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Control of Mercury, Dioxins/Furans, and Particulate Matter Emissions from Sewage Sludge Incinerators for Compliance with New US EPA Regulations

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APC TECHNOLOGIES, INC.

CBE

TECHNICAL SESSIONS

90 YEARS

Background

- 2011 Regulations, 40 CFR Part 60…
  - Subpart LLLL—Standards of Performance for New Sewage Sludge Incineration Units
  - Subpart MMMM—Emission Guidelines and Compliance Times for Existing Sewage Sludge Incineration Units
- New emission limits for…
  - Particulate matter, HCl, CO, dioxins/furans, mercury, NOX, SO2, cadmium, lead, and fugitive emissions from ash handling
  - >> Mercury was/is a common exceedance
- Compliance deadline March 2016

Background (cont'd)

- This paper/presentation presents 4 case studies of…
  - Air emission control systems installed on four SSIs
  - To control mercury, dioxins/furans, and particulate matter
  - Each of which commenced operation during 2016
- For each case study…
  - Discussion of key design considerations
  - Description of the emission control equipment installed at the sites
  - Compliance testing results
  - Summary of operating experience to date (~2 years of operation)

Selected Process Data for the 4 SSIs

	FBI#1[4]	FBI#2	FBI#3	FBI#4
FBI Sludge feed rate, dry kg/hr (dry lbs/hr)	1,180 (2,600)[1]	4,990 (11,000)[1]	950 (2,100)[2]	1,020 (2,250)[1]
Gas exhaust volumetric flow rate, Nm^3/hr (SCFM)	13,780 (8,200)[1]	48,740 (29,000)[2]	10,080 (6,000)[2]	11,430 (6,800)[1]
Existing air emission control equipment (prior to addition of advanced emission controls)[3]	• Venturi scrubber • Tray scrubber • WESP	• Venturi scrubber • Tray scrubber • WESP	• Venturi scrubber • Tray scrubber • WESP	• Venturi scrubber • Tray scrubber • WESP

(1) Maximum level.
(2) Typical level.
(3) WESP= Wet electrostatic precipitator.
(4) FBI = Fluidized-bed incinerator.

Emission Limits and Emission Levels Prior to Installation of Advanced Emission Controls

	Emission Levels Prior to Installation of Advanced Emission Controls					
	FBI#1	FBI#2	FBI#3	FBI#4	Regulatory Limit- New SSIs	Regulatory Limit- Existing SSIs
Mercury emissions, mg/dscm @ 7% O_2	0.750 (1)	0.178 (1)	0.093 (2)	0.074 (2)	0.0010	0.037
Particulate matter emissions, mg/dscm @ 7% O_2	N/A	3.8 (1)	12.0 (2)	1.5 (2)	9.6	18
Dioxins/furans emissions, ng/dscm @ 7% O_2 (3)	N/A	N/A	0.095 (TMB) 0.0032 (TEQ)	0.12 (TMB) 0.0072 (TEQ)	0.013 (TMB) 0.0044 (TEQ)	1.2 (TMB) 0.10 (TEQ)
Cadmium emissions, mg/dscm @ 7% O_2	N/A	N/A	3.4E-04	0.0031	0.0011	0.0016
Lead emissions, mg/dscm @ 7% O_2	N/A	N/A	0.0054	0.086	6.2E-04	0.0074

