

***Industrial Boiler MACT HCL/PM Control with
Wet Scrubbing / Wet ESP Control Technology"***

**Buzz Reynolds VP Wet ESP
Siemens Environmental Systems & Services**

Industrial Boiler NESHAP Rule

- Issued: January 31, 2013
- Compliance by:
 - Existing Units = January 31, 2016 with 1 year extension possible
 - New Units = January 31, 2013 or upon start-up (commenced construction after 6/4/10)
- Controls: HCL, Hg, PM, CO



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Part V

Environmental Protection Agency

40 CFR Part 63

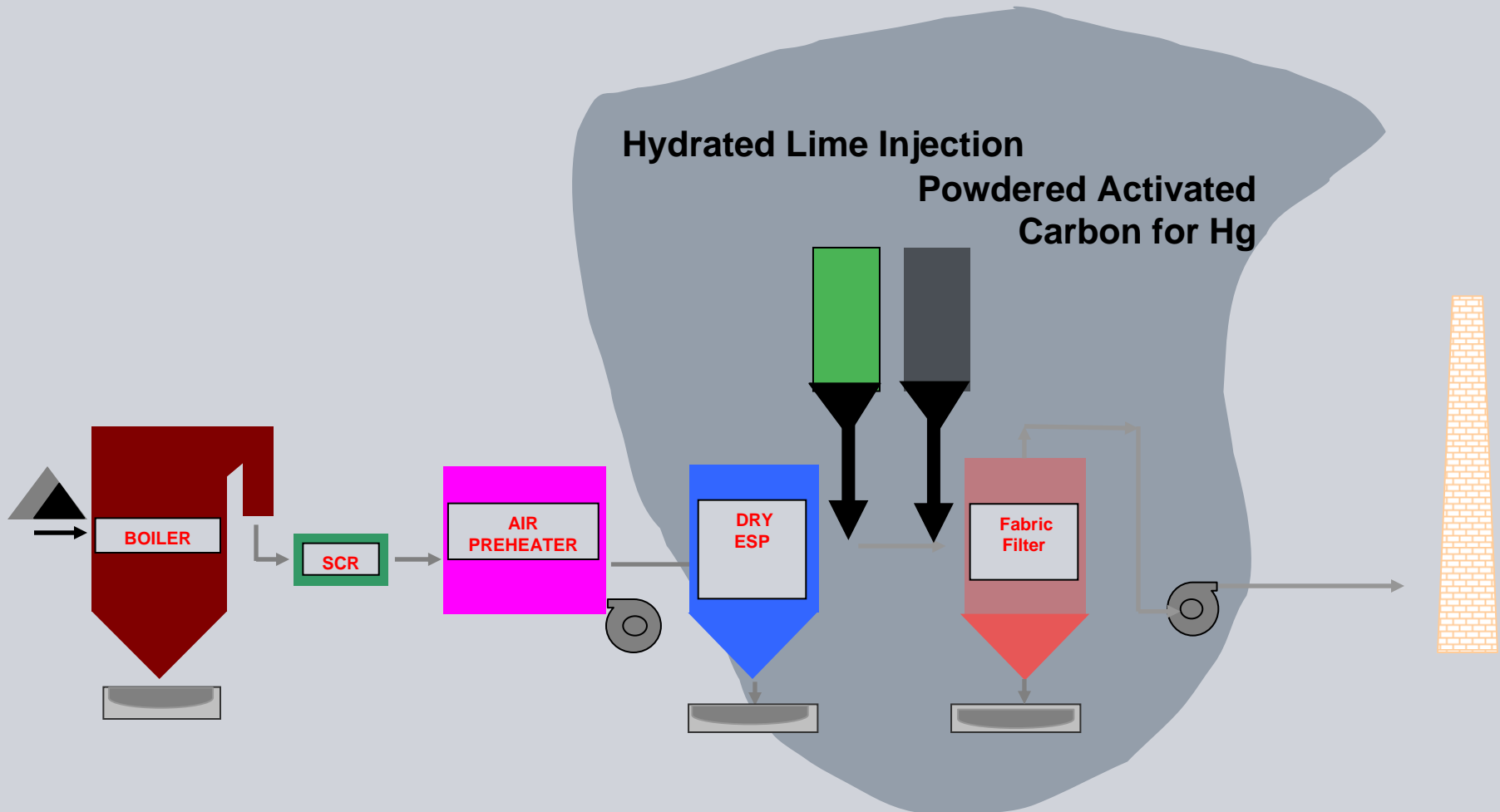
National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters; Final Rule

