Results of the MACT Comprehensive Performance Test of the DOE Oak Ridge TSCA Incinerator

By

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American Institute of Chemical Engineers

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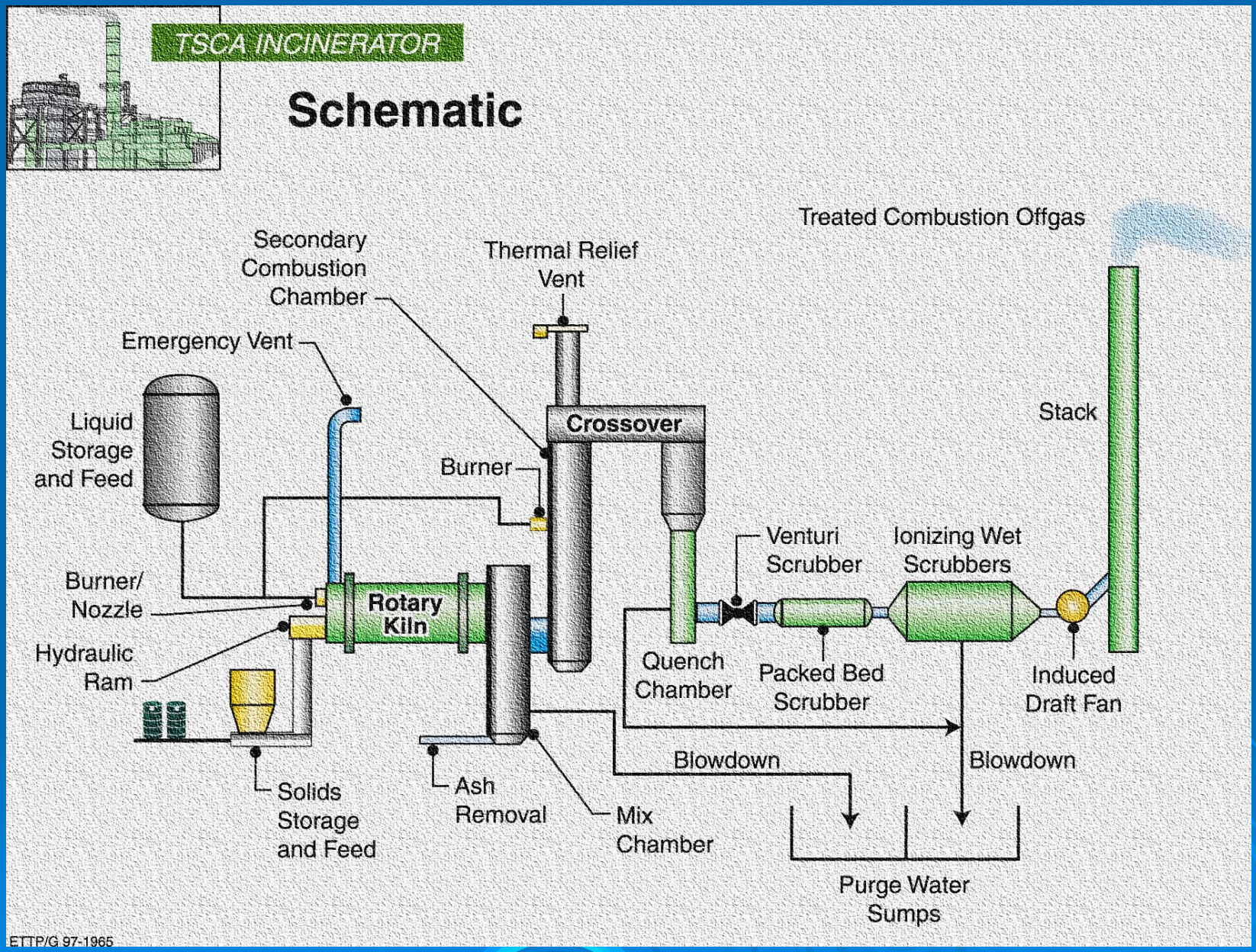

TSCA INCINERATOR
Schematic
Treated Combustion Offgas
Secondary Combustion Chamber
Thermal Relief Vent
Emergency Vent
Liquid Storage and Feed
Crossover
Stack
Burner
Venturi Scrubber
Ionizing Wet Scrubbers
Burner/ Nozzle
Rotary Kiln
Hydraulic Ram
Quench Chamber
Packed Bed Scrubber
Induced Draft Fan
Blowdown
Blowdown
Solids Storage and Feed
Ash Removal
Mix Chamber
Purge Water Sumps
ETTP/G 97-1965

Purpose of Testing

- Demonstrate Compliance with MACT Standards
  - Maximum Achievable Control Technology
  - National Emission Standards for Hazardous Air Pollutants (NESHAPS) for Hazardous Waste Combustors
  - 40 CFR 63, Subpart EEE (1200 to 1213)
- Obtain a MACT Title V Operating Permit

Testing Strategy

- Obtain a "Data-In-Lieu-Of" Approval for Results from the 2001 Trial Burn
  - Previous Results Show Acceptable Emissions for Some Constituents
    - Dioxins/Furans
    - Mercury
    - HCl/Cl_2
  - Obtaining Credit Allows a Reduced Scope and Cost Compliance Test

Testing Strategy

- Show Compliance with the Remaining Emission Standards
  - Particulate
  - Semi-Volatile Metals (Cd and Pb)
  - Nonvolatile Metals (As, Be, and Cr)
  - Destruction and Removal Efficiency
  - Total Hydrocarbons

Testing Strategy

- The Results of the 2001 Trial Burn Did Not Demonstrate Simultaneous Compliance with the DRE Standard and the Carbon Monoxide Standard or the Total Hydrocarbon Standard
  - The THC Instrument Malfunctioned
  - The Incinerator Experienced CO Spikes above 1000 ppmv

Testing Objectives -Emission Standard Demonstration

- Particulate: <0.015 gr/dscf @ 7%O_2 (34 mg/dscm @ 7%O_2)
- Semi-Volatile Metals: <240 µg/dscm @ 7%O_2
- Nonvolatile Metal: <97 µg/dscm @ 7%O_2
- DRE: >99.99%
- THC: <10 ppmv

