Review of Hazardous Waste Combustion

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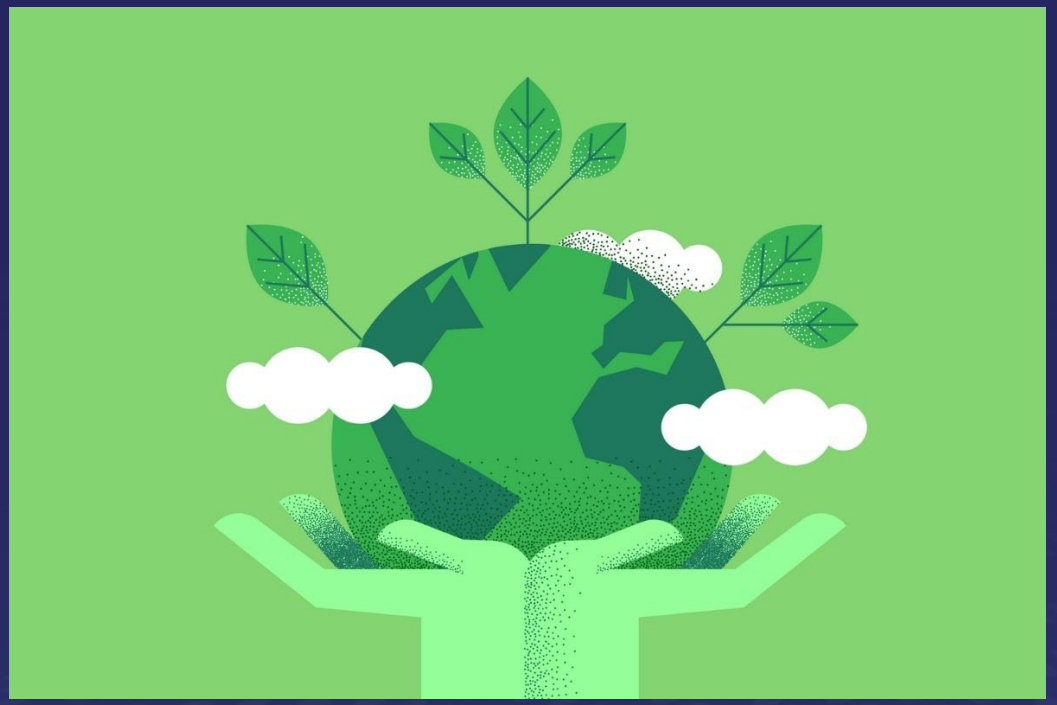
Hazardous Waste Combustion Regulatory Programs

- Resource Conservation and Recovery Act (RCRA)
- Title V of the Clean Air Act (CAA)
  - Maximum Achievable Control Technology (MACT)

Resource Conservation and Recovery Act (RCRA)

- Part B permitting
- Trial Burn
- Monitoring & Recordkeeping



Joint Authority of RCRA and CAA

- Title V permit focuses on the operation of the combustion unit
  - Air emission
  - Related operating parameter
- RCRA permit focuses on basic hazardous waste management
  - General facility standards
  - Corrective action
  - Other combustor-specific concerns
  - Other hazardous waste management units

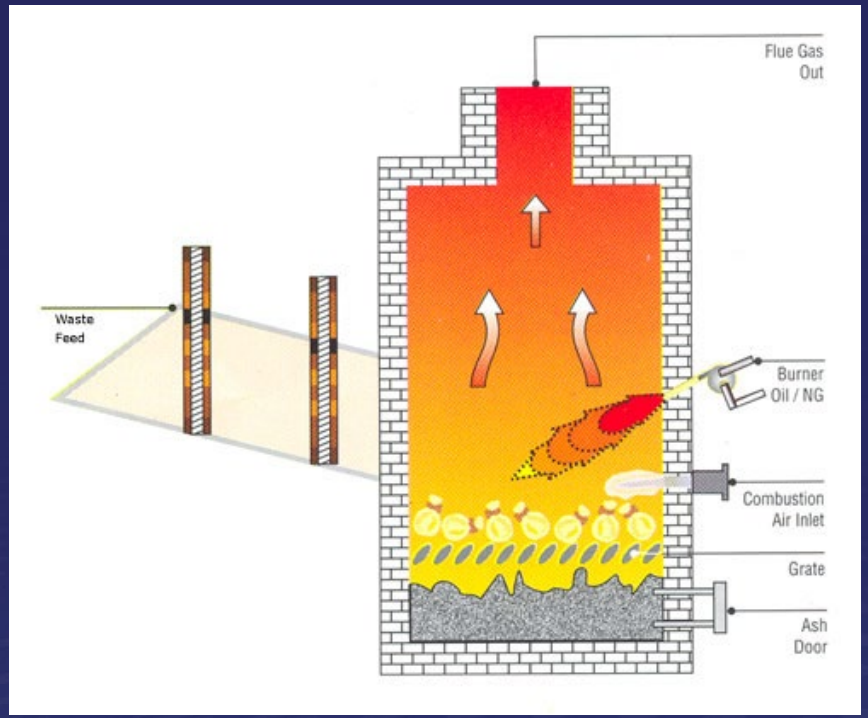
Examples of RCRA to MACT Changes

- Revised (Lower) Emission Standards
- Group Metals (SVM, LVM, VM)
- Feedstream analysis plan
- MACT Startup, Shutdown & Malfunction (SSM) and Operations & Maintenance (O&M) Plans
- Comprehensive Performance Test (CPT)
- Notification of Compliance (NOC)