Dry Technologies for HCL, Hg, PM Control

- **Duct Injection**
- **Spray Dryer Absorber Systems**
- **Circulating Dry Scrubber**
- **Fabric Filters**
- **Dry ESPs**



Conventional Wisdom = DSI+ PAC + Fabric Filter



Issues with DSI / PAC / FF Controls

DSI

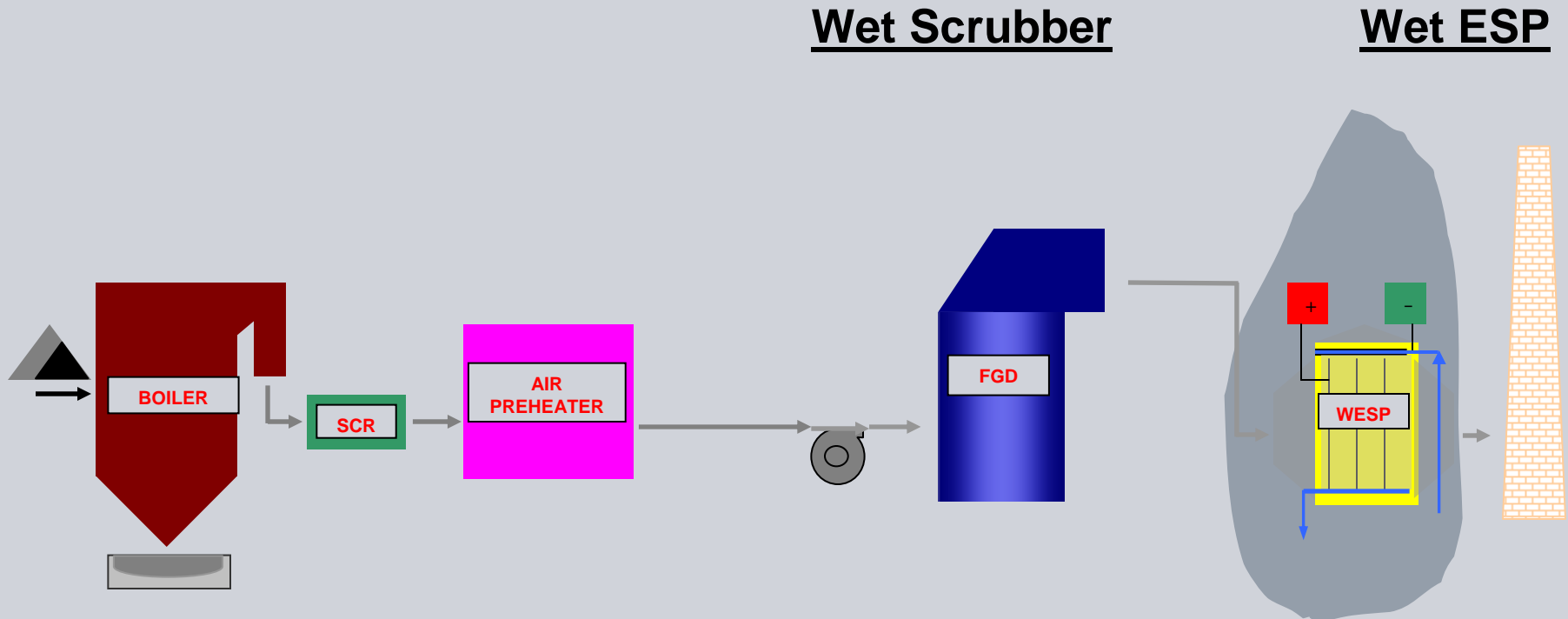
- Increased PM loading
 - does DESP have capacity
- Increased maintenance
 - plugging issues
- Increased operating costs
 - on-going sorbent injection
- Impact on ash sales