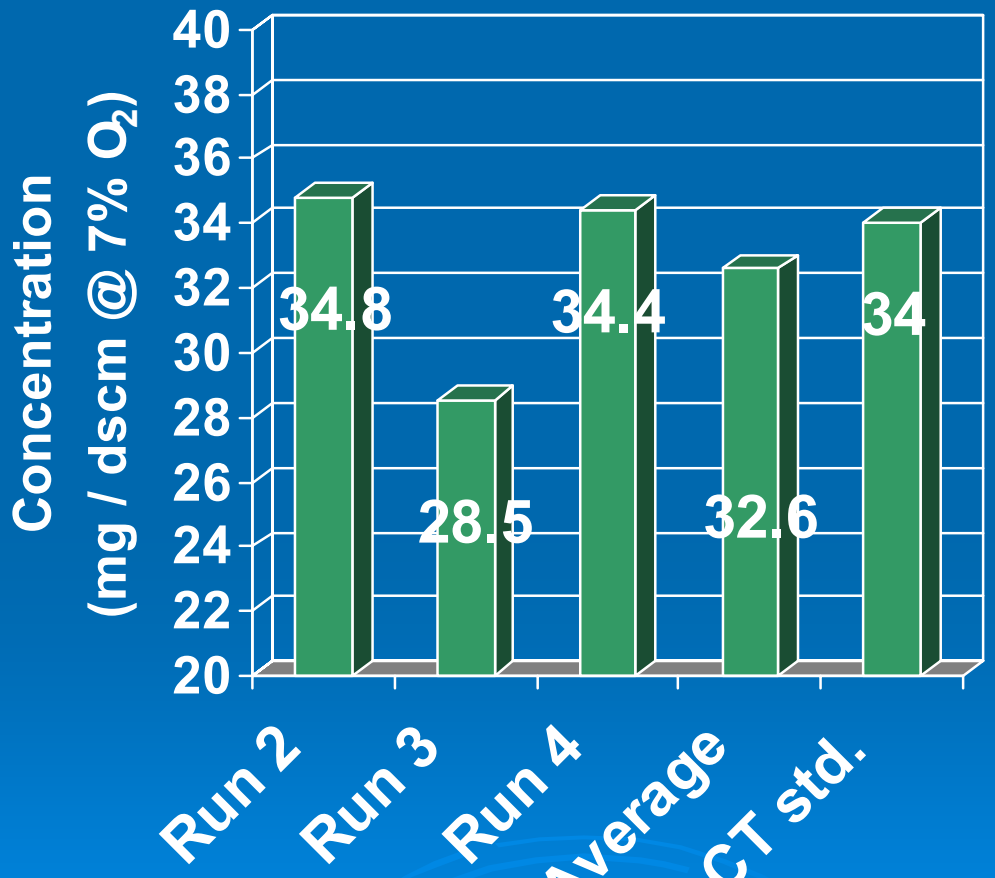
Testing Objectives
-Establish Operating Parameter Limits

- Duplicate the 2001 Trial Burn Operating Parameters to have Consistency with the “Data-In-Lieu-Of” Operating Conditions
- Obtain Operating Parameters Limits (OPL) for the Parameter Requirements in 40 CFR 1209 (i) through (p)

TSCA Incinerator Testing

- Pre-Testing Conducted December 16, 2004
- Comprehensive Performance Test (CPT) Conducted March 15 to 18, 2005

