REINHOLD ENVIRONMENTAL Ltd.

2013 APC Round Table & Expo Presentation

July 8-9, 2013, in St. Louis, MO / Hosted by Ameren

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APC Round Table

ELG & Biological Wastewater Treatment

Jay Harwood | St. Louis, MO | July 8, 2013




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Agenda

- Effluent Guidelines – Overview of EPA Draft Regs
- Overview of biological treatment options used in coal-fired power plant wastewater treatment
- FGD Wastewater Treatment Using phys/chem + ABMet biofilter - History, Capability, Case-Studies
- Questions

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Effluent Limitation Guidelines

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Effluent limitation guidelines

- Revision of 30 year-old guidelines based upon demonstrated technological capabilities
- Will cover wastewater discharges not previously addressed nationally
- Will provided guidance for regional EPA and State regulators to set NPDES discharge limits
- Based on past 4 years worth of study, sampling, information gathering across the US at a variety of facilities
- Technology based
- Individual permitting authorities have ability to set lower limits
- Incentives for time extension through pond CCR elimination or ZLD

Draft May 2013, Final rule mid-2014
Compliance starting 2017 to 2022 through NPDES renewal

Plans may still change!

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What are the major changes?

- Based on the preferred options:
  - Comingling of streams to lower concentrations before discharge is not allowed
  - Wet FGD stream limits for Se, As, Hg, NO_3
  - Leachate stream limits for As, Hg
  - Non-chemical cleaning waste limits for Cu, Fe
  - Wet fly ash stream discharges are prohibited
  - Wet bottom ash stream discharges are prohibited in some options
  - Sub 50 MW facilities are mostly exempt from all

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FGD stream impacts

Proposed FGD BAT effluent limits (pre-publication):

Constituent	30 day avg values	Max 1 day limit
Total Selenium	10 µg/L	16µg/L
Mercury	119 ng/L	242 ng/L
Arsenic	6 µg/L	8 µg/L
Nitrate-Nitrogen	0.13 mg/L	0.17 mg/L

Limits must be met prior to; reuse, comingling with any other stream, or discharge

Multiple options presented, 5 of which are based on phys/chem + anoxic/anaerobic biological systems

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Ash stream impacts

Proposed leachate BAT effluent limits (pre-publication):

Constituent	30 day avg values	Max 1 day limit
Mercury	119 ng/L	242 ng/L
Arsenic	6 µg/L	8 µg/L

Limits must be met prior to; reuse, comingling with any other stream, or discharge

In cases where bottom ash ponds are allowed, they cannot be used for dilution under ELG

Zero-pollutant discharge allowed from stations' fly ash ponds (and bottom ash in worst case)

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New challenges, new solutions

- In many cases, plants will have to meet much stricter WQ criteria on streams than ELG's dictate
- FGD streams, by definition will need phys/chem + anoxic biological or thermal evaporation
- Currently available non-biological options for FGD streams cannot achieve the required reductions of all constituents of concern
- Variability of FGD wastewater chemistry means every treatment system will be unique

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Biological wastewater treatment

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What is biological wastewater treatment?

Use of bacteria to perform certain tasks such as removing or converting constituents in water streams. Primary uses are:

- Remove nitrate (anoxic)
- Remove ammonia (aerobic)
- Remove organic material (aerobic)
- Convert dissolved constituents to their insoluble forms either through respiration or indirect precipitation (anoxic, anaerobic)