Fabric Filter

- Increased pressure drop
 - may require new larger fans
- More real estate for FF
 - is there enough room
- On-going bag replacement
 - cost + outage time
- Increased waste by-product
 - need to landfill

Are all costs factored into overall life cycle analysis?

Alternative Approach = Scrubber + Wet ESP



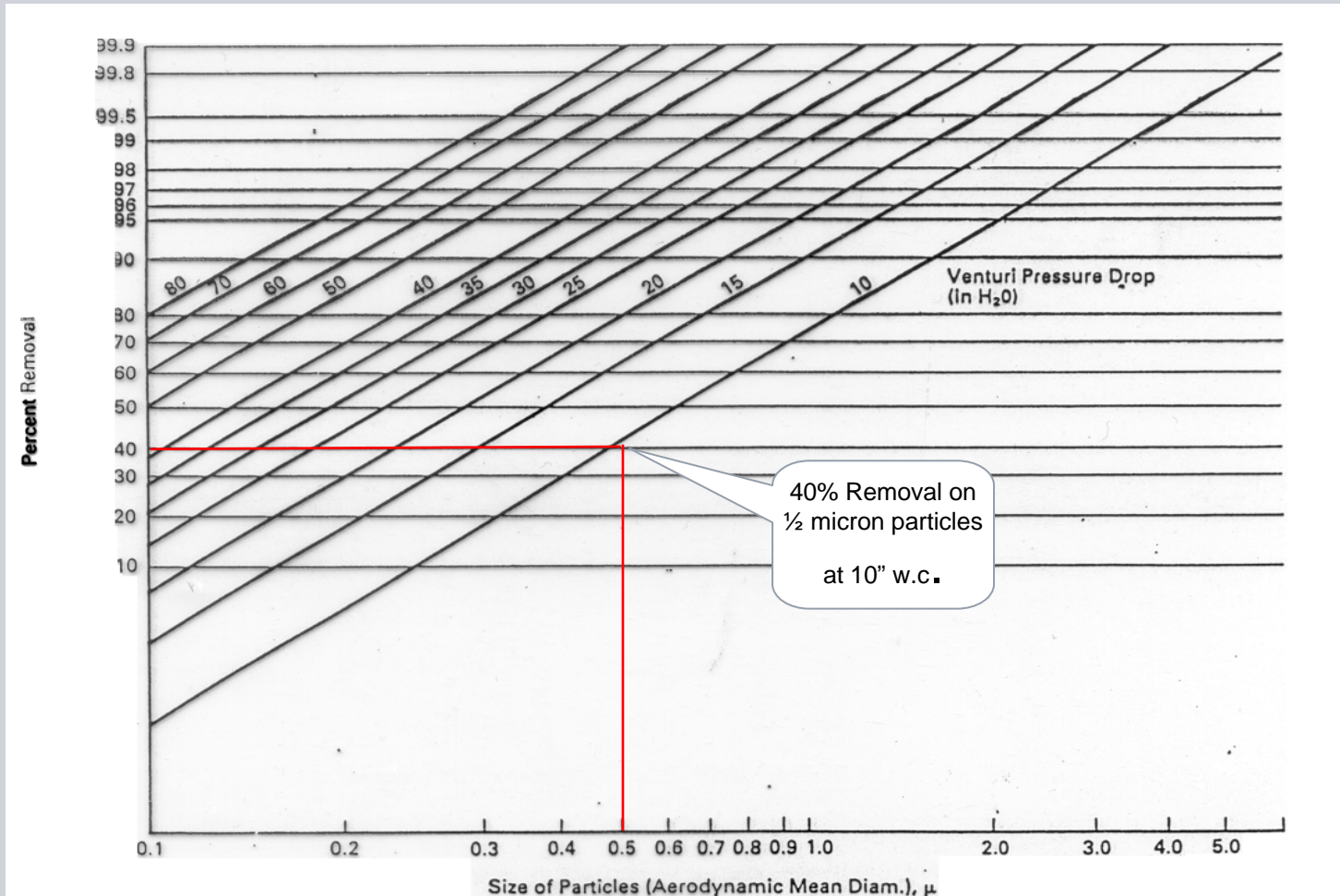
Wet Technologies for HCL, Hg, PM Control

