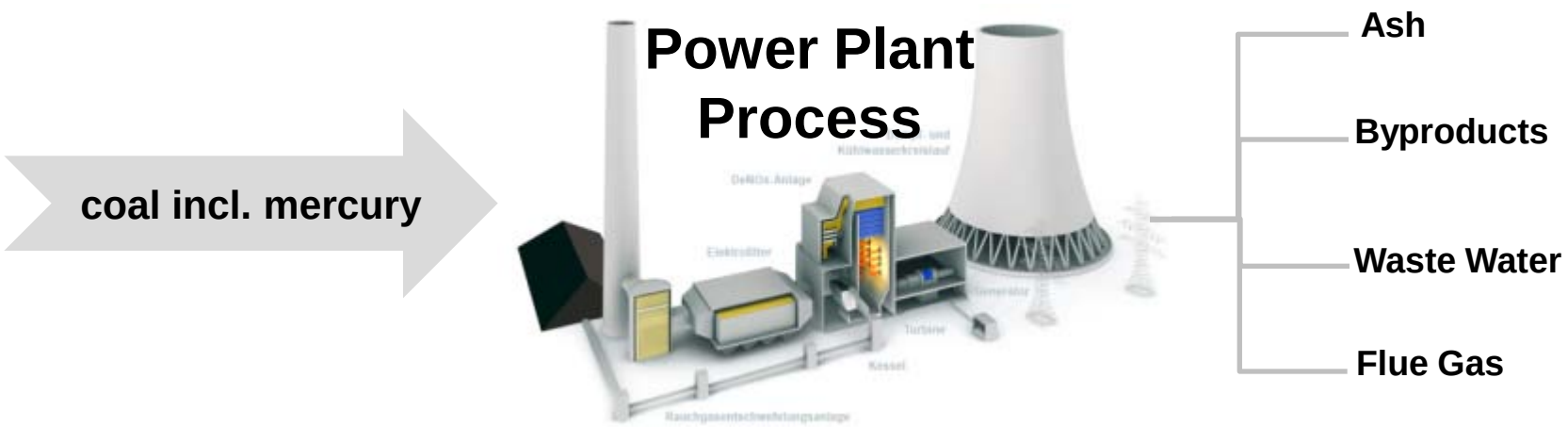
EVONIK INDUSTRIES

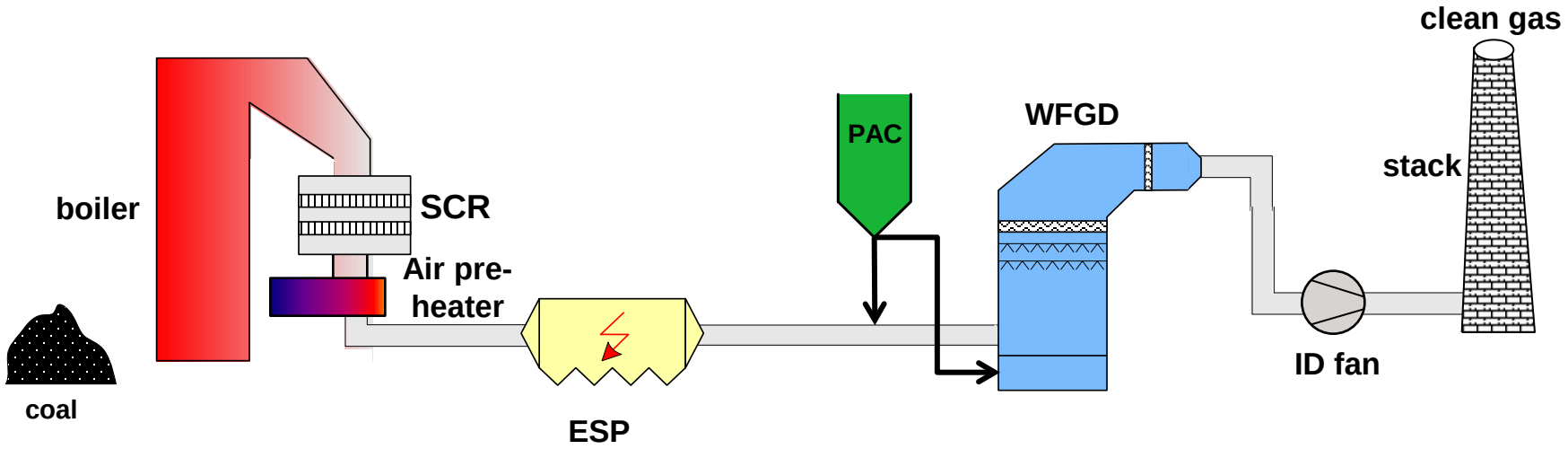
The Path of Mercury



- Removal of Mercury in a flue gas steam ash, waste water, flue gas or byproducts (e.g. gypsum).

