

Dry Sorbent Injection For CPM Mitigation

McIlvaine Hot Topic Hour
July 11 , 2013

Novinda Environmental Services



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Innovative Solutions for Industry

Agenda

- What is CPM?
- Why is it a problem?
- How is CPM Measured?
- CPM Mitigation
- Case Study

What is CPM?

Condensible Particulate Matter (CPM)

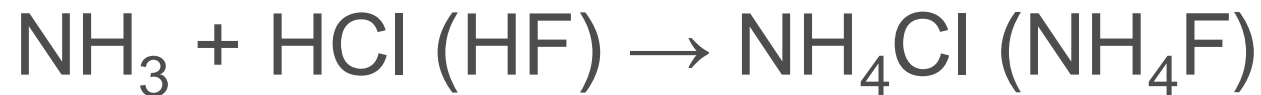
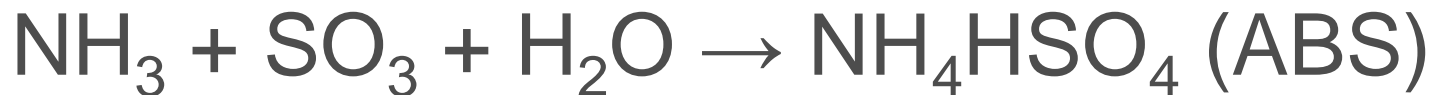
- Liquid or solid aerosols formed in atmosphere
- CPM – Inorganic compounds (CPM-I)
 - Formed from precursor reactants upon cooling
 - E.g., NH_3 , SO_3 , HCl/HF
- CPM – Organic compounds (CPM-O)
 - Condensing volatile organic compounds (VOC)
- EPA will regulate as part of $\text{PM}_{2.5}$
- Some States already regulating by permit
- Measured by EPA Method 202 (dry impinger technique)

What is CPM?

SO₃ (Blue Plume)

- 1,000 ppmv SO₂ ==> 7 ppmv SO₃
- SCR can increase SO₃ by 100%
- APH Corrosion (H₂SO₄ condensation – 290° F)
- ABS Fouling (from NH₃ slip)

What is CPM?