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- **Wet Scrubbers**
- **Wet ESPs**



Scrubber Limitations for PM Removal



40% Removal on 1/2 micron particles at 10" w.c.

Why WESP Technology

Multi-Pollutant Control

- PM_{2.5} (filterable PM)
- SO₃ (condensable PM)
- Metals
- Mercury (limited)
- > 90% control

Opacity Reduction

- <10% visible plume

Operationally

- Low Pressure Drop (@1.0")
- No Moving Parts
- Minimal Maintenance
- Self-Cleaning with water
- Water by-product goes to WFGD
- Smaller footprint than FF
- Flexible to Upset Conditions
- No impact on upstream equipment

Fuel Flexibility

- Switch to lower cost, higher S coal

A Final Polishing Device

Vertical Tubular Scrubber / WESP



Test Results

Kyanite- East Ridge Test Results

Pollutant	Units	Inlet	Outlet	Removal %
S02	Ppm	3580.07	21.4	99.4
ACID MIST (H2S04)	gr /dscf	0.228	0.0159	93.0
PM2.5	gr /dscf	1.6	0.006	99.6
NOx	Ppm	41.1	21.5	47.7
CONDENSED, INORGANIC	Gr/dscf	0.13102	0.0143	89
CONDENSED, ORGANIC	Gr/dscf	0.14148	0.01573	90
OPACITY		>50%	<5%	

Pressure Drop Comparison

DSI / PAC / Fabric Filter

= 7"- 12" W.C. pressure drop
May require new ID fans?

Scrubber + Wet ESP

= 7-15" W.C. average pressure drop
Existing ID Fans may be acceptable.

It depends upon situation



Real Estate Comparison

Scrubber + Wet ESP

Velocity = 7-10 fps

@ Half the size of a FF

Use area between WFGD & stack.

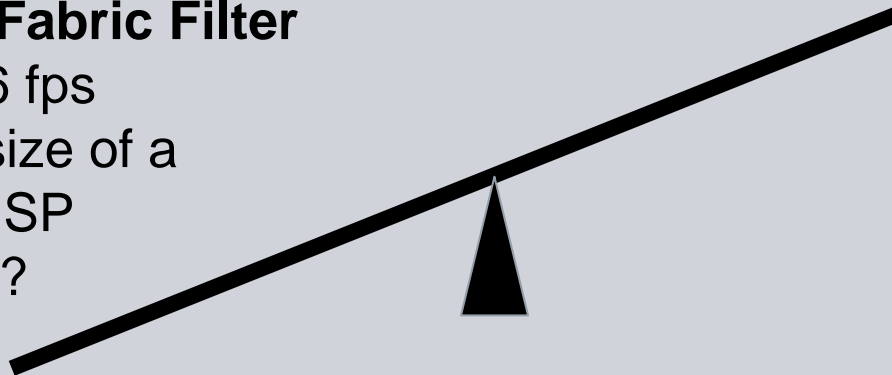
DSI + PAC+ Fabric Filter

Velocity = 4-6 fps

@ twice the size of a

Scrubber/WESP

Is there room?