- Evonik's Patented Mercury technology:
  Capture of the Mercury
  - Use of Powder Activated Carbon in wet FGD Slurry
  Sequestering of the Mercury
  - PAC / Mercury becomes part of the Wet FGD waste water.
  - Removal of the Mercury from the waste water treatment system.

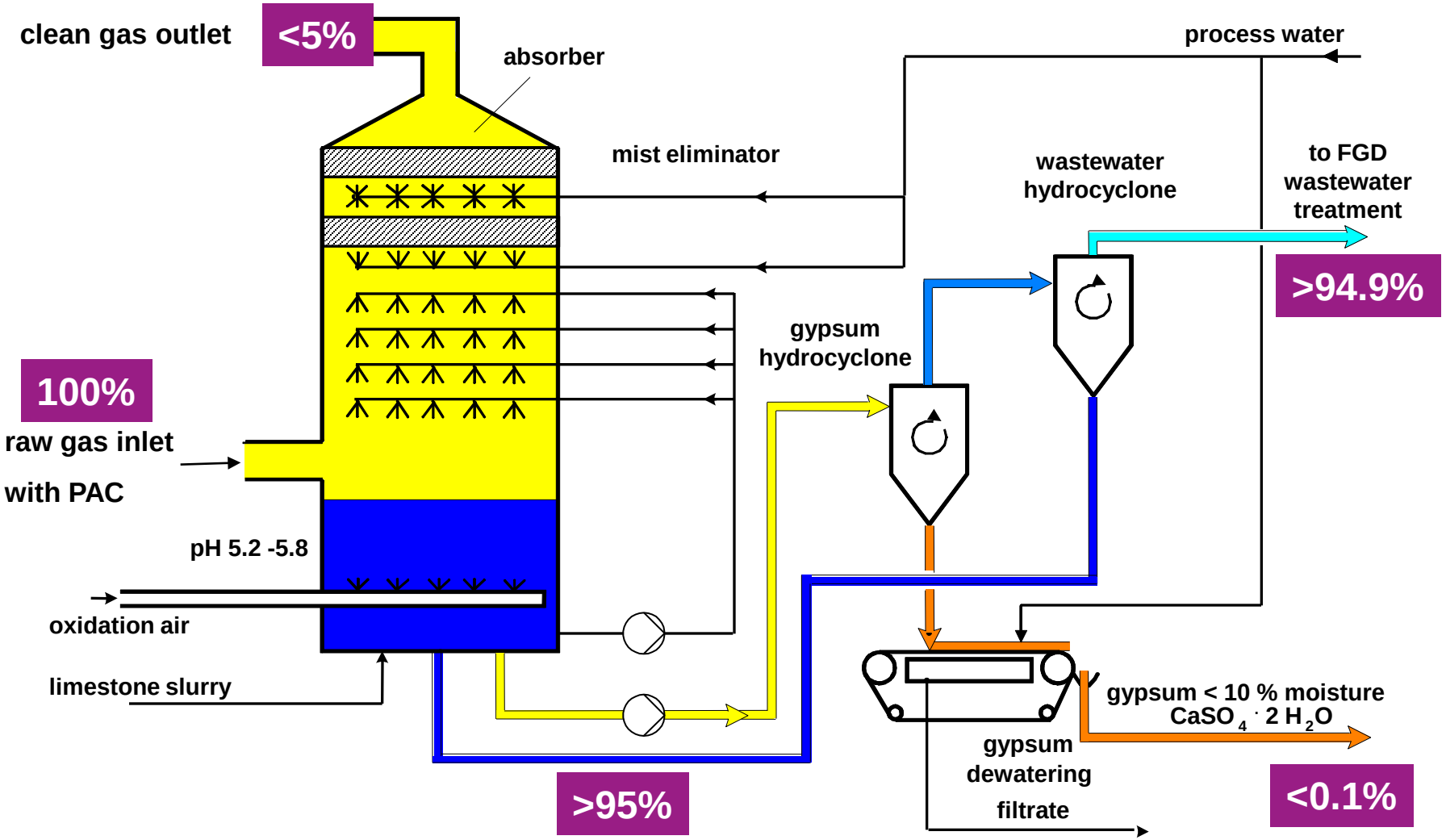
Evonik's Patented Technology



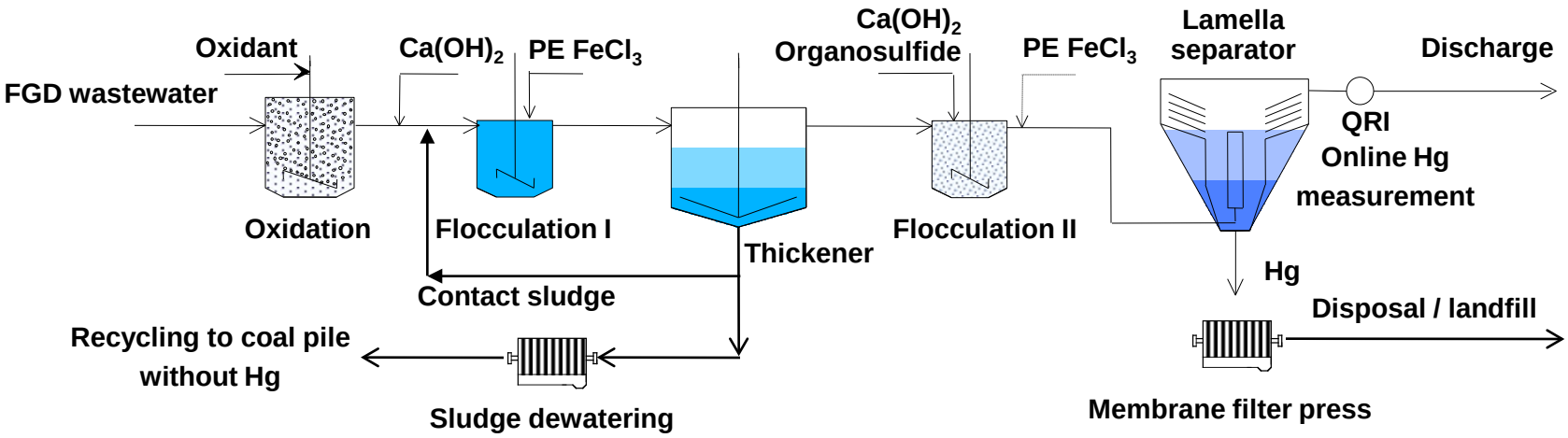
Initial Step - Mercury Capture from the flue gas stream

- Introduction of PAC into system – either into the flue gas stream upstream of wet FGD or direct injection into the slurry.
- Mercury is absorbed in the wet FGD system flue gas slurry.
  - Powder Activated Carbon (PAC) to bind the Mercury.

Mercury Capture / Sequestering



Evonik's Patented Technology
Two Stage Waste Water Process



- Evonik Utilizes a Two Stage Process for Waste Water Treatment (WWT)
- Waste is minimized by sending 97% of the waste material back to the unit for consumption. 3% is sent to landfill for disposal.
- Minimize the metals on the Waste Water Treatment discharge.

Full Scale Demonstration
Marl Station - Unit #5

Marl Station, Germany

Purpose of Marl Station: Steam supplier to the Marl Chemical Park (1600 acres of industrial utilized land)