Hazardous Waste Combustion Units in Texas

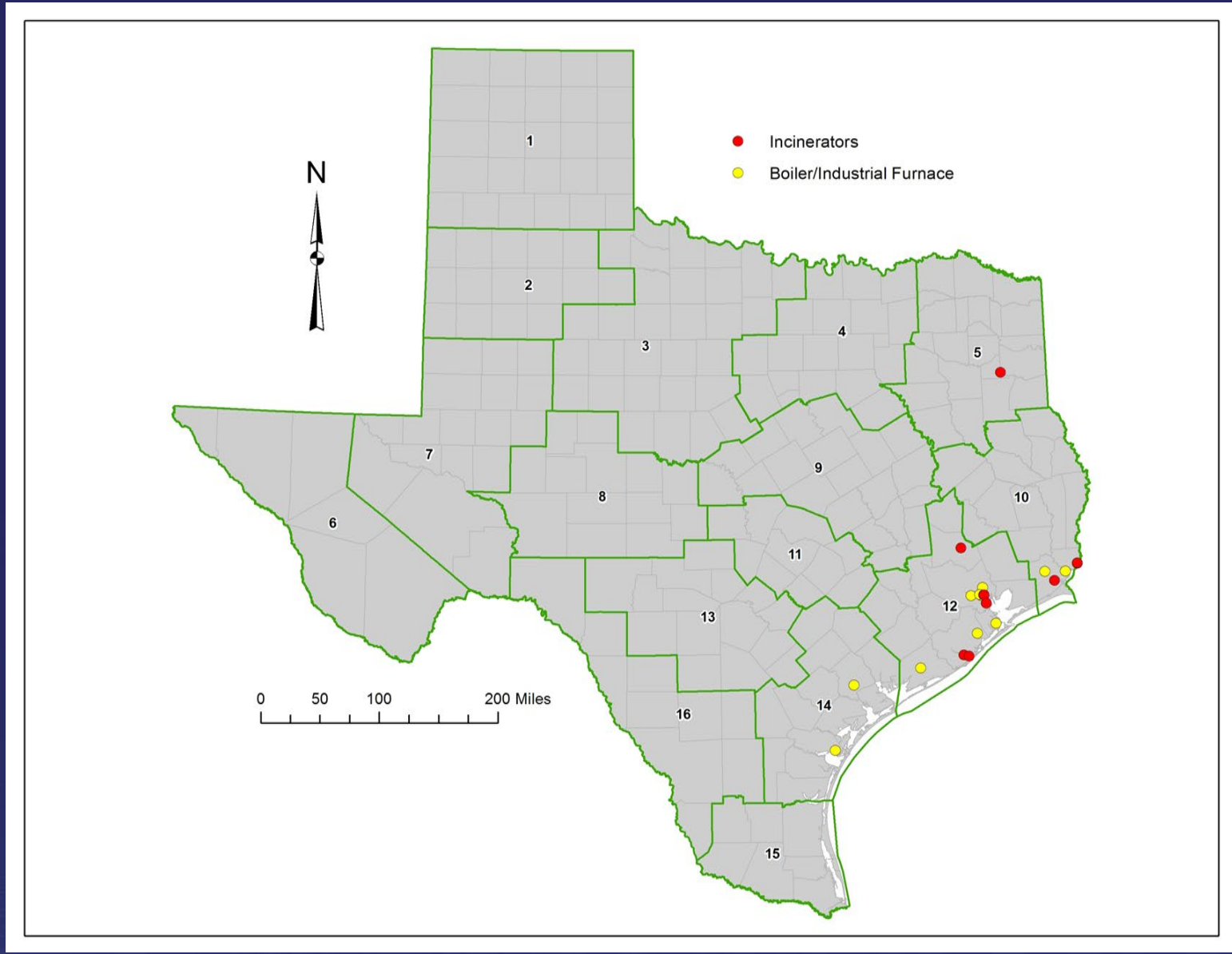
62 combustion units across 24 sites

- 14 Incinerators
- 34 Liquid-Fired Boilers
- 8 Halogen Acid Furnaces
- 1 Sulfuric Acid Furnace
- 5 Miscellaneous Units