Key Design Considerations for Emission Controls

- 95.1% - 99.9% removal of mercury required

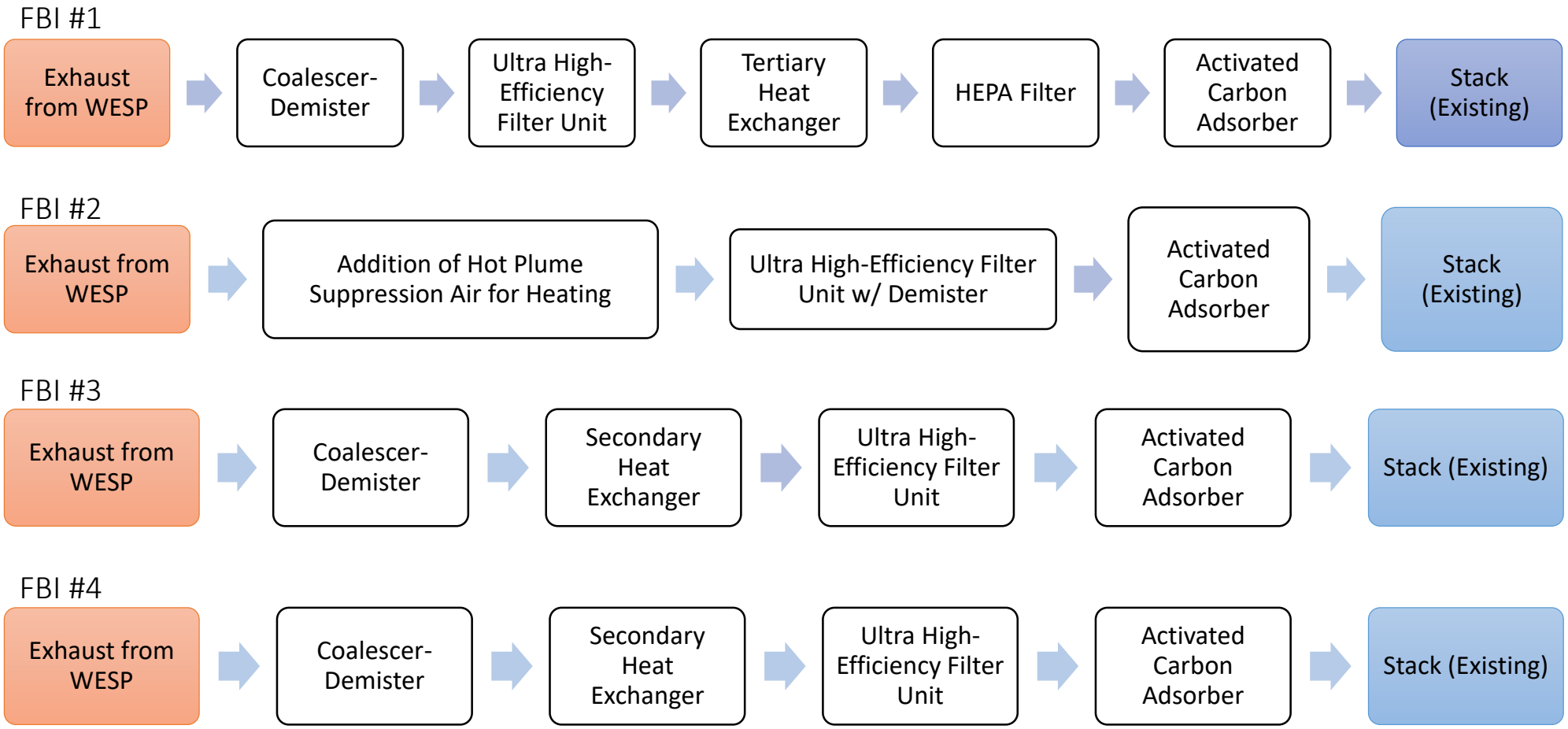
  >>> Fixed carbon bed of sulfur-impregnated carbon required

- Fixed carbon bed in turn requires…
  1. Particulate-free exhaust gas
  2. Condensation prevention
  3. Provisions to avoid carbon bed hot spots and fires

- Once these pieces are place (for mercury control)…

  >>> Particulate matter, cadmium, lead, and dioxins/furans will be controlled effectively at the same time.

Advanced Emission Control Equipment Installed



Compliance Test Results

	Regulatory Limit- New SSIs	Regulatory Limit- Existing SSIs	FBI#1	FBI#2	FBI#3	FBI#4
Mercury emissions, mg/dscm @ 7% O_2 (removal efficiency)	0.0010	0.037	9.76E-06 (99.98%)	4.3E-05 (99.8%)	5.37E-04	2.7E-04
Particulate matter emissions, mg/dscm @ 7% O_2	9.6	18	0.872	N/A	2.26	6.04
Dioxins/furans emissions, ng/dscm @ 7% O_2[(1)]	0.013 (TMB) 0.0044 (TEQ)	1.2 (TMB) 0.10 (TEQ)	0.00452 (TMB) 7.16E-05 (TEQ)	N/A	4.37E-03 (TEQ)	0.0017 (TEQ)
Cadmium, emissions mg/dscm @ 7% O_2	0.0011	0.0016	8.36E-05	N/A	1.16E-04	1.4E-04
Lead emissions, mg/dscm @ 7% O_2	6.2E-04	0.0074	7.98E-04	N/A	3.64E-04	1.99E-04

(1) TMB= Total mass basis; TEQ= Total equivalents basis. The regulation requires that one of the two standards be met.

(2) Percentages listed for mercury emissions are removal efficiencies.

Other Findings

- No carbon bed hot spots
- Experience regarding condensation and particulate
- Infrequent particulate filter change-out frequencies

Conclusions

- All four incinerators met the strictest standard for mercury
- All four incinerators met the standards for particulate matter, dioxins/furans, cadmium and lead.
- Three systems have had their one-year compliance test, again with all units passing
- No carbon bed hot spots
- Infrequent particulate filter change-out frequencies – costs as projected

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