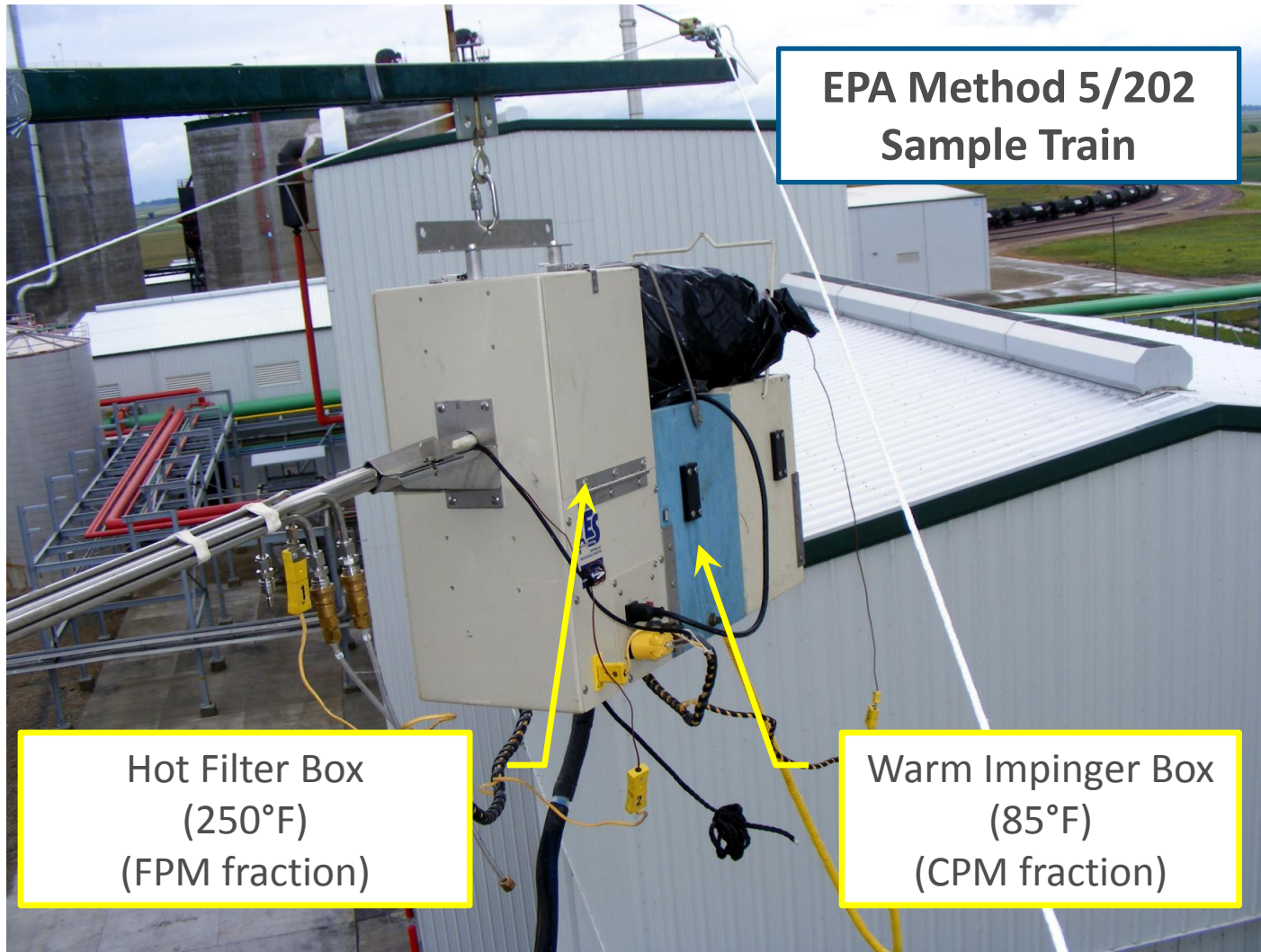


What is CPM?



ABS Formed After Baghouse

CPM Measurement

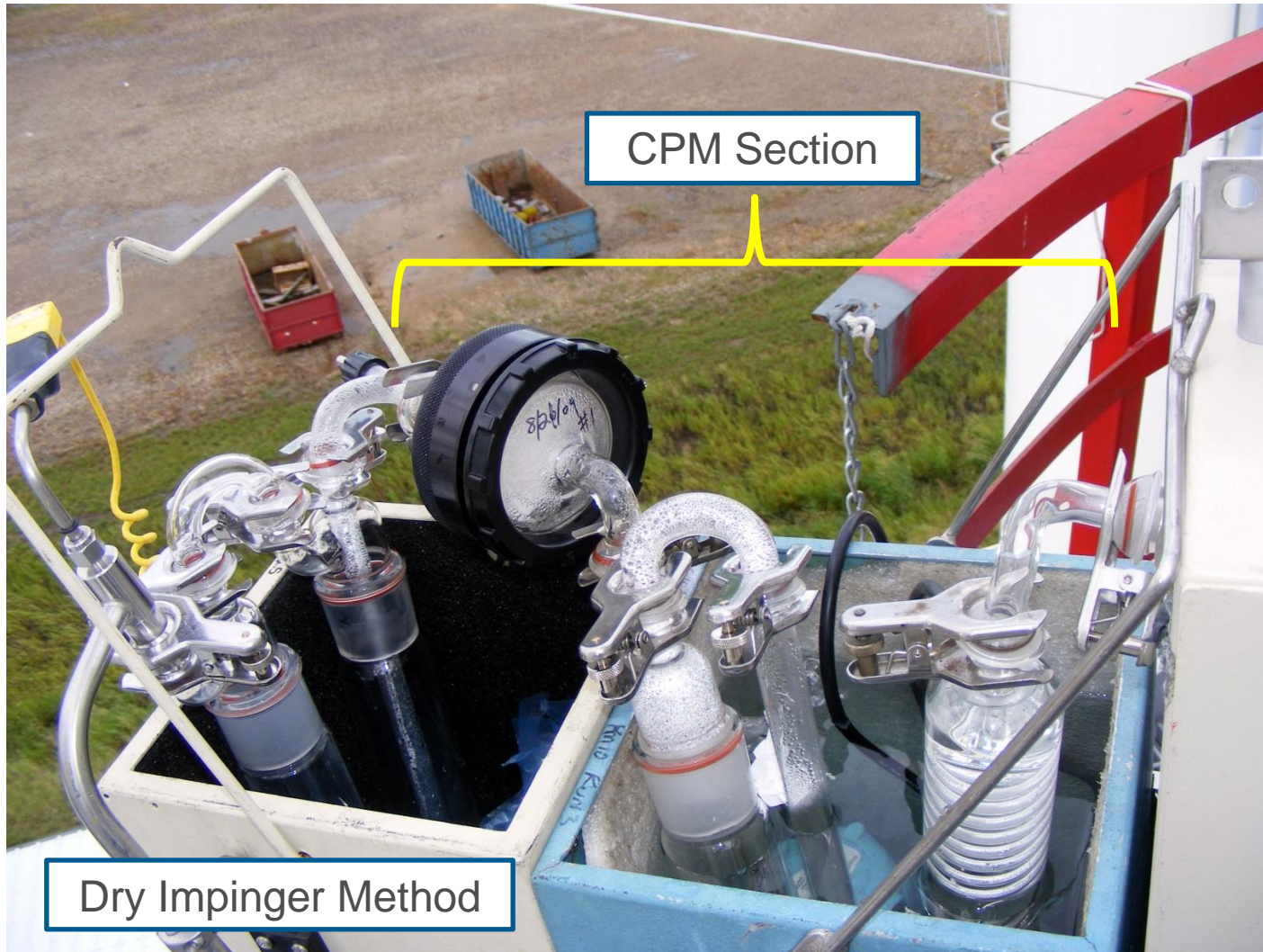


EPA Method 5/202
Sample Train

Hot Filter Box
(250°F)
(FPM fraction)