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Types of biological systems

Suspended growth

- Bacteria “free-floating”
- Homogenous/mixed

Fixed film

- Bacteria fixed to media in biofilm
- Homogenous/mixed or packed/plug flow

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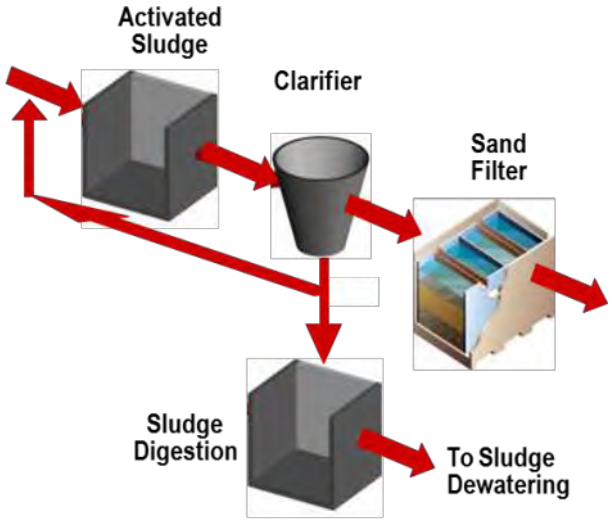
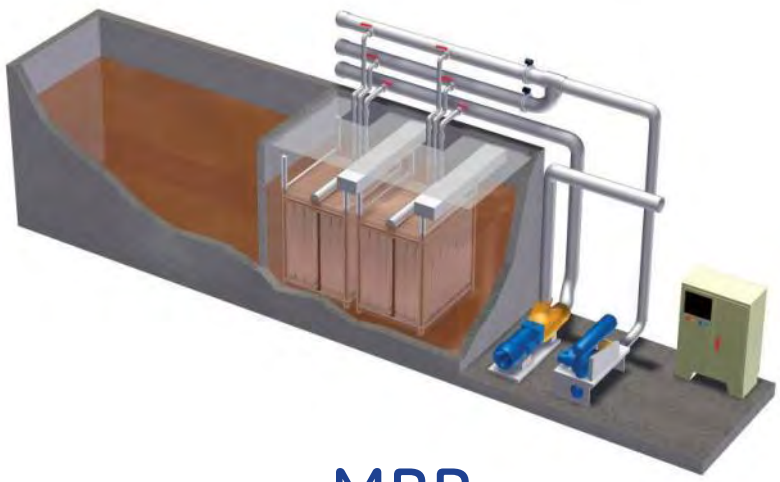
Common systems



CAS

- Conventional Activated Sludge
- Suspended-growth bioreactors + clarification
- Aerobic, anoxic, anaerobic
- Used for multiple purposes



MBR

- Membrane Bioreactor
- Suspended-growth bioreactors + UF or MF membrane filtration
- Aerobic, anoxic, anaerobic
- Used for multiple purposes

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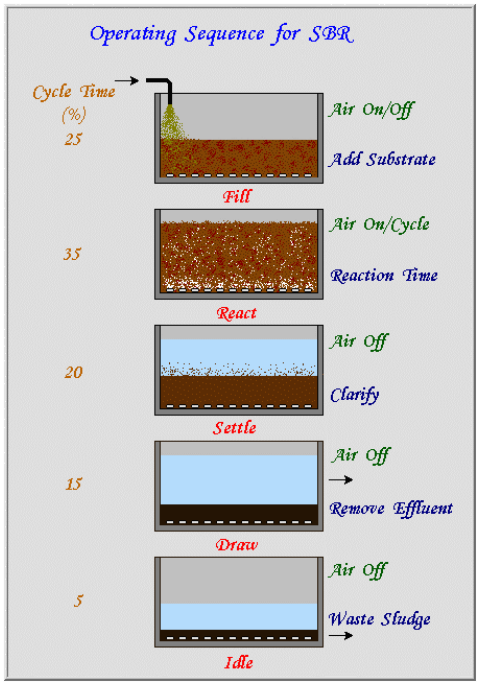
Common systems

MBBR

- Moving Bed Bioreactor
- Fixed-film, mixed tank
- Aerobic
- Typically used for organic reduction



SBR

- Sequencing Batch Reactor
- Suspended-growth operated in batch mode
- Aerobic, anoxic
- Used for organic polishing and denitrification

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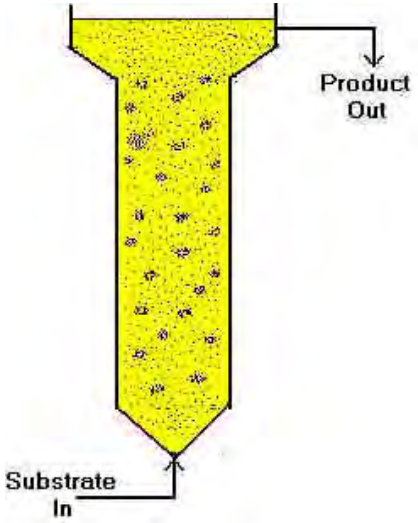
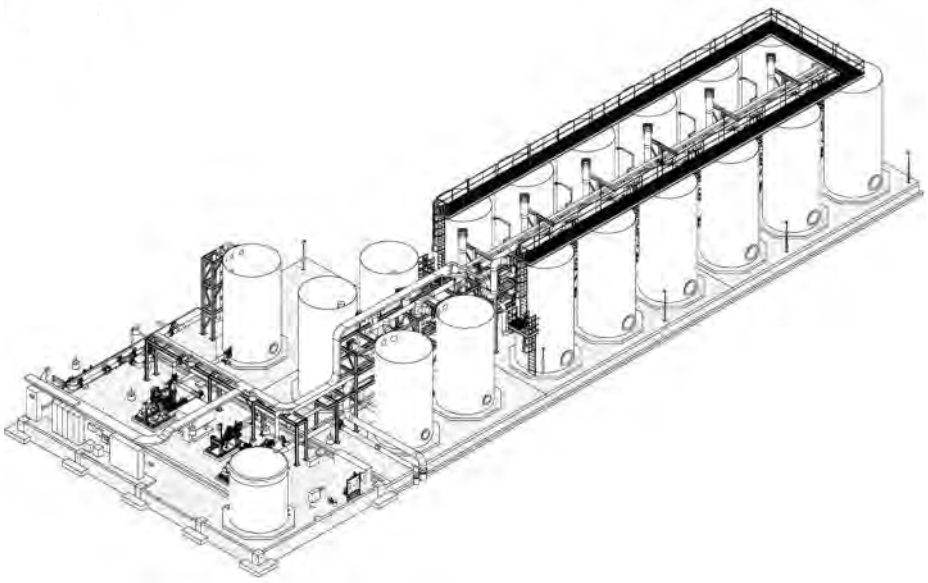
Common systems