Particulate Emissions



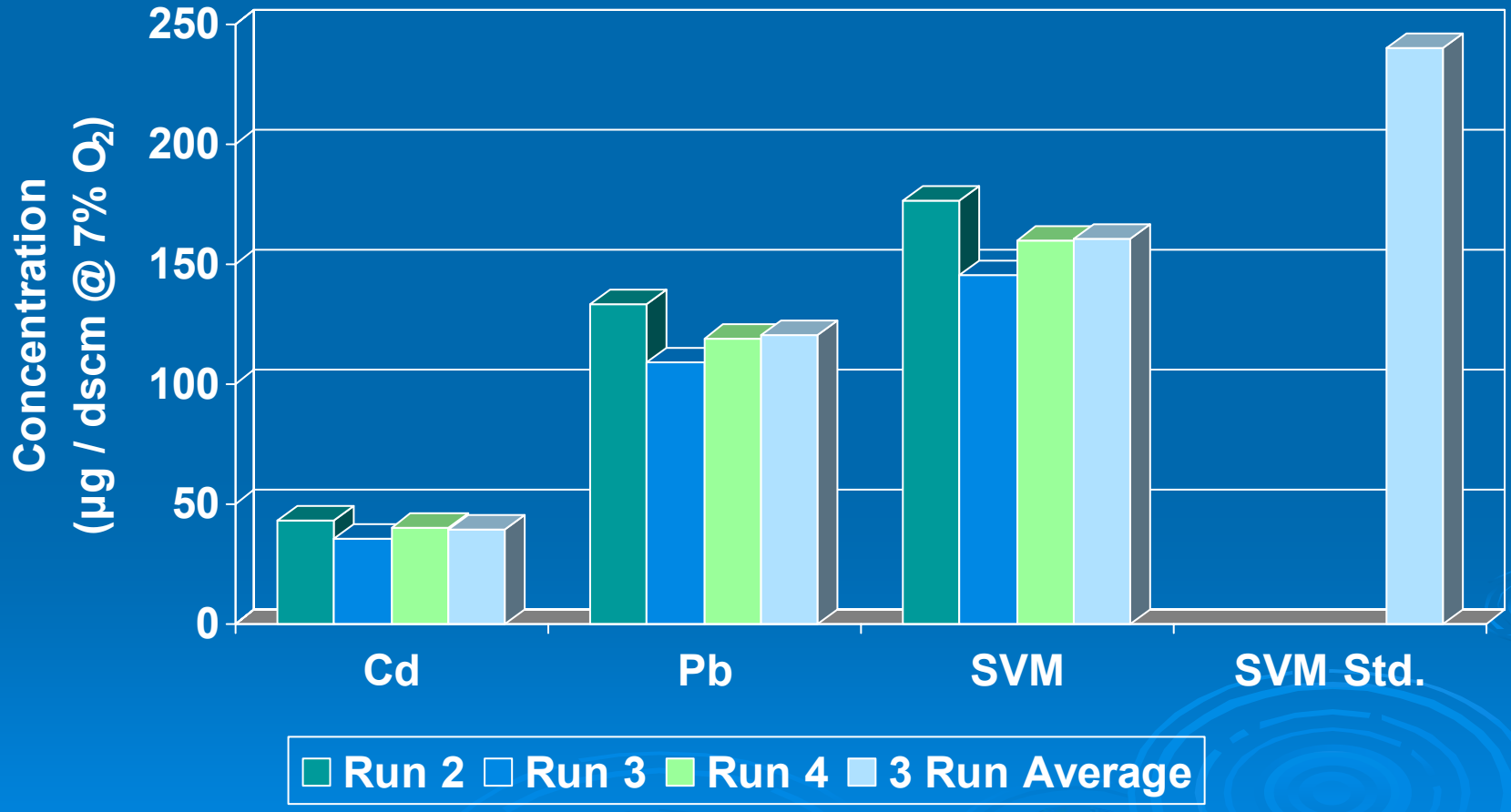
Ash Feed With Liquids

- Run 2: 7.7 lbs/hr
- Run 3: 7.9 lbs/hr
- Run 4: 8.2 lbs/hr

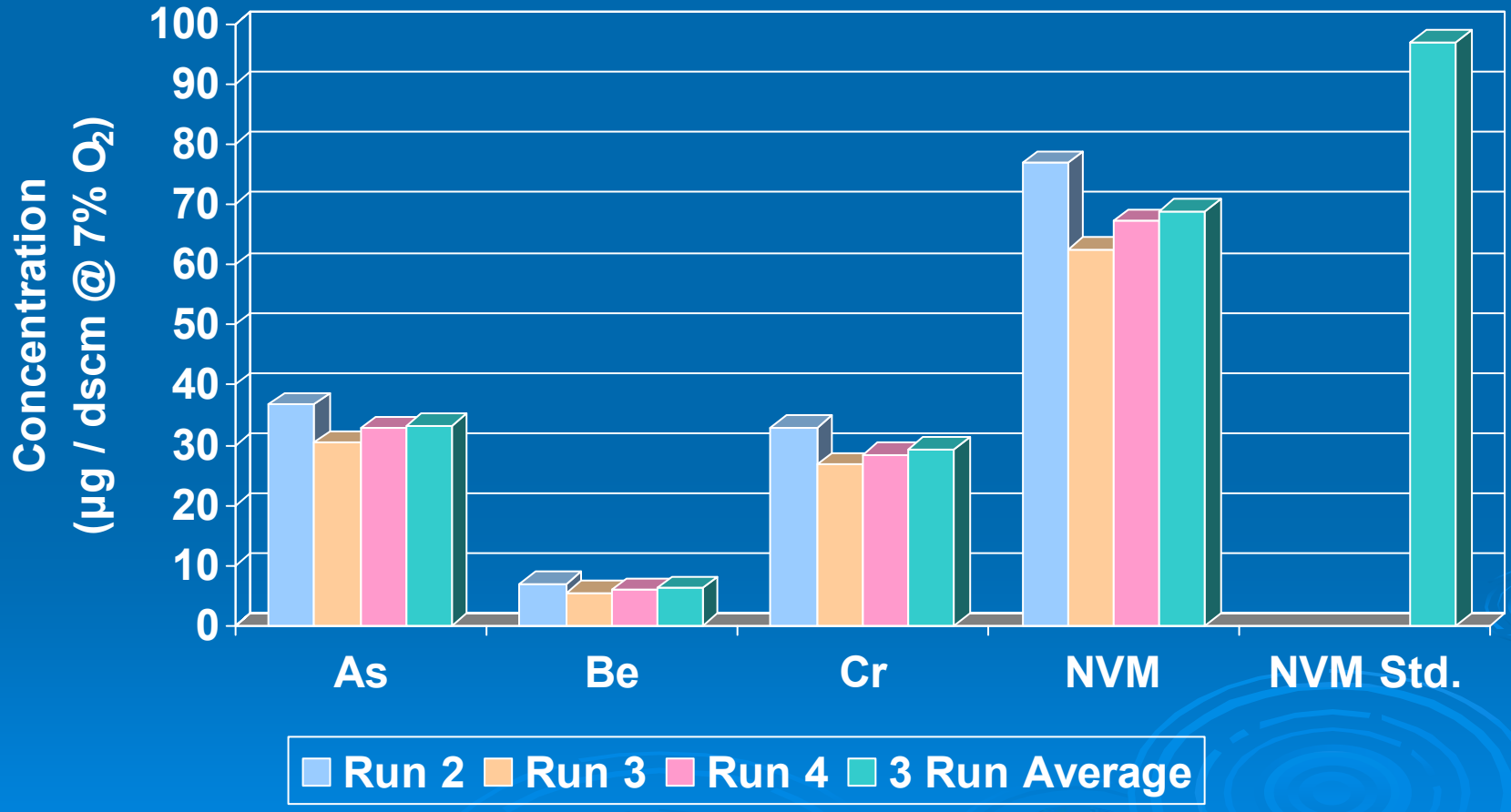
Ash Feed With Solids

- Run 2: 93.6 lbs/hr
- Run 3: 109 lbs/hr