Total Plant Size: 600 MW

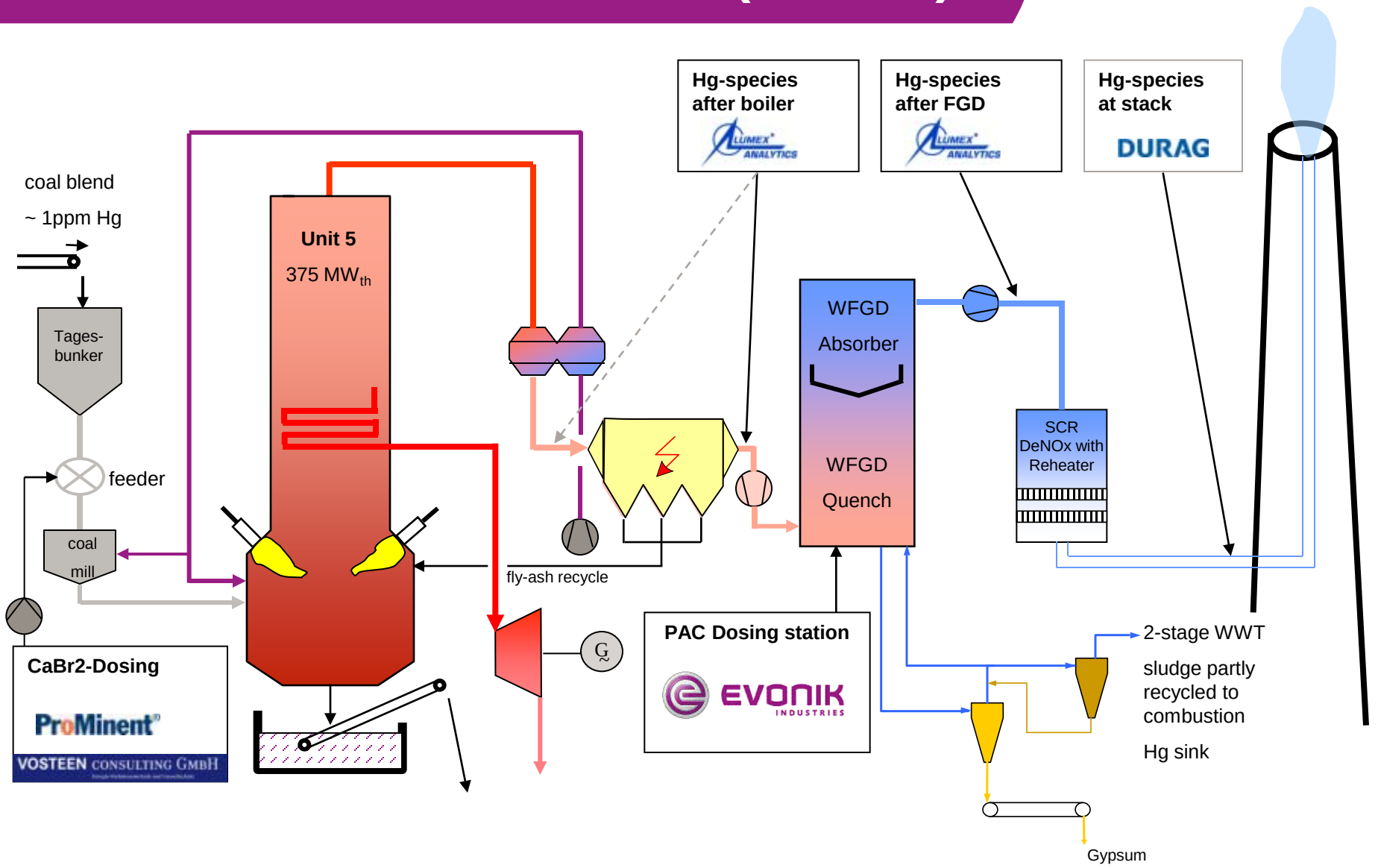
Configuration:

- **KW I:** 2 pulverized coal-fired Benson boilers – wet ash extraction (1,060 / 1,230 k#/hr), 8 turbine-generators
- **KW II:** 1 pulverized coal-fired Benson boiler – wet ash extraction (617 k#/hr), 1 turbine-generator
- **KW III:** 2 natural gas-fired boilers, 2 gas turbines, 1 steam turbine; operated as a gas and steam turbine combined cycle plant equipped for cogeneration