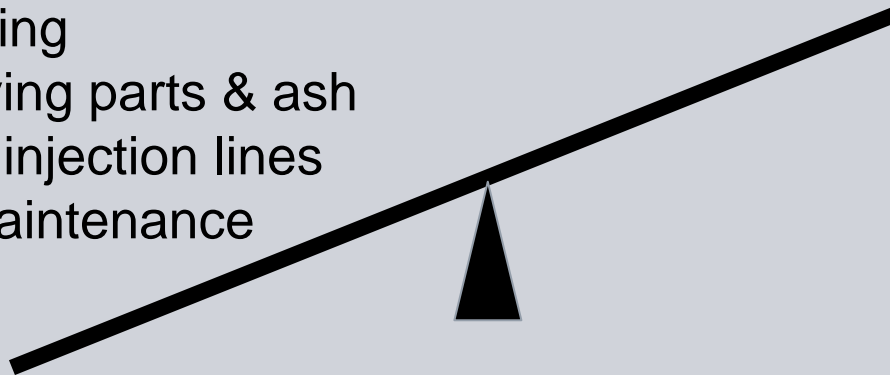
Maintenance Comparison

DSI+ PAC+ Fabric Filters

- Bag Replacement every 3-5 years
- Hopper smoldering/fires
- Ash conveying
- A lot of moving parts & ash
- Plugging of injection lines
- Constant maintenance

Scrubber+ Wet ESP

Alloy internals - no replacements
Everything is saturated & wet
No moving parts & no ash
Outage inspection & maintenance



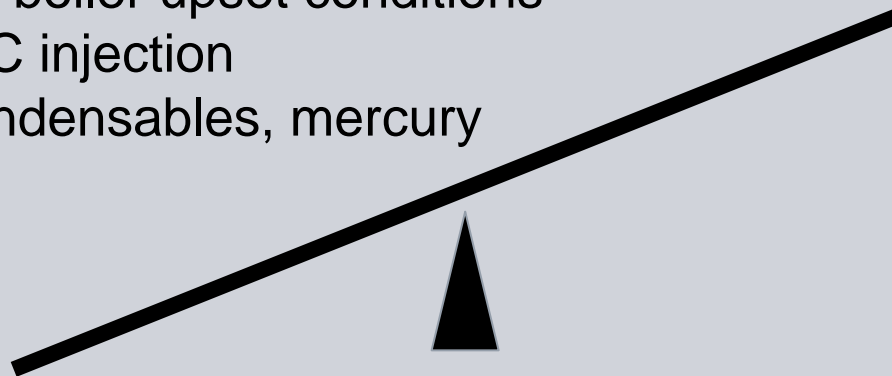
Process Comparison

Scrubber + Wet ESP

- Better at handling boiler upset conditions
- No DSI or PAC Injection

DSI/PAC/Fabric Filter

- More sensitive to boiler upset conditions
- Needs DSI + PAC injection for removal of condensables, mercury