- Run 4: 112 lbs/hr

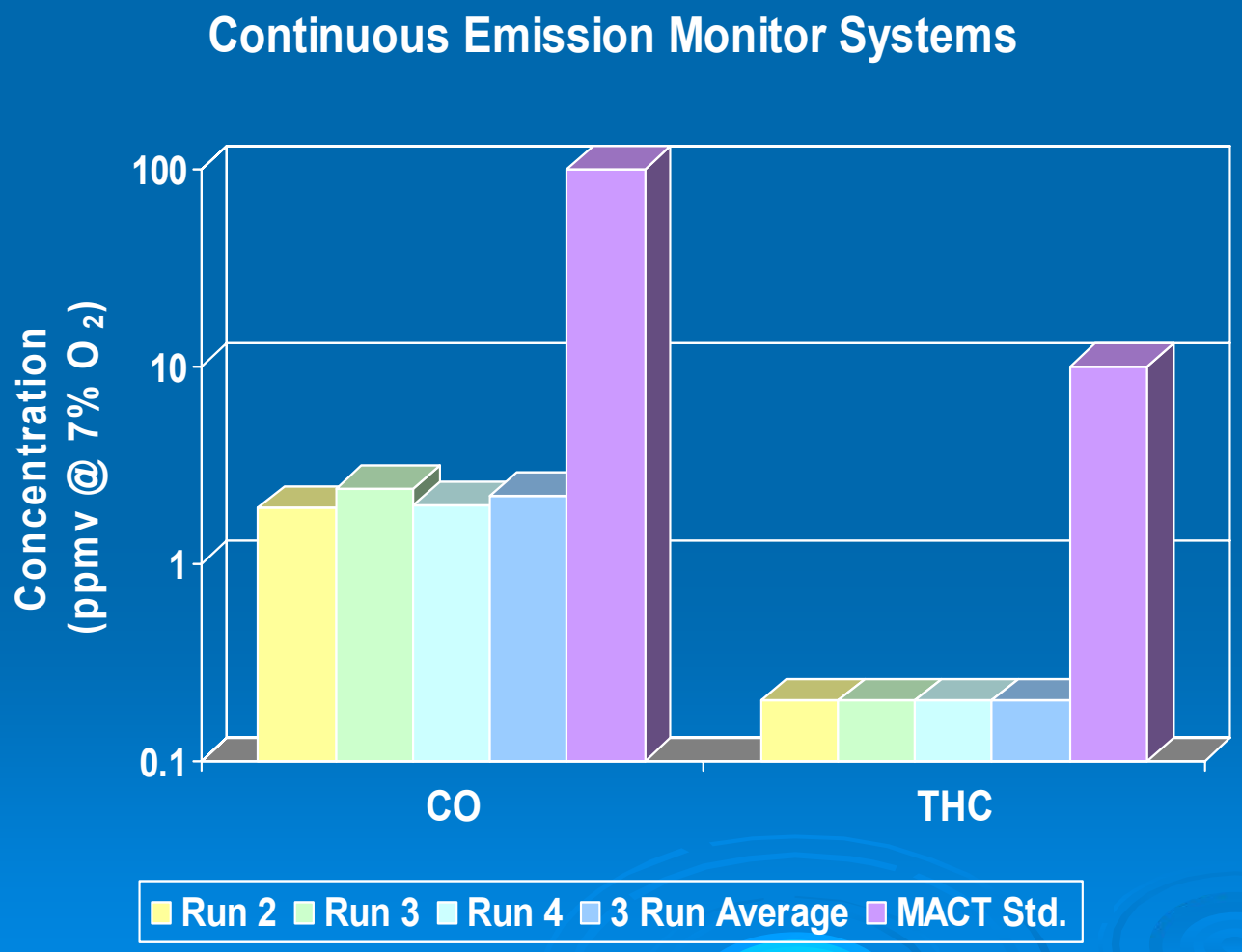
SVM Emissions



NVM Emissions



Emissions
- Combustion Parameters



DRE Results:

CCl_4: >99.99980
1,2,4-TCB: >99.999925

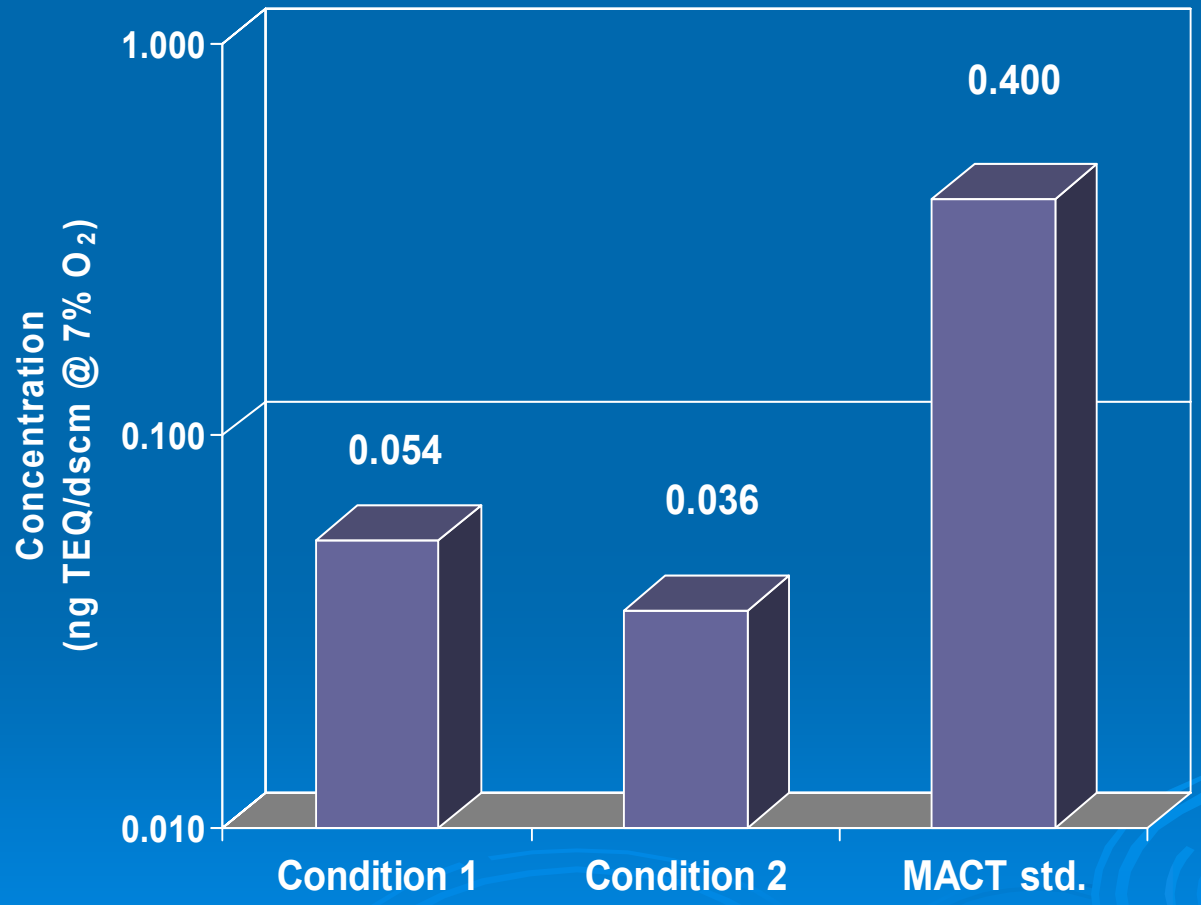
Spike Rates:

CCl_4: 20.6 lbs/hr
1,2,4-TCB: 63.7 lbs/hr

Concentrations Reported on a Dry Basis

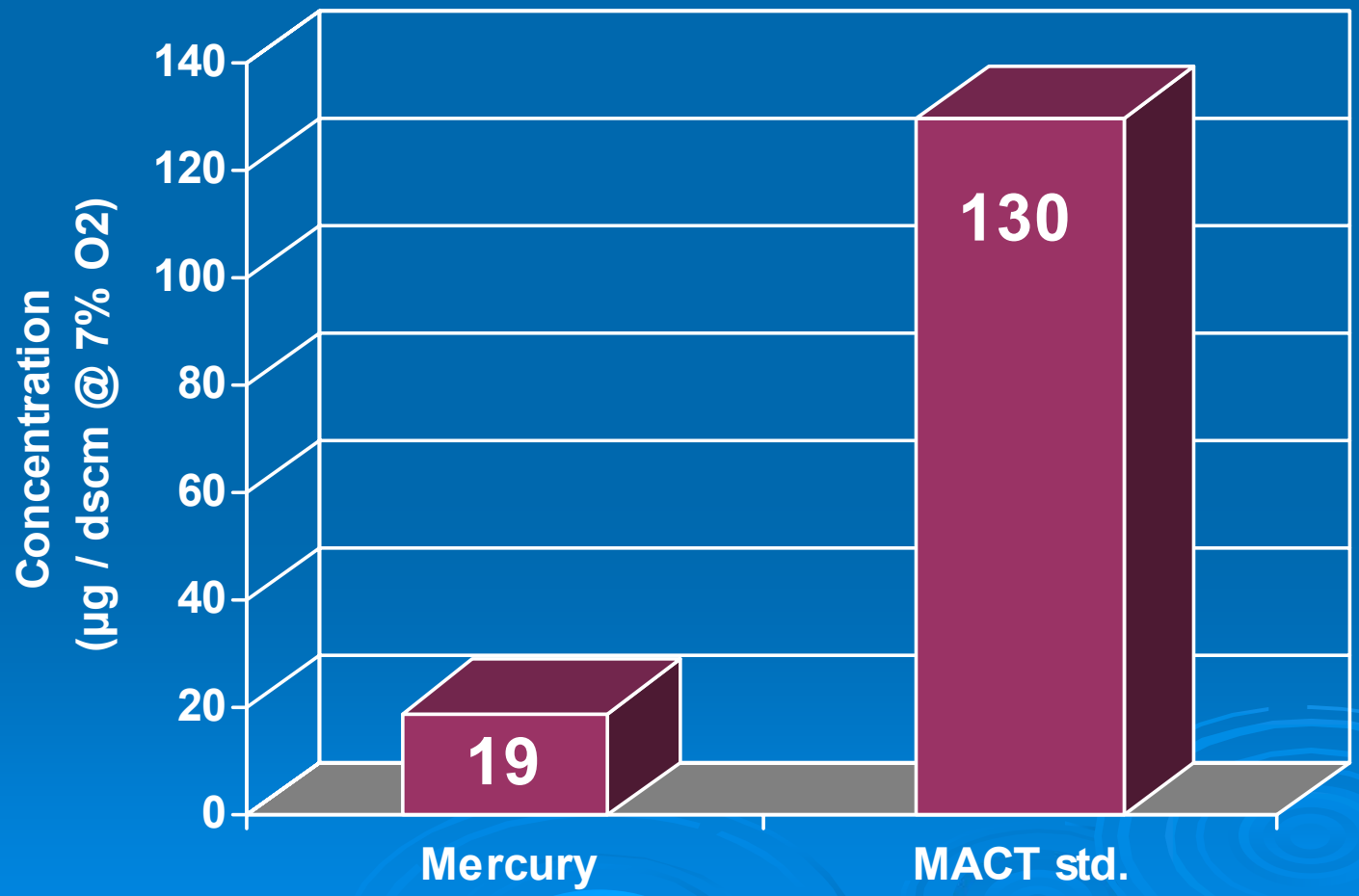
THC Reported as “Propane Equivalent”

Emissions Previously Reported - Dioxins/Furans (PCDD/PCDF)

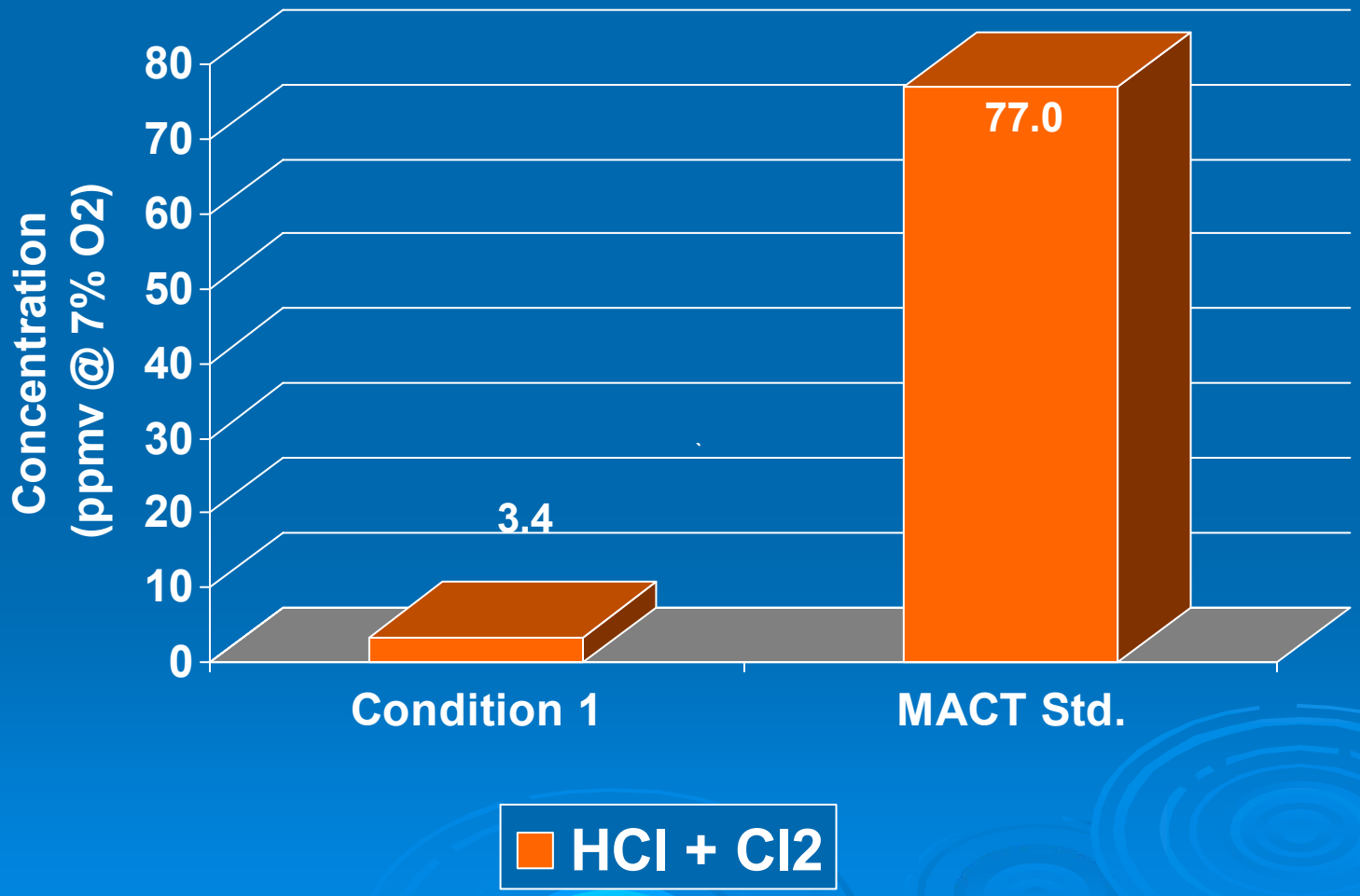


TEQ – Toxicity Equivalent Quotient is an international standard method of quantifying the toxicity of the various dioxin/furan congeners to the toxicity of the most toxic congener 2,3,7,8 – Tetrachlorodibenzo(p)dioxin.