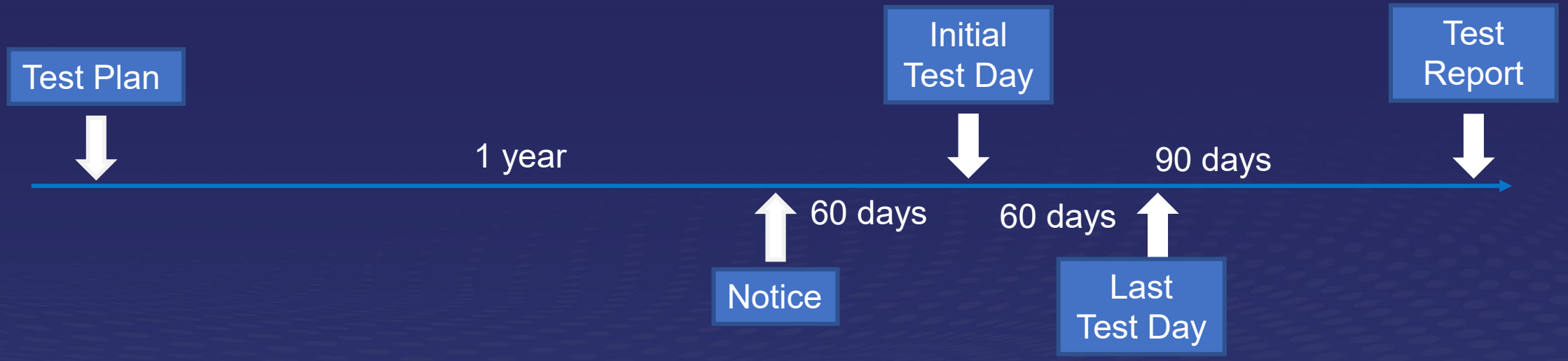
Location of Combustion Units

Regions 5, 10, 12, 14



Performance Testing Requirements

- Trial Burn Test – approved Trial Burn Plan
- Comprehensive Performance Tests (CPT) – 5 years
- Dioxin/Furan Confirmatory Performance Tests (CfPT) - 31 months



Combustion Test Plans Tools

- CPT Plan Common Deficiencies
- CPT Plan Cover Sheet
- CPT Plan Review Checklist

CPT Cover Sheet

Comprehensive Performance Test Plan Cover Sheet

Source	
Location	
Unit Type	
Unit ID	
Date of Latest NOC (month/Day/Year)	
Start Date of Latest CPT (month/Day/Year)	
Next CPT Start Deadline (month/Day/Year)	

Check All That Apply:

Source Information:

	Source Type	Regulations
	Incinerator	63.1219
	Liquid Fuel Boiler	63.1217
	Halogen Acid Furnace	63.1218
	Solid Fuel Boiler	63.1216

CPT Review Checklist - Start

I&HW Comprehensive Performance Test Plan Review Checklist

This checklist is designed to remove line items that are not applicable based on the characteristics of the facility. After indicating the facility's characteristics in the form, any not applicable items will be sorted to the bottom of the checklist and grayed out.

INSTRUCTIONS

1. Press the "SCREENING FORM" button to access the form
2. Fill out the form with the site/test characteristics
3. When all entries are made, press the "Get Checklist" button on the form
4. Not applicable items will be sorted to the bottom of the checklist and grayed out
5. If after generation of a sorted checklist there is a need to see form answers, refer to the "Answers" worksheet
6. If changes are needed, re-open the form and fill it out again (information already entered in the checklist will not be lost)
7. To remove all form answers and remove sorting from the checklist, open the form and press "Clear"

FOR TCEQ USE ONLY

1. After completion of the review, press the "FOR TCEQ USE ONLY" button to open the "NOD" worksheet and reveal the TCEQ review "Adequate" column within the checklist.
2. Once on the "NOD" worksheet, press the "GENERATE NOD TABLE" button to generate a table of deficient items.
3. The NOD Table will appear on the "NOD" worksheet.