Marl Full Scale Demonstration Objectives

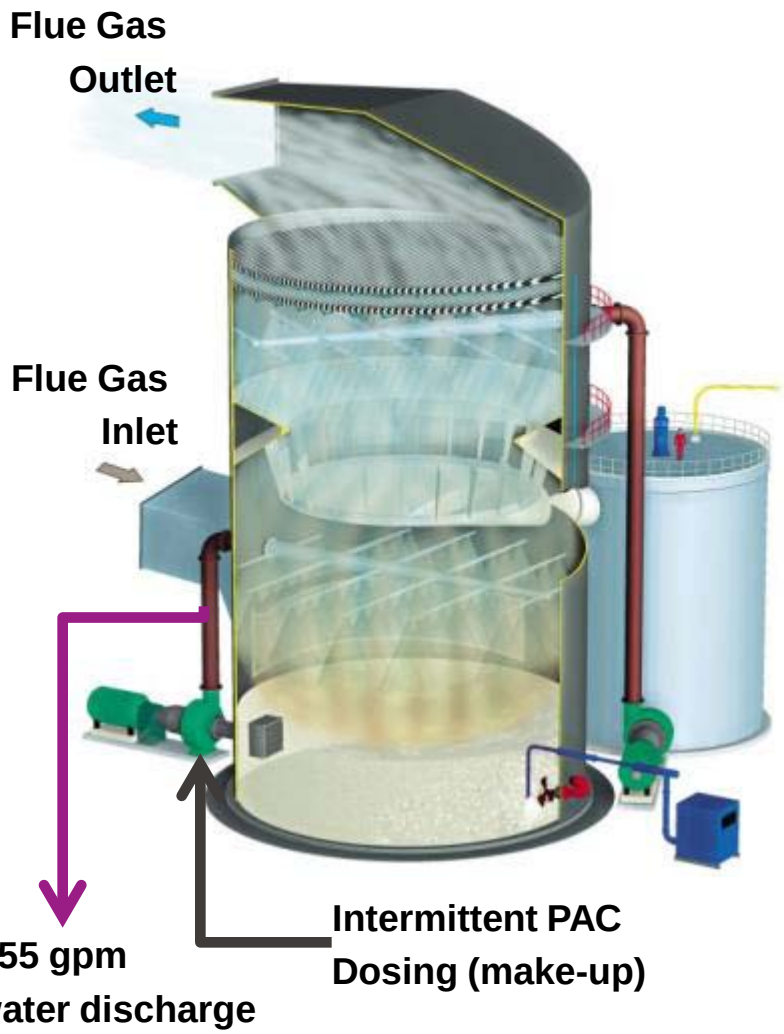
- Determine if ≥90 % Hg Reduction without SCR is possible
- Determine if $CaBr_2$ Injection Affects FGD and Waste Water Treatment Process
- Determine if PAC Injection Affects FGD and WWT Processes
- Determine what Chemical Factors Affects the Process

Tail-End SCR – Plant Marl (375MW)



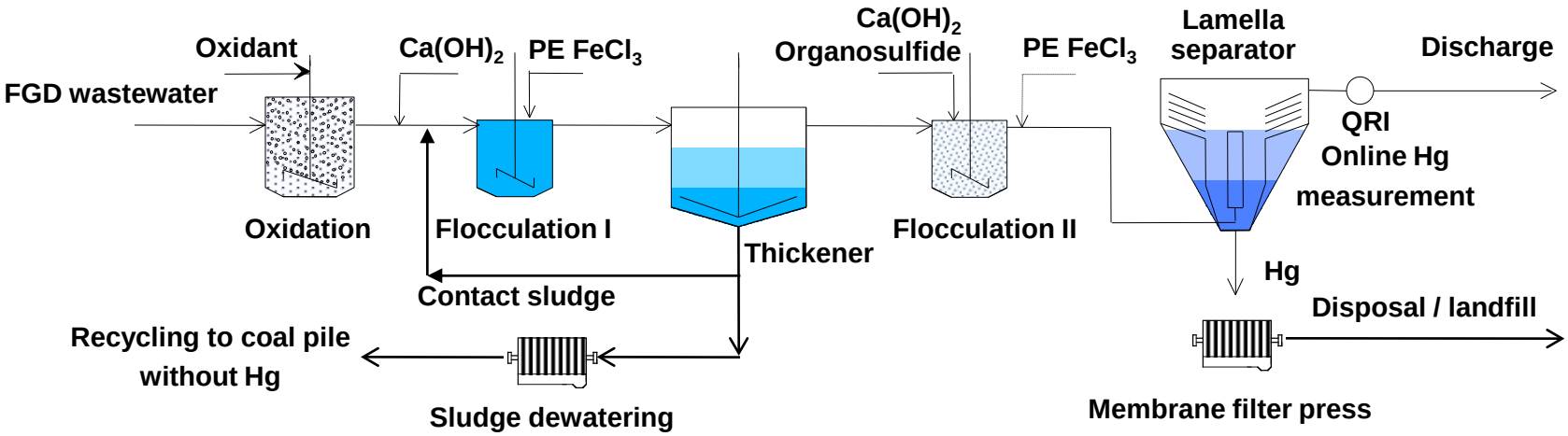
Full Scale Demonstration
Marl Station - Unit #5

Baseline – Natural Mercury Removal		
Hg – FGD Inlet	Hg – FGD Outlet	75% Hg capture
8.5 Hg^{2+}	<0.3 Hg^{2+}	
1.5 Hg^{o}	2.2 Hg^{o}	
10.0 Hg total	<2.5 Hg total	
Evonik - Mercury Removal		
Hg – FGD Inlet	Hg – FGD Outlet	**95% Hg capture**
CaBr Addition	PAC in WFGD	
9.9 Hg^{2+}	<0.4 Hg^{2+}	
0.1 Hg^{o}	0.1 Hg^{o}	
10.0 Hg total	<0.5 Hg total	