FBR

- Fluidized Bed Bioreactor
- Fixed-film, mixed tank
- Anoxic, anaerobic
- Used for denitrification and metals removal



ABMet®

- Fixed-film, packed bed
- Anoxic, anaerobic
- Used for denitrification and metals removal

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FGD wastewater treatment

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The ABMet biofilter

Anoxic biofilter system

Beneficial, naturally occurring, facultative anaerobic microbes

Converts nitrate to nitrogen gas

Reduces soluble selenium (selenate or selenite) to insoluble elemental and retains until backwash

Reduces mercury

Precipitates metals as sulfides

Tolerant to 35,000 mg/L chloride

Feed temperature 40 to 105^{O}F

pH 6 - 9

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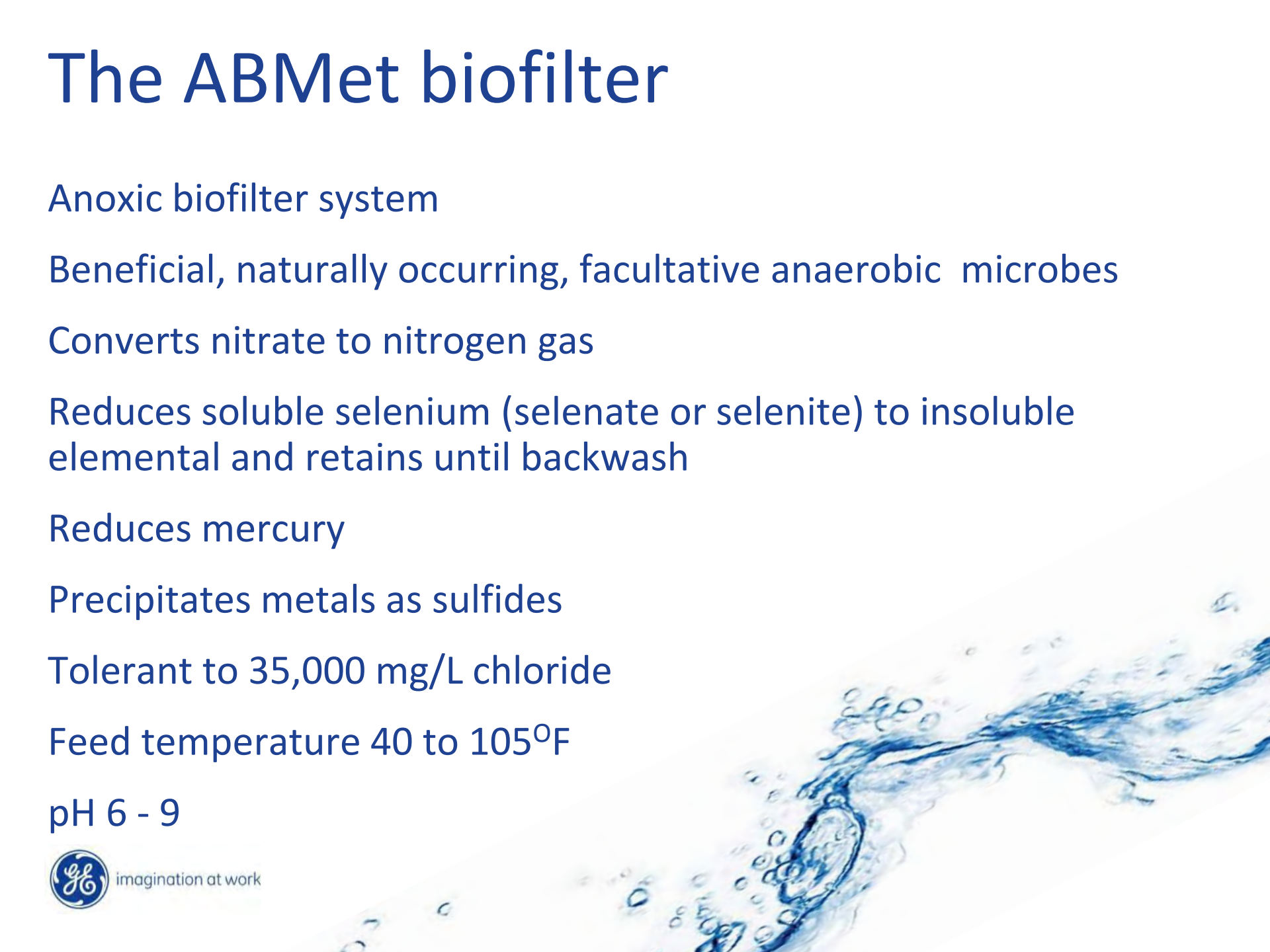
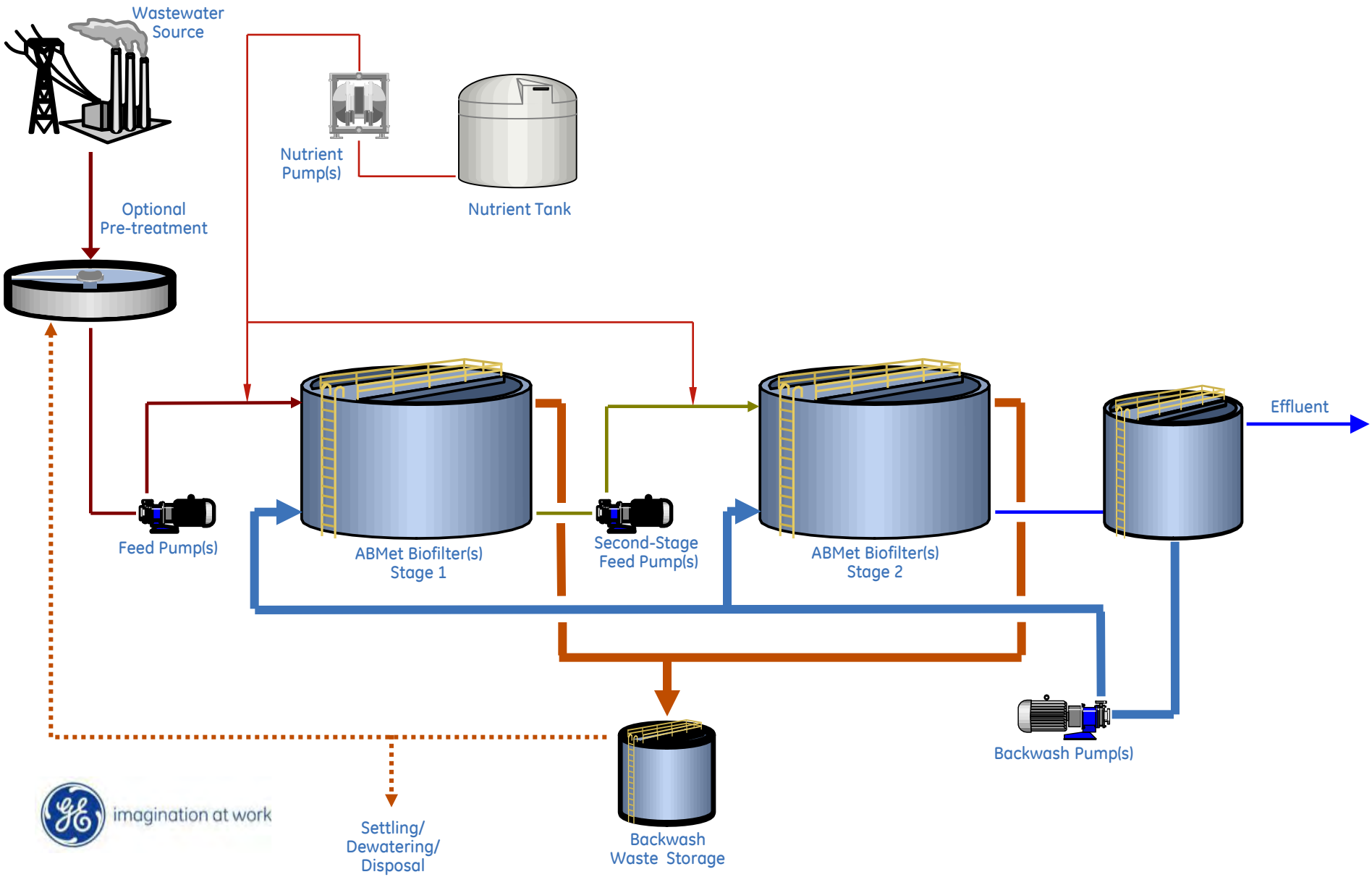
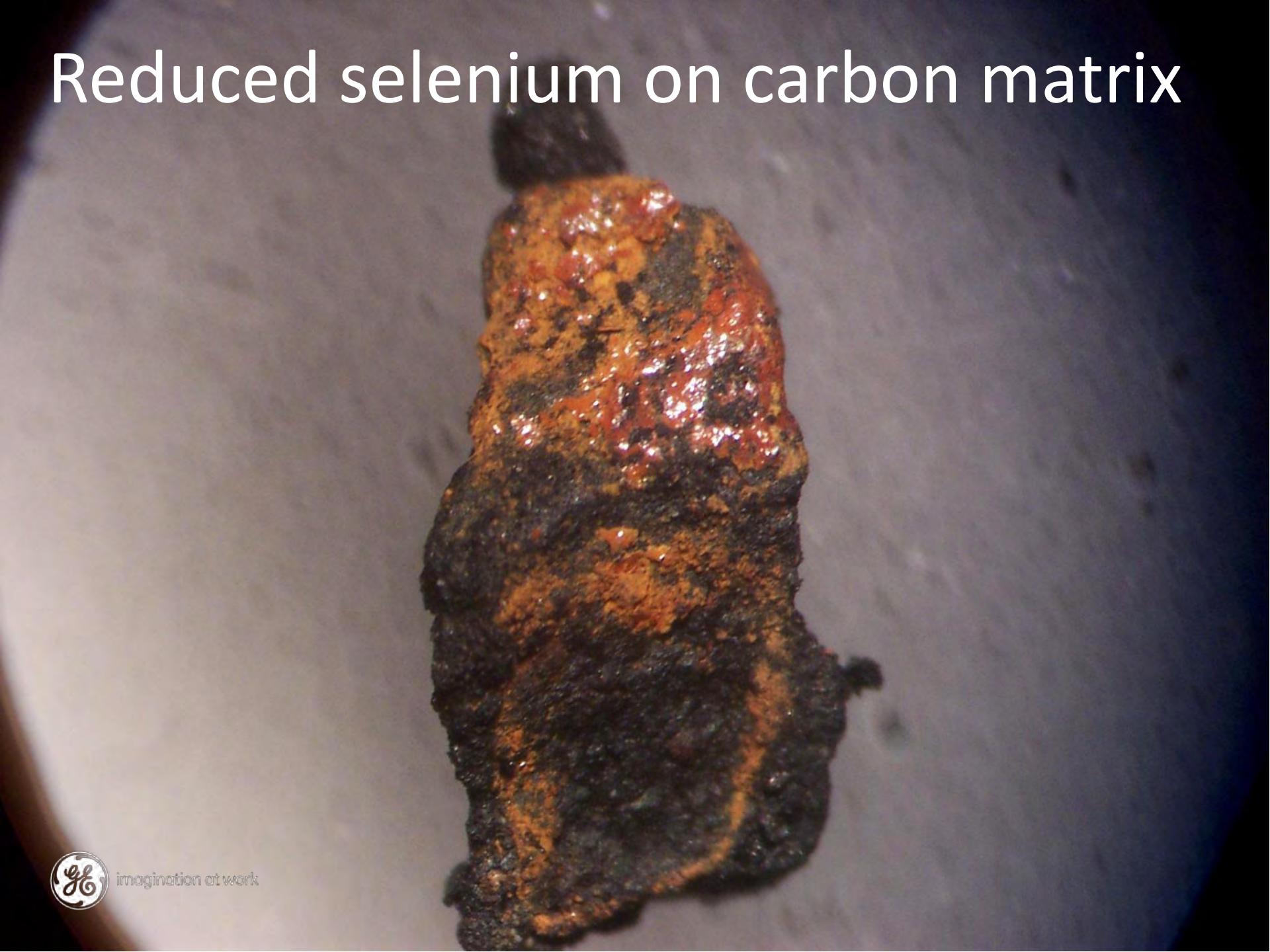