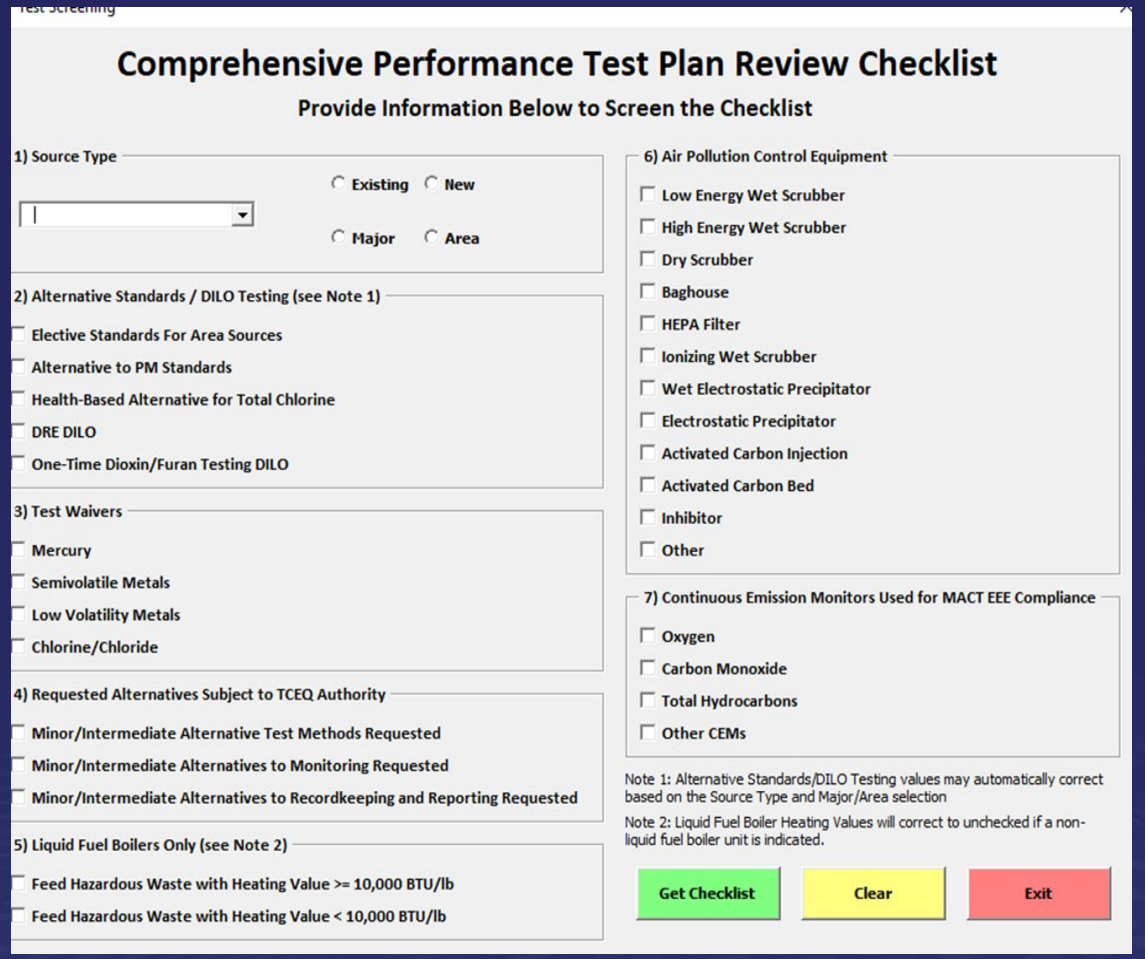
SCREENING FORM

FOR TCEQ USE ONLY

DRAFT v. 2.3

CPT Plan Checklist – Screening Sheet

- Source Type
- Alternative Standards/Data-in-Lieu Testing
- Test Waivers
- Requested Alternatives
- Liquid Boiler Only
- Air Pollution Control Equipment
- Continuous Emission Monitors used for MACT EEE Compliance



CPT Plan Checklist - Example

Item No.	Section	Requirements	Regulation	Addressed Y/N/NA	Location	Comments
1	1	***CONTENT OF COMPREHENSIVE PERFORMANCE TEST PLAN***				
2	1.A.	***General***. The source must provide the following:				
3	I.A.1.	An analysis of each feedstream, including hazardous waste, other fuels, and industrial furnace feedstocks, as fired, that includes:	§63.1207(f)(1)(i)			
4	1.A.1.a	Heating value, levels of ash (for hazardous waste incinerators only), levels of semivolatile metals, low volatile metals, mercury, and total chlorine (organic and inorganic); and	§63.1207(f)(1)(i)(A)			
5	1.A.1.b	Viscosity or description of the physical form of the feedstream;	§63.1207(f)(1)(i)(B)			
6	1.A.2	For organic hazardous air pollutants established by 42 U.S.C. 7412(b)(1), excluding caprolactam (CAS number 105602) as provided by §63.60:	§63.1207(f)(1)(ii)			
7	1.A.2.a	An identification of such organic hazardous air pollutants that are present in the feedstream, except that the source need not analyze for organic hazardous air pollutants that would reasonably not be expected to be found in the feedstream. The source must identify any constituents that it excludes from analysis and explain the basis for excluding them. The source must conduct the feedstream analysis according to §63.1208(b)(8). The source may qualify for reduced analysis in lieu of the feedstream identification required by this section, on a case by case basis, according to the conditions set forth in §63.1207(f)(1)(ii)(D);	§63.1207(f)(1)(ii)(A)			
8	1.A.2.b	An approximate quantification of such identified organic hazardous air pollutants in the feedstreams, within the precision produced by the analytical procedures of §63.1208(b)(8); and	§63.1207(f)(1)(ii)(B)			