Emissions Previously Reported - Mercury Emissions



Emissions Previously Reported - HCl/Cl_2 Emissions



Operating Parameter Limits

40 CFR 63.1209 Reference Paragraph	Operating Parameter	Proposed Operating Parameter Limits	Comments
(j) DRE			
(j)(1)	Minimum combustion chamber temperatures	1,580°F at rotary kiln (primary combustion chamber) exit 2,205°F at the secondary combustion chamber exit	HRA AWFCO, established in data-in-lieu-of approval (DILOA) for dioxins/furans (D/F) HRA AWFCO, established In DILOA for D/F
(j)(2)	Maximum combustion gas velocity in the stack	23.0 feet/second	HRA AWFCO, established in DILOA for D/F and HCl/Cl2
(j)(3)	Maximum hazardous waste feed rates:		
	Maximum organic liquid feed rate to the kiln	443.5 lbs/hr	HRA AWFCO, established in the CPT
	Maximum organic liquid feed rate to the SCC	459.2 lbs/hr	HRA AWFCO, established in the CPT
	Maximum aqueous feed rate to the kiln (hourly rolling average)	478 lbs/hr	HRA AWFCO, established in DILOA for D/F
	Maximum solid waste feed rate to the kiln (hourly rolling average)	801.9 lbs/hr	HRA AWFCO, Established in the CPT
(j)(4)	Operation of waste firing system:		
	Minimum atomization pressure for organic liquid waste feed systems and aqueous waste feed systems	7.5 psig, each	Administrative control
	Maximum stack gas carbon monoxide	100 ppm	HRA AWFCO -limit always In-effect when feeding hazardous waste
	Maximum viscosity of organic liquids fed to kiln and SCC	100 centipoises	Administrative control

Operating Parameter Limits

40 CFR 63.1209 Reference Paragraph	Operating Parameter	Proposed Operating Parameter Limits	Comments
(k) Dioxins and furans:			
(k)(2)	Minimum combustion chamber temperatures	1,580°F at rotary kiln exit 2,205°F at the secondary combustion chamber exit	HRA AWFCO, established in DILOA for D/F HRA AWFCO, established in DILOA for D/F
(k)(3)	Maximum combustion gas velocity In stack	23.0 feet/second	HRA AWFCO, established in DILOA for D/F and HCl/Cl2
(k)(4)	Maximum hazardous waste feed rates	Same as provided above for DRE	HRA AWFCO, Established in the CPT
(l) Mercury:			
(l)(1)	Total mercury feed rate in all feed streams	0.0040 lbs/hr	12 hour rolling average AWFCO, flow basis established in the 2001 Trial Burn (zero removal basis)
(l)(2)	Wet scrubber parameters (See scrubber parameters below for hydrochloric acid and chlorine gas)	Not applicable when using a zero percent removal assumption.	Not applicable

Operating Parameter Limits

40 CFR 63.1209 Reference Paragraph	Operating Parameter	Proposed Operating Parameter Limits	Comments
(n) Semi-volatile metals and nonvolatile metals:			
(n)(2)	Feed-rate limits:		
	-Combined cadmium and lead	$F_{Pb} / 8.6 + F_{Cd} / 10.4 \leq 1.0$ Where: F_{Pb} = Mass feed rate of Lead in the total waste feed (g/hr), and F_{Cd} = Mass feed rate of Cadmium in the total waste feed (g/hr).	12 hour rolling average AWFCO, established in the CPT
	-Combined arsenic, beryllium, and chromium	$F_{As} / 6.8 + F_{Be} / 22.5 + F_{Cr} / 9.3 \leq 1.0$ Where: F_{As} = Mass feed rate of Arsenic in the total waste feed (g/hr), F_{Be} = Mass feed rate of Beryllium in the total waste feed (g/hr), and F_{Cr} = Mass feed rate of Chromium in the total waste feed (g/hr).	12 hour rolling average AWFCO, established in the CPT

Operating Parameter Limits

40 CFR 63.1209 Reference Paragraph	Operating Parameter	Proposed Operating Parameter Limits	Comments
(m) Particulate matter:			
(m)(1)(A)	Minimum venturi scrubber pressure drop	No less than 8.6 in. W.C.	HRA AWFCO, established in DILOA for D/F and HCl/Cl2
(m)(1)(B)(2)	Maximum scrubber liquid solids content	27,336 µmhos/cm total blowdown conductivity for combined quench recycle and IWS	HRA AWFCO, established in the CPT
(m)(1)(B)(4)	Minimum blowdown rate	Not required; measuring solids content.	
(m)(1)(C)	Venturi minimum water flow	122 gpm	HRA AWFCO, established in DILOA for D/F and HCl/Cl2
(m)(1)(D)	Minimum IWS voltage	20,597 (IWS-1) 19,970 (IWS-2) volts per stage	HRA AWFCO, established in the CPT
(m)(2)	Maximum combustion gas velocity In stack	23.0 feet/second	HRA AWFCO, established in DILOA for D/F and HCl/Cl2
(m)(3)	Maximum ash feed rate: -Liquid waste feed (hourly rolling average) -Solid waste feed (hourly rolling average)	 8.14 lbs/hr 118.1 lbs/hr	 HRA AWFCO, established in the CPT HRA AWFCO, established in the CPT