ABMet flow diagram



Reduced selenium on carbon matrix



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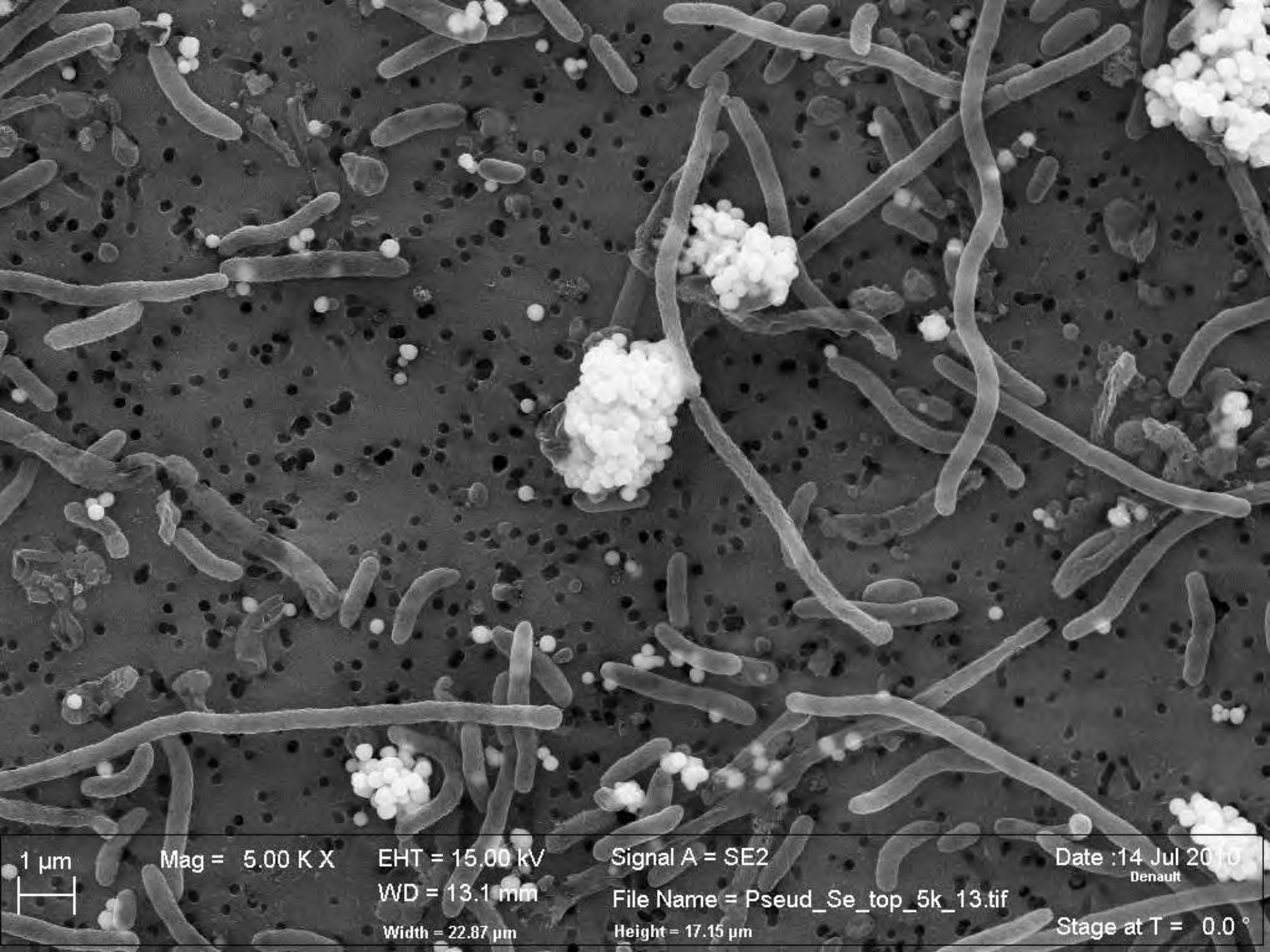
1 µm
Mag = 5.00 K X
EHT = 15.00 kV
WD = 13.1 mm
Width = 22.87 µm
Signal A = SE2
File Name = Pseud_Se_top_5k_13.tif
Height = 17.15 µm
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Waste handling