Hg-concentration in absorber solution approx. 300-500 ppb – PAC feed rate @ 0.17 #/MMACFM)

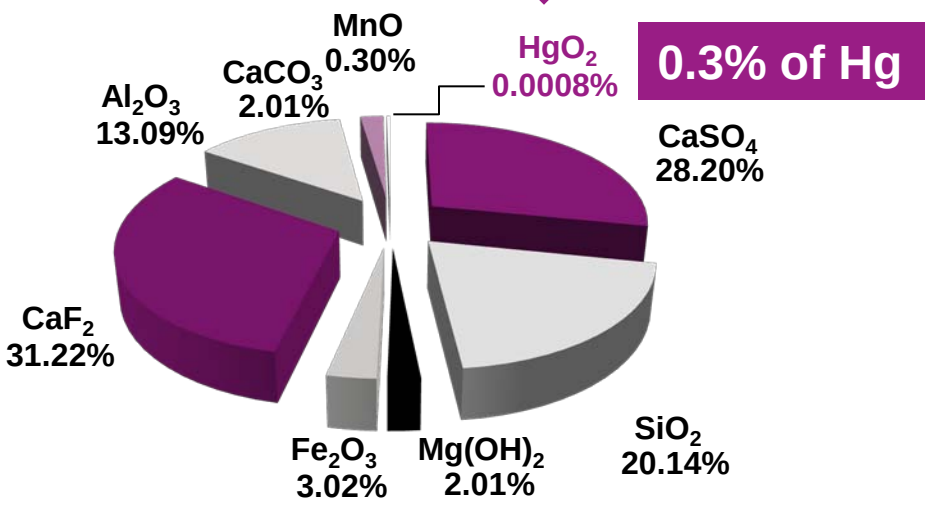
Full Scale Demonstration
Waste Water Characteristics



Sludge Composition

97%

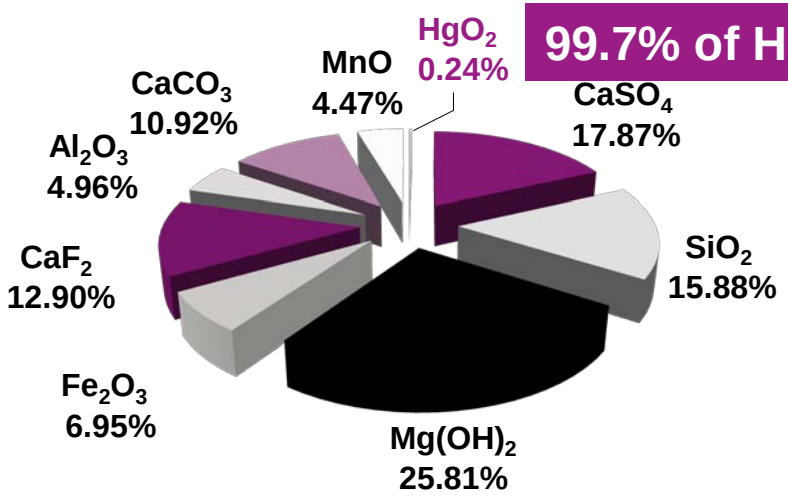
0.3% of Hg



3%

Sludge Composition

99.7% of Hg



Comparison of Technologies

Evonik Technology	Traditional PAC Injection
Wet FGD Driven	Baghouse Required
PAC does not effect Fly Ash or Fly Ash Sales	Contamination of Fly Ash
Requires 0.2- 0.3 lbs PAC per MMacfm for 95% removal	Requires 3-10 lbs of PAC per MMacfm – Dependent on system
Evonik Technology	**Conventional Wet FGD**
Very limited reemission	Re-emission of Mercury possible
Gypsum Quality not Affected	Mercury contained in Gypsum or waste water discharge

Conclusions

- 3 lbs / hr PAC added to 300,000 acfm of flue gas lowers the Hg-concentration from 10.0 µg/m^3 to below 0.5 µg/m^3 Hg in the purified gas.
- Oxidized Hg is adsorbed within the FGD, elemental Hg passes through (nearly) unaffected. Hg oxidation e.g. by $CaBr_2$
- The PAC/gypsum mixture can be separated completely using hydrocyclones (gypsum whiteness unaffected).
- Various chemical factors affect capture rate

Questions ?

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