Operating Parameter Limits

40 CFR 63.1209 Reference Paragraph	Operating Parameter	Proposed Operating Parameter Limits	Comments
(o) Hydrochloric acid and chlorine gas:			
(o)(1)	Limit for total feed-rate of chlorine and chloride (organic and inorganic) in all feed streams	151 1bs/hr	12 hour rolling average AWFCO, established in DILOA for D/F and HCl/Cl2
(o)(2)	Maximum combustion gas velocity In stack	23.0 feet/second	HRA AWFCO, established in DILOA for D/F and HCl/Cl2
(o)(3)(i)	Minimum venturi scrubber pressure drop	8.6 inches W.C.	HRA AWFCO, established in DILOA for D/F and HCl/Cl2
(o)(3)(ii)	Minimum pressure drop across the packed bed scrubber	0.1 inches W.C.	Design value – administrative limit
(o)(3)(iii)	Minimum liquid feed pressure to the packed bed scrubber	7 psig	Design value – administrative limit
(o)(3)(iv)	Minimum pH for packed bed scrubber	6.2 pH Units	HRA AWFCO, established in DILOA for D/F and HCl/Cl2
(o)(3)(v)	Minimum scrubber water flow rates (hourly rolling averages): Venturi Packed bed IWS	 122 gpm 119 gpm 446 gpm	HRA AWFCO for each, established in DILOA for D/F and HCl/Cl2

Operating Parameter Limits

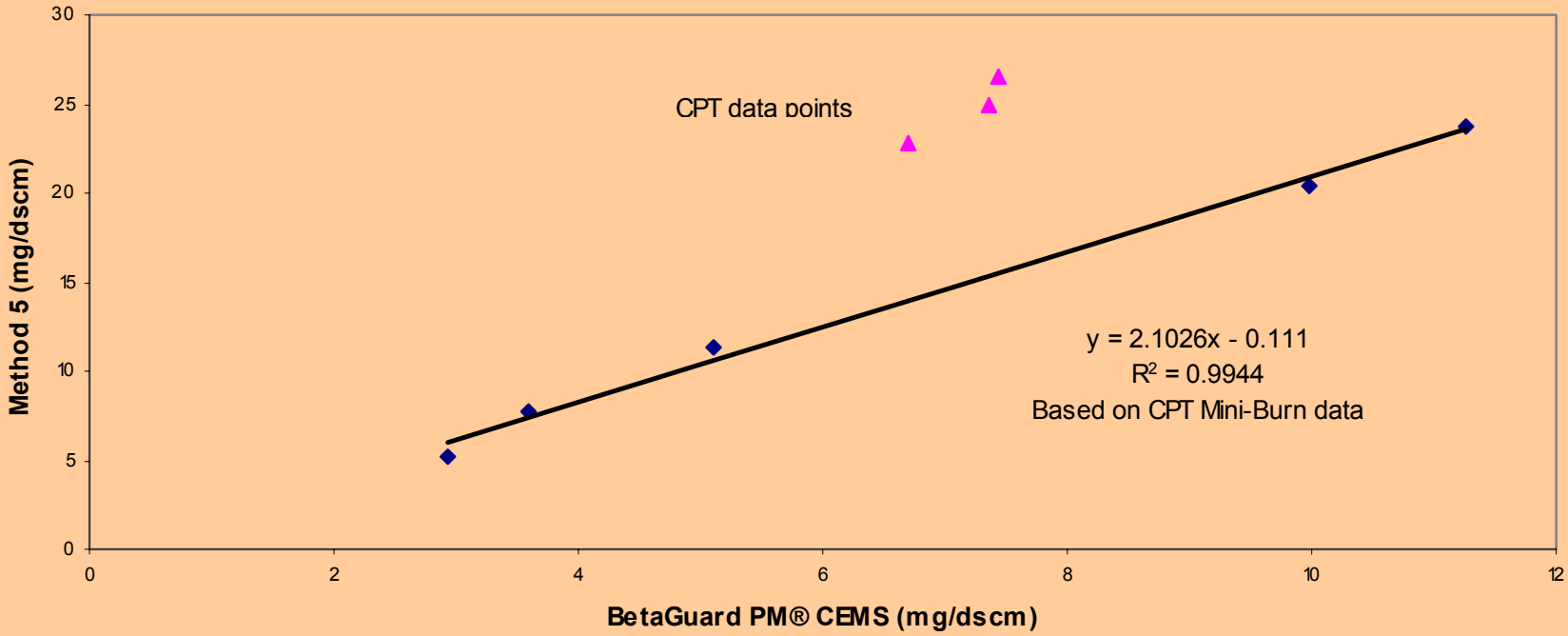
40 CFR 63.1209 Reference Paragraph	Operating Parameter	Proposed Operating Parameter Limits	Comments
(p) Maximum combustion chamber pressure			
(p)	Maximum combustion chamber pressure lower than ambient pressure	0.0 in W.C.	Instantaneous AWFCO
Other parameters:			
	Quench Chamber Maximum outlet temperature	210°F	Instantaneous AWFCO
	Thermal relief vent open	Open	Instantaneous AWFCO
	Kiln surge vent opening	Open	Instantaneous AWFCO
	Loss of kiln rotation	0 RPM	Instantaneous AWFCO
	Loss of kiln combustion fan	Fan not running	Instantaneous AWFCO
	Loss of SCC combustion fan	Fan not running	Instantaneous AWFCO
	Burner flameout on burner Tags 501 or 516	Flameout	Instantaneous AWFCO

Operating Parameter Limits

- Requested the RCRA Permit Conditions that are Duplicated by MACT OPL be Removed from the Facility RCRA Permit

BetaGuard PM® Particulate Emission Monitor

Figure 2. BetaGuard PM® and Mini-Burn Method 5 Correlation with CPT Data Superimposed