Warm Impinger Box
(85°F)
(CPM fraction)

CPM Measurement



CPM Reduction

- Air Heater Modifications (treat symptoms)
 - Modify soot blowing
 - Frequency, duration, pressure
 - Air vs. steam
 - Enamel coating
 - Add steam coils to AH primary/secondary inlet air ducts
- Eliminate CPM Precursors (fix problem)
 - DeNOx Systems (SNCR, SCR)
 - Reduce NH₃ Slip
 - Tuning – routine frequency
 - Perform dry sorbent injection (**DSI**) to mitigate SO₃

CPM Reduction

DSI Technology

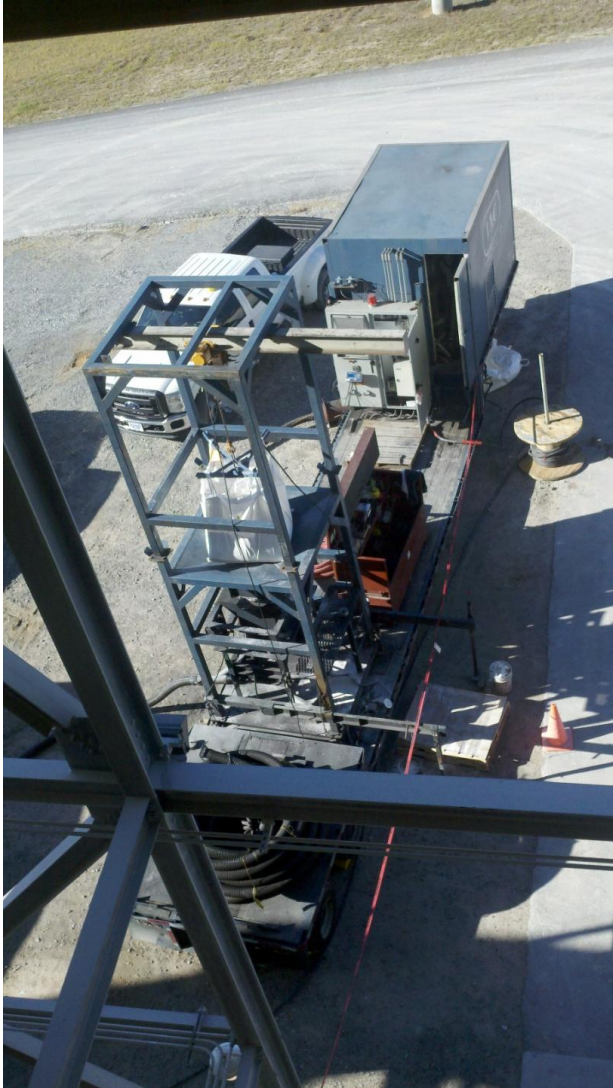
- Trona/hydrated lime: SO_2 , SO_3 , H_2SO_4 , HCl , HF
- Direct duct injection
- With ESP or FFBH
- Eliminate acid gas CPM precursors (SO_3 , HCl , HF)

CPM Reduction

Parameters Affecting Acid Gas Removal by DSI

- Sorbent injection rate
- Sorbent particle size (trona - 35 μm ; HL – 2 μm)
- Residence time in the flue gas stream
- Dispersion (mixing) within the flue gas
- Particulate control device used (ESP vs. baghouse)
- Other acid gases (e.g., high SO_2 concentration)

Case Study



Reference Unit

- Rotary Calciner
- PJFF baghouse
- Low Filterable PM (FPM < 0.01 gr/dscf)
- CPM found to be 20X FPM
- CPM almost all inorganic

Case Study

Test Run Number	1	2	3	Average
Start Time	13:30	17:41	8:22	
End Time	14:30	18:41	9:22	
Total Run Time (min)	60	60	60	
Total Filterable PM				
PM Conc. (gr/dscf)	0.0073	0.0056	0.0061	0.0063
Emission Rate (lb/hr)	2.73	2.11	2.27	2.37
CPM Organic Fraction				
CPM-Organic Conc. (gr/dscf)	0.0096	0.0009	0.0021	0.0042
Emission Rate (lb/hr)	3.57	0.35	0.77	1.56
CPM Inorganic Fraction				
CPM-Inorganic Conc. (gr/dscf)	0.131	0.124	0.147	0.134
Emission Rate (lb/hr)	48.9	46.9	55.2	50.3
Total PM				
Total PM Conc. (gr/dscf)	0.148	0.131	0.155	0.145
Emission Rate (lb/hr)	55.2	49.3	58.2	54.3
CPM-Inorganic, % of Total				
	88.6%	95.0%	94.8%	92.8%

Case Study

PM Species	Baseline PM (lb/hr)	DSI PM (lb/hr)	% RE
Filterable PM	2.4	0.3	87.5%
CPM-Inorganic ¹	50.3	1.6	96.2%
CPM-Organic	1.6	2.6	---
Total PM	54.3	4.4	91.9%

¹CPM-Inorganic is ABS, NH₄Cl and NH₄F

Questions?

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