- Low solids volumes are mostly elemental metals, metal sulfides and some biomass
- Can be dewatered with a belt or plate/frame press typically to 15-30% dry product
- Can be sent to thickening/dewatering, settled or recirculated to clarifier
- TCLP testing passed in every attempt

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GE ABMet water quality

Constituent	Influent value	Avg effluent value
Chloride	< 35,000 mg/L	
TSS	< 100 mg/L	< 20 mg/L
pH	6-9	6-9
Temperature	40 – 105^{O}F	
Nitrate-N	< 250 mg/L	ND < 1 mg/L
Mercury	< 5 µg/L	< 0.012 µg/L*
Selenium	< 10 mg/L	< 0.01 mg/L
Other Metals	< 10 mg/L	< 0.01 mg/L

*With additional treatment process, depending on specific water chemistry

NE US station case study

- Single unit, 1,300 MW base-load station
- Combined Outfall limits of <33 µ/L total Se
- 600 gpm = <350 gpm FGD + 0–600 gpm fly ash landfill leachate
- Retrofit following existing FGD WW phys/chem
- Operational Oct 2011
- Design Basis
  - Feed Se: 1,000 – 2,000 ug/L
  - Effluent Se: <25 µg/L
  - Feed NO3-N: 40-50 mg/L

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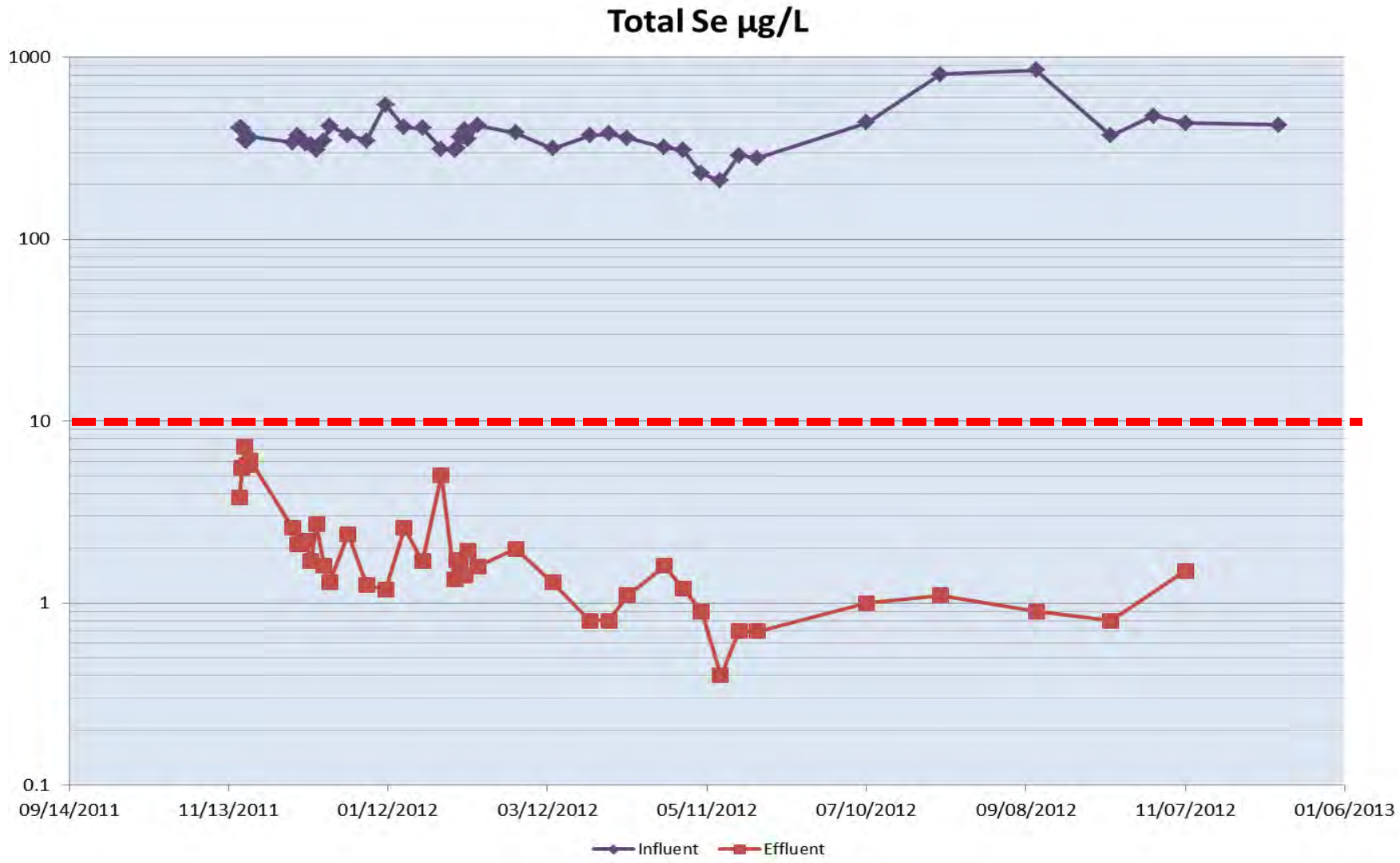
NE US station – total Se