Combustion Test Reports Tools

- CPT Report Format
- CPT Report Forms
- CPT Laboratory Report QA/QC Checklist

CPT Report Format

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

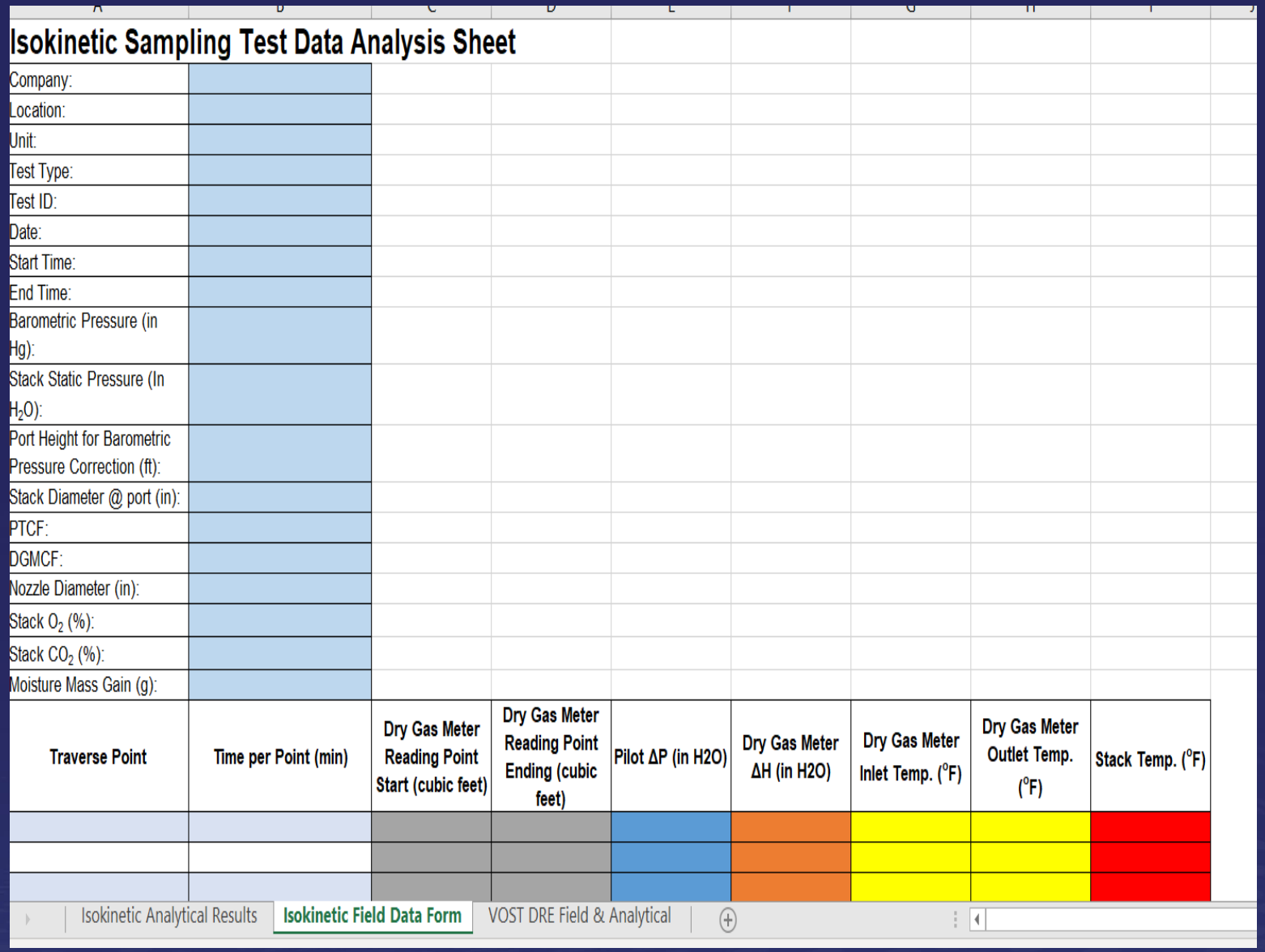
ORGANIZATION, CONTENT AND FORMAT

COMPREHENSIVE PERFORMANCE TEST (CPT)/RCRA TEST REPORT

TABLE OF CONTENTS

CPT Report Forms

- Required for all CPT Test Reports
- Excel Spreadsheet
- Isokinetic Sampling Test Data Analysis Sheet



Isokinetic Sampling Test Data Analysis Sheet

Company:	
Location:	
Unit:	
Test Type:	
Test ID:	
Date:	
Start Time:	
End Time:	
Barometric Pressure (in Hg):	
Stack Static Pressure (In H_2O):	
Port Height for Barometric Pressure Correction (ft):	
Stack Diameter @ port (in):	
PTCF:	
DGMCF:	
Nozzle Diameter (in):	
Stack O_2 (%):	
Stack CO_2 (%):	
Moisture Mass Gain (g):	