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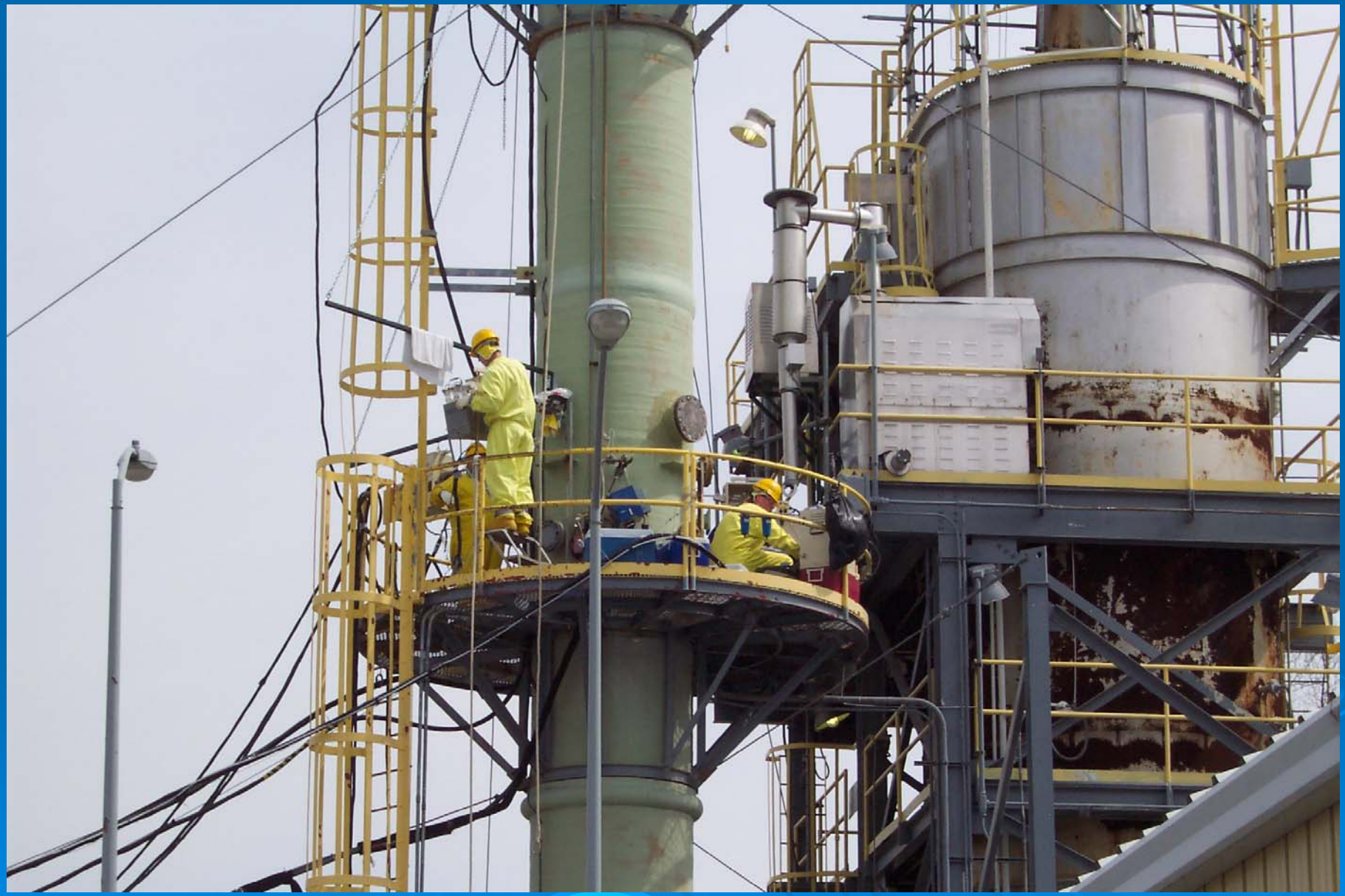

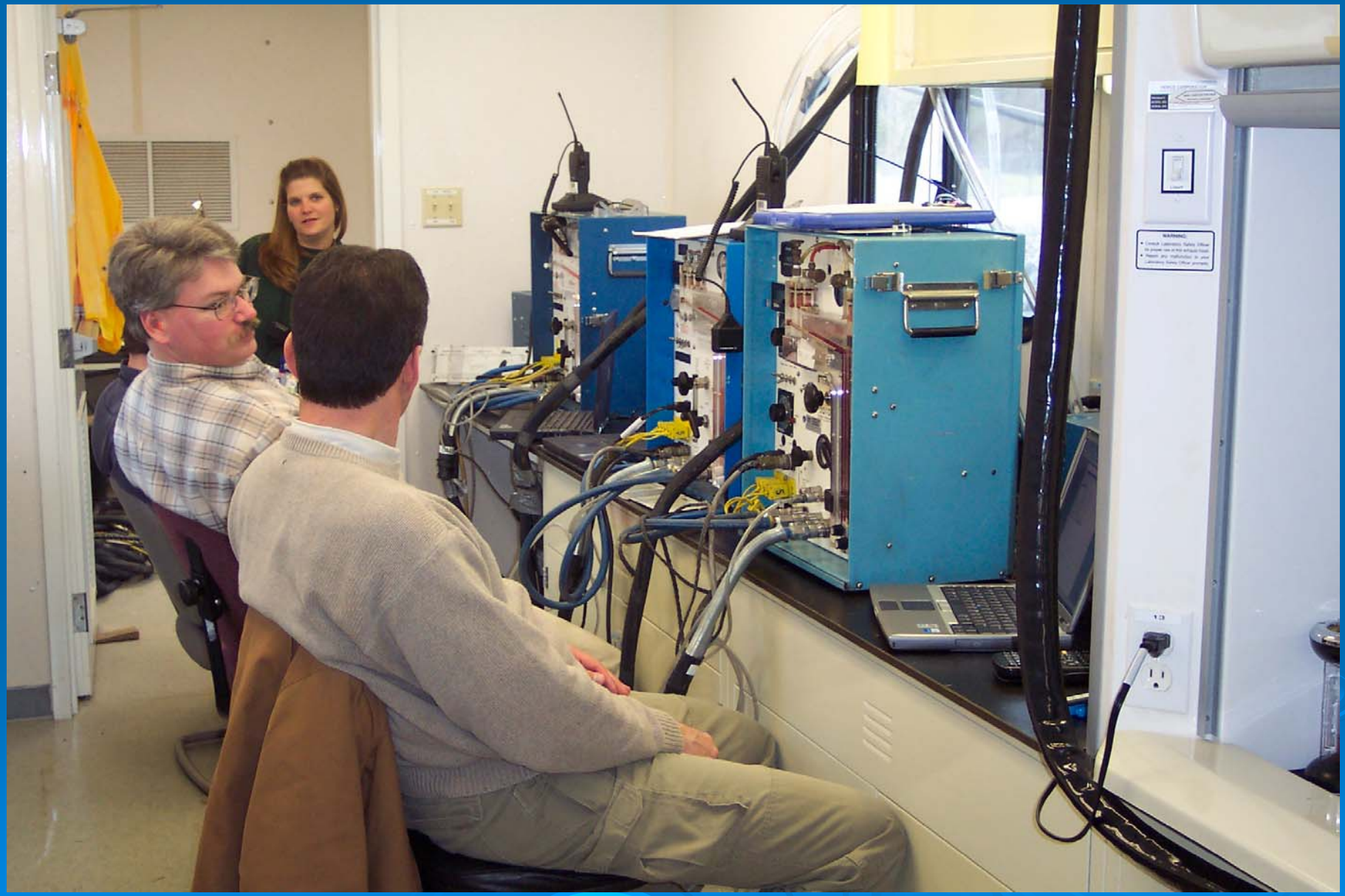


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