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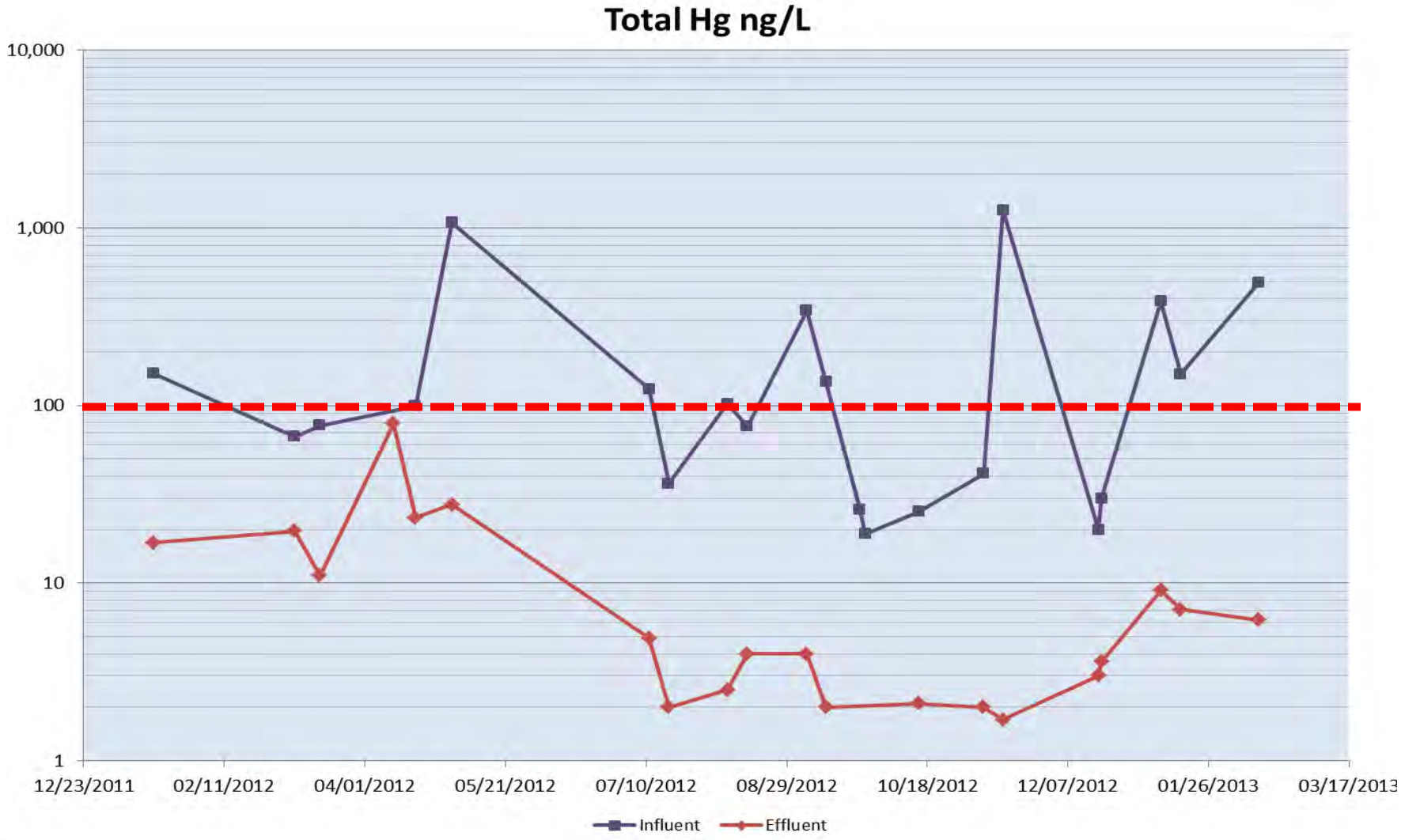
NE US station – total Hg



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Thank You




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