Traverse Point	Time per Point (min)	Dry Gas Meter Reading Point Start (cubic feet)	Dry Gas Meter Reading Point Ending (cubic feet)	Pilot ΔP (in H2O)	Dry Gas Meter ΔH (in H2O)	Dry Gas Meter Inlet Temp. (°F)	Dry Gas Meter Outlet Temp. (°F)	Stack Temp. (°F)

Isokinetic Analytical Results | Isokinetic Field Data Form | VOST DRE Field & Analytical

CPT Report Forms Continued

Isokinetic Analytical Results

- Hydrogen Chloride/ Chlorine Runs
- Particulate Matter
- Metals
- Dioxins and Furans
- DRE

Analytical Results Summary				
Enter Final Numerical Results Used in Compliance Determinations				
Hydrogen Chloride/Chlorine Runs (mg/sample)	**Run 1**	**Run 2**	**Run 3**	**Run 4**
Test Method ID				
Run ID				
Test Date				
Hydrogen Chloride HCL (mg/sample)				
Chlorine Cl2 (mg/sample)				
Particulate Matter Collected (mg/sample)	**Run 1**	**Run 2**	**Run 3**	**Run 4**
Test Method ID				
Run ID				
Test Date				
Particulate Matter Collected (FH - mg/sample)				
Metals Runs (ug/sample)	**Run 1**	**Run 2**	**Run 3**	**Run 4**
Test Method ID				
Run ID				
Test Date				
ANTIMONY (ug/sample)				
ARSENIC (ug/sample)				
BARIUM (ug/sample)				
BERYLLIUM (ug/sample)				
CADMIUM (ug/sample)				
CHROMIUM (ug/sample)				
LEAD (ug/sample)				
MERCURY (ug/sample)				
COBALT (ug/sample)				
MANGANESE (ug/sample)				

CPT Report Forms Continued

Volatile Organic Sampling Train (VOST) Field Data Inputs

VOST Sampling Train Field Data Inputs

Analytical Results Input POHC #1

Analytical Results Input POHC #2

Analytical Results Input POHC #3

Condition 1	DGM Final Reading (L)	DGM Inital Reading (L)	Average Meter Gas Temp (Deg F)	Dry Gas Meter Calibration Factor	Barometric Pressure (in Hg)	Sampling Height Diff (ft)	Corrected Barometric Press. (in Hg)	POHC #1 Tenax Tube (ug POHC)	POHC #1 Tenax/C (ug/POHC
Run 1 Pair 1						0	0		
Run 1 Pair 2						0	0		
Run 1 Pair 3						0	0		
Run 1 Pair 4						0	0		
Run 2 Pair 1						0	0		
Run 2 Pair 2						0	0		
Run 2 Pair 3						0	0		
Run 2 Pair 4						0	0		
Run 3 Pair 1						0	0		
Run 3 Pair 2						0	0		
Run 3 Pair 3						0	0		
Run 3 Pair 4						0	0		
Condition 2									
Run 4 Pair 1						0	0		
Run 4 Pair 2						0	0		
Run 4 Pair 3						0	0		
Run 4 Pair 4						0	0		

Isokinetic Analytical Results | Isokinetic Field Data Form | **VOST DRE Field & Analytical**

Industrial and Hazardous Waste Permits Website

Hazardous Waste Combustion Program

UPDATE All plans and reports **must be submitted using applicable** documents listed below.

Comprehensive Performance Test (CPT) Reports

- **REQUIRED** **CPT Report Forms**, all Hazardous Combustion Reports, Field Data and Analytical Data **must be submitted using** the Combustion Report Forms.
- **Example CPT/RCRA Test Report Draft Format**
- **REQUIRED** **Example CPT Laboratory Data Report QA/QC Checklist**

CPT Plans

- **CPT Plan Common Deficiencies**, a list of common deficiencies for CPT Plans to improve CPT Plan reviews.
- **REQUIRED** **Example CPT Plan Cover Sheet**

CPT Plan Review Checklist:

- **REQUIRED** **CPT Plan Review Checklist in Excel**: Use to select applicable requirements
- **CPT Plan Review Checklist in Word** : Use with assistive technology

How Do You Control Operations to Ensure Compliance with Emission Standards?

