STACK EMISSION TEST RESULTS FROM EXISTING AND NEW HIGH TEMPERATURE FLUID BED MUNICIPAL SLUDGE INCINERATORS OPERATING IN US AND ONTARIO (CA)

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ready for the resource revolution



TOPICS OF DISCUSSION

OHigh Temperature Fluid Bed Municipal Sludge Incinerators (Thermylis[®], SSI, HTFB, Thermal Oxidizer)

OMACT Background Information & MACT Limits

OMACT Compliance Equipment

OStack Emission Test Results

Conclusions

High Temperature Municipal Sludge Incinerators



NEW INCINERATOR TO MEET US EPA MACT





FLUID BED REACTOR



FLUID BED REACTOR



TYPICAL HEAT INPUT / OUTPUT





Primary Heat Exchanger (Tube & Shell)

- Preheat Combustion Air
- Eliminate Auxiliary Fuel Usage



SECONDARY HEAT RECOVERY



- Plume Suppression
- Process Steam Generation
- Seasonal Building Heating
- Thermal Fluid Heating
- Electricity Production (Turbine Generator)



ALSTOM

ALSTOM Power Energy Recovery Waste Heat Boller



DRY ASH SYSTEM (DRY APCS)



SEMI-DRY ASH SYSTEM (SEMI-DRY APCS)



Continuous Autothermic Process
Flexible Process for Variations in Total Solids
Turbulence Without Moving Parts
Nearly Isothermal Conditions
Quick Response to Variations in Feed Rate
Minimum Heat Loss During Shutdowns
High Combustion Efficiency at Low Excess Air
Power Generation









GREEN BAY, WI





SLUDGE PORT AND AUXILIARY FUEL GUNS



Sludge Lines

Fuel Injectors

SNCR FOR NOx REMOVAL



Urea, when combined with NO_X of the flue gas at high temperatures, transforms the noxious substances into N₂, CO₂ and H₂O

SNCR = Selective Non-Catalytic Reduction





REACTOR REHAB



MACT Background Information

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MACT Limits

MACT BACKGROUND INFORMATION

OMACT (Maximum Achievable Control Technology)

Olssued by US EPA on March 21st, 2011

OApplies to new and existing municipal sludge fluid bed incineration plants in US

Compliance by March 21st, 2016 for all plants in operation

OPlants not in compliance with MACT should be retrofitted to meet the new emission limits

Retrofit Equipment: Wet ESP, Mercury Removal System, Scrubber Caustic Addition, NOx Removal System

US EPA MACT LIMITS

EPA Guideline for NEW and EXISTING FB Incinerators

Pollutant	Units	Existing FB	New FB
		(@ 7% O ₂)	(@ 7% O ₂)
Cd	mg/dscm	0.0016	0.0011
СО	ppmvd	64	27
HCI	ppmvd	0.51	0.24
Hg	mg/dscm	0.037	0.0010
NO _x	ppmvd	150	30
Pb	mg/dscm	0.0074	0.00062
PCDD/PCDF,TEQ	ng/dscm	0.1	0.0044
PCDD/PCDF,TMB	ng/dscm	1.2	0.013
PM	mg/dscm	18	9.6
SO ₂	ppmvd	15	5.3

Pollutant based equipment selection			
Pollutant	Equipment		
со	High Efficiency Combustion		
NO _x	Ammonia/Urea Injection at Freeboard (SNCR)		
SO ₂	Caustic injection at Wet Scrubber		
нсі			
РМ	Venturi Scrubber + Wet ESP		
Cd			
Pb			
Hg	Fixed Carbon Bed Adsorber		
PCDD/PCDF,TEQ			
PCDD/PCDF,TMB			

MACT Compliance Equipment

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TYPICAL PROCESS FLOW DIAGRAM (RETROFIT EQUIPMENT)



SPC: Sorbent Polymer Composite

TYPICAL PROCESS FLOW DIAGRAM (RETROFIT EQUIPMENT)



Stack Emission Test Results

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RETROFIT PLANT INFORMATION (SPC MODULES)



Scrubber

SPC Modules











THERMYLIS PLANT EMISSIONS (EXISTING INCINERATORS)



Average mercury removal efficiency for Incinerator 4, 5, 6 and 7 = 87%

NEW PLANT INFORMATION (FIXED CARBON BED)

Adsorber

To Stack



Start Up Heater Skid







Incinerator No. 1 is equipped with fixed carbon bed installed after scrubber (Canadian Installation)



Incinerator No. 2 is equipped with fixed carbon bed installed after scrubber (Canadian Installation)



Incinerator No. 3 is equipped with fixed carbon bed installed after wet ESP (US Installation)

INCINERATOR NO. 4 & 5





Incinerator No. 5



Incinerators No. 4 & 5 are equipped with fixed carbon bed installed after scrubber (Canadian Installation)



Incinerators No. 6 is equipped with fixed carbon bed installed after scrubber (Canadian Installation)



Incinerators No. 7 is equipped with fixed carbon bed installed after scrubber (Canadian Installation)



Incinerator No. 8 is equipped with fixed carbon bed installed after wet ESP (US Installation)

MERCURY EMISSIONS (SPC)







Existing Incinerators (US Installation) -vs- Ontario (CA)



MERCURY EMISSIONS (FIXED CARBON BED)



FIXED CARBON BED MERCURY REMOVAL EFFICIENCY



Conclusions



CONCLUSIONS

- 9 existing and 8 new incinerators have been considered for this study. Incinerators are located in US and Ontario (CA).
- Retrofitted plants are meeting the MACT emission limits in US.
- For new incineration systems in US, we recommend fixed carbon bed adsorber to be able to meet 1 micron/dscm mercury emission requirement in stack. Extremely high efficiency (>95%).
- For existing incineration systems in US, we recommend SPC modules to be able to meet 37 micron/dscm mercury emission requirement. Low removal efficiency (>70%).
- Fixed carbon bed adsorber is difficult to operate compared to SPC modules. However, it has significantly higher removal efficiency.
 - For new incineration systems in Ontario (CA) (70 microgram/drm3), we recommend SPC modules for mercury removal.

Thank you