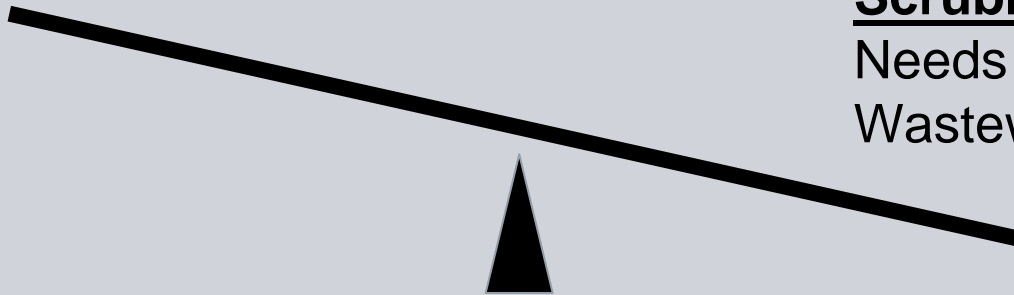
Water Usage Comparison

Fabric Filter

No water used

Scrubber/Wet ESP

Needs source of water
Wastewater treatment

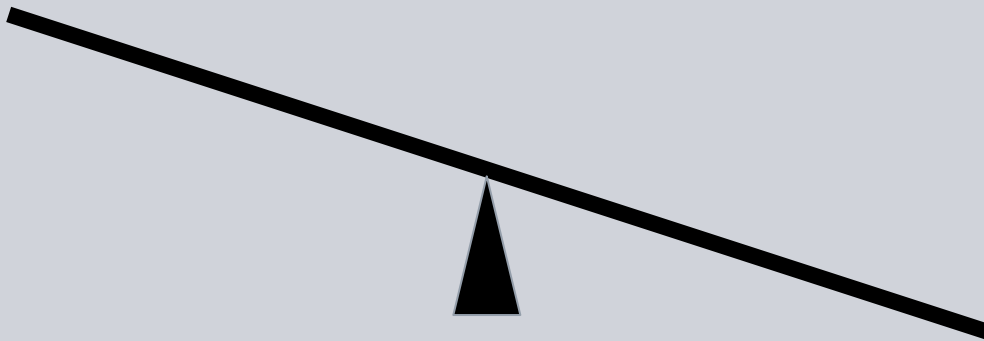


Capital Cost Comparison

Fabric Filter
\$5- \$10/cfm

Equipment Only

WESP
\$10-\$20/cfm



Summary

- **Scrubber / Wet ESP offers**

- Removal of both filterable & condensable PM2.5 including
- HCL, SO₂, SO₃ (H₂SO₄), metals, and Hg

- **Advantages of Scrubber / WESP vs DSI / PAC /FF are:**

- Lower maintenance
- Less real estate
- Not as sensitive to upsets

Analyze the economic benefits

- Lower operating/maintenance costs vs Higher capital cost

Note: 3 Major Regulations Overlap

- **Cement NESHAP Rule**
 - Issued: February 12, 2013
 - ***Compliance by: September 9, 2015***
 - Controls: HCL, Hg, PM & THC

- **Industrial Boiler NESHAP Rule**
 - Issued: January 31, 2013
 - ***Compliance by: January 31, 2016***
 - Controls: HCL, Hg, PM, CO

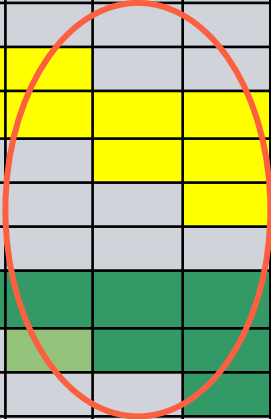
- **Utility Mercury Air Toxics (MATS) Rule**
 - Issued: February 16, 2012
 - ***Compliance by: April 16, 2015***
 - Controls: HCL (SO₂), Hg, PM

Resources, Pricing and Delivery will be impacted!

Boiler MACT Time Line

Estimated Schedule to meet MACT – September 9, 2015 Compliance Date

	2012	2013				2014				2015			
Activity	4th Q	1stQ	2ndQ	3rd Q	4th Q	1stQ	2ndQ	3rd Q	4th Q	1stQ	2ndQ	3rd Q	4th Q
MACT Regulation													
Finalized	█												
Published		█											
Compliance Testing													█
Consulting Engineering													
Selection	█	█	█										
Evaluation		█	█	█	█								
RFPs				█	█	█	█						
POs issued *					█	█	█	█					
Vendors													
Evaluation	█	█	█	█	█								
Send Proposals			█	█	█	█	█						
Design Engineering					█	█	█	█					
Fabrication						█	█	█	█				
Shipment							█	█	█	█			
Erection								█	█	█	█		
Commissioning									█	█	█	█	
Pre-Testing												█	█
Testing													█



THANK YOU

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