Test Conditions

- Worst-case scenario
  - Maximum total and pumpable hazardous waste feed rate
  - Maximum stack flow rate
  - Minimum combustion chamber temperature
- Three runs for each test condition

Types of Operating Parameter Limits (OPLs)

- OPLs set during the Trial Burn/Comprehensive Performance Test
- OPLs set by combustion unit design
- OPLs set by manufacturer's recommendations

Determining OPLs

- Calculate the OPLs from the process data
- Different types of OPLs calculated
  - One Minute Average
  - Hourly Rolling Average
  - Average of the Maximum or Minimum Hourly Rolling Averages
  - 12-Hour or Greater Rolling Averages

MACT EEE Monitoring Requirements

- Destruction and Removal Efficiency (DRE)
- Dioxins/Furans (D/Fs)
- Mercury
- Particulate Matter
- Semi-Volatile Metals (SVMs) and Low Volatile Metals (LVMs)
- HCl/Cl_2.

Example of Determining a Minimum Combustion Temperature Limit

DRE – Test Condition One	Run 1	Run 2	Run 3	Average	Minimum Combustion Chamber Temperature Limit
	1800 °F	1810 °F	1805 °F	1805 °F	**1860 °F**
D/F – Test Condition Two	**Run 1**	**Run 2**	**Run 3**	**Average**	
	1850 °F	1860 °F	1870 °F	1860 °F	

Data-in Lieu or Test Waiver

- Similar design and operation
- Destruction and Removal Efficiency (DRE)
- Total Hydrocarbon (THC)
- Maximum Theoretical Emission Concentration (MTEC) Waiver
- Thermal Concentration Limit Waiver

Example Demonstration of Operating Parameter Limits

Operating Parameter	Established Operating Limit	Basis for Operating Limit	Monitoring Basis	Applicable Emission Standards
Minimum Chamber Temperature	1500 °F	2016 CPT	HRA	HC, DRE
Maximum Gas Flow Rate	40,000 dscfm	2021 CPT	HRA	HC, DRE, PM
Maximum Hazardous Waste Feed Rate	25,000 lb/h	2016 CPT	HRA	HC, DRE

MACT EEE Emission Limits

	Incinerators
Dioxin/Furans	0.20 or 0.40 ng TEQ/dscm
Mercury	130 ug/dscm
Particulate Matter	0.013 gr/dscf
Semi Volatile Metals (Pb + Cd)	230 ug/dscm
Low Volatile Metals (As + Be + Cr)	92 ug/dscm
Total Chlorine	32 ppmv
Carbon Monoxide (CO)	100 ppmv
Hydrocarbons (HC)	10 ppmv
DRE	99.99% or 99.9999%

MACT EEE Emission Limits Continued

	Liquid Fuel-fired boilers	
	Heating Value < 10,000 Btu/lb	**Heating Value ≥ 10,000 Btu/lb**
Dioxin/Furans	0.40 ng TEQ/dscm	0.40 ng TEQ/dscm
Mercury	19 ug/dscm	4.2E-5 lb/MMBtu
Particulate Matter	0.035 gr/dscf	0.035 gr/dscf
Semi Volatile Metals (Pb + Cd)	150 ug/dscm	8.2E-5 lb/MMBtu
Low Volatile Metals (Cr only)	370 ug/dscm	1.26E-4 lb/MMBtu
Total Chlorine	31 ug/dscm	5.08E-5 lb/MMBtu
Carbon Monoxide (CO)	100 ppmv	100 ppmv
Hydrocarbons (HC)	10 ppmv	10 ppmv
DRE	99.99% or 99.9999%	99.99% or 99.9999%

What Testing Methods Are Required?

- Dioxins and furans - Method 0023A or Method 23
- Metals (Mercury, Cadmium, Lead, Arsenic, Beryllium, and Chromium) - Method 29
- Hydrogen Chloride and Chlorine gas - Method 26/26A
- Particulate Matter - Methods 5 or 5I
- Other test methods - EPA Publication SW-846

Common MACT EEE Calculation Procedures for All Isokinetic Methods

- Determine the volume of the sample collected at standard conditions on a dry basis
- Determine **t**he mass of the hazardous air pollutant captured in the sampling train
- Correct the measured concentration to 7% oxygen, dry basis

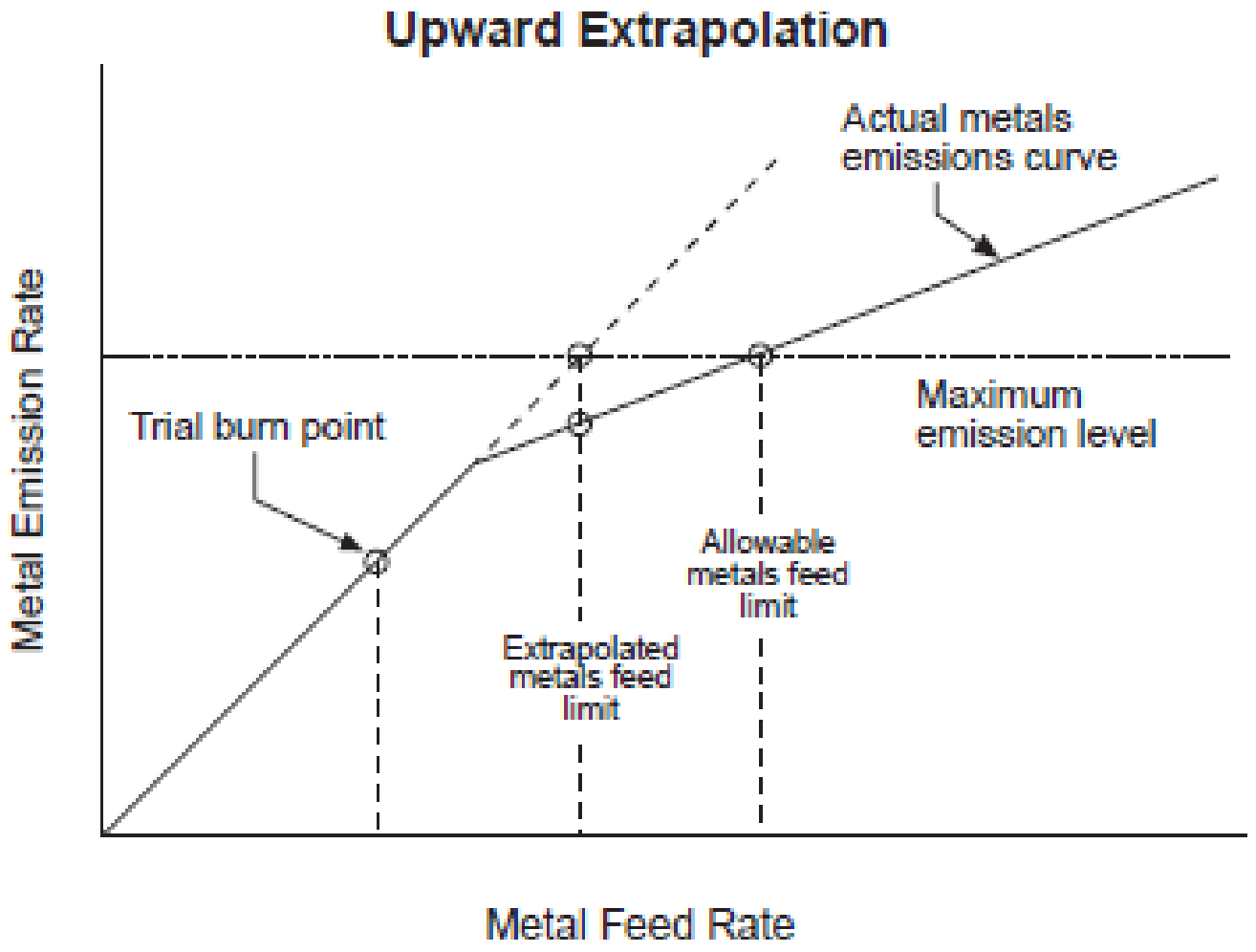
Example Demonstration of Emission Standards

Parameter	Final MACT Limit	Result
DRE	99.99 %	>99.9996
Dioxins and Furans	0.40 ng TEQ/dscm @ 7% O2	<0.0018
Mercury	130 ug/dscm @ 7% O2	<5.1
Semi-Volatile Metals (SVM)	230 ug/dscm @ 7% O2	<121
Low Volatility Metals (LVM)	97 ug/dscm @ 7% O2	<44
Carbon Monoxide (CO)	100ppmvd @ 7% O2	0.5
Total Hydrocarbons (THC)	10 ppmvd @ 7% O2	3.6
Total Chlorine (HCl/Cl_2)	32 ppmvd @ 7% O2	13
Particulate Matter (PM)	0.013 gr/dscft @ 7% O2	0.0030

MACT Extrapolation of Metal Feed Rates

- Mercury
- Semivolatile and Low Volatile Metal
- Extrapolation methodology in CPT plan
- Varied on a Case-By-Case Basis

Example of Upward Extrapolation of Feed Rate Limits



System Removal Efficiency (SRE)

Assuming SRE is eligible for Extrapolation from a Test Condition to an Emission Limit

$$\text{Feed rate} = \frac{\text{Emission Standard}}{1-\text{SRE}}$$

$$F_{limit} = F_{test} \times \frac{E_{limit}}{E_{test}}$$

Policy of Limiting Extrapolation

$$F_{Limit} = F_{test} \times \frac{E_{limit}}{E_{Metal}} \times 0.8 \quad \text{OR } F_{Limit} = F_{test} \times 3$$

(whichever is less)

Additional Sources

- https://www.epa.gov/emc/emc-promulgated-test-methods
- https://www.epa.gov/hw-sw846
- https://www.epa.gov/stationary-sources-air-pollution/hazardous-waste-combustors-national-emission-standards-hazardous
- http://www.tceq.texas.gov/permitting/waste_permits/ihw_permits/ihw.html

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Questions?

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