



Massachusetts Department of Environmental Protection (MassDEP) Top Case Best Available Control Technology (BACT) Guidelines

This information is maintained by the MassDEP, Bureau of Air and Waste, Air Pollution Control Program, and is subject to change. These listings present Top Case BACT guidelines for Non-major air contaminants emitting sources.

For a particular air contaminant subject to BACT under a Prevention of Significant Deterioration (PSD) permit, or Lowest Achievable Emission Rate (LAER) under 310 CMR 7.00 Appendix A, Emission Offsets and Nonattainment Review, collectively termed Major New Source Review, the Top Case Guidelines do not apply. PSD BACT and Appendix A LAER must be analyzed on a case-by-case basis.

This Guidance is published for informational purposes only. Use of the applicable Top Case BACT emissions limitations contained herein may preclude the need for applicants to prepare and submit a “top-down BACT analysis” for MassDEP’s review, and will streamline the Air Quality permitting process for both the applicants and MassDEP. Applicants should note that BACT requirements for any new or modified air contaminants source are subject to change through the MassDEP 310 CMR 7.02 Air Quality Plan Approval (permitting) procedures. Please contact the MassDEP Regional Office that regulates your facility should you have any questions related to these Top Case BACT guidelines.

Please be aware that, in addition to BACT requirements, federal NSPS, MACT and/or GACT requirements may also apply pursuant to 40 CFR Parts 60, 61 and 63.

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MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – COMBUSTION SOURCES

BOILERS (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations	Control Technology	BACT Determination
Boilers 10 mmBtu to <40 MMBtu	Natural Gas	NOx	0.0350 lb/MM Btu	Low NOx burners, FGR	310 CMR 7.26(33)(b): IPS Regulations
		PM	0.010 lb/MM Btu		
		CO	0.080 lb/MM Btu		
		VOC	0.030 lb/MM Btu		
Boilers 10 mmBtu to <40 MMBtu	Ultra Low Sulfur Distillate 0.0015 %	NOx	0.150lb/MMBtu	Low NOx burners, FGR	310 CMR 7.26(33)(b): IPS Regulations
		PM	0.020 lb/MMBtu		
		CO	0.080 lb/MM Btu		
		VOC	0.030 lb/MM Btu		
Boilers ≥40 MMBtu to <100 MMBtu	Natural Gas	NOx	0.011 lb/MMBtu	Ultra Low NOx burners, Low NOx burners, FGR	US EPA RBLC Database
		PM	0.002 lb/MMBtu		
		CO	0.035 lb/MMBtu		
		VOC	0.035 lb/MMBtu		
Boilers ≥40 MMBtu to <100 MMBtu	Ultra Low Sulfur Distillate 0.0015 %	NOx	0.100 lb/MMBtu	Ultra Low NOx burners, Low NOx burners, FGR	US EPA RBLC Database
		PM	0.015 lb/MMBtu		
		CO	0.035 lb/MMBtu		
		VOC	0.035 lb/MMBtu		
Boilers ≥100 mmBtu to <250 MMBtu	Natural Gas	NOx	0.011 lb/MMBtu	Ultra Low NOx burners, Low NOx burners, FGR, SCR	310 CMR 7.02 Plan Approval, Transmittal Number X229675
		PM	0.01 lb/MMBtu		
		CO	0.011 lb/MMBtu		
		VOC	0.03 lb/MMBtu		

BOILERS (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations	Control Technology	BACT Determination
Boilers >100 MMBtu to 249 MMBtu	Ultra Low Sulfur Distillate 0.0015 %	NO _x	0.100 lb/MMBtu	Ultra Low NO_x burners, Low NO_x burners, FGR, SCR	310 CMR 7.02 Plan Approval, Transmittal Number X229675
		PM	0.03 lb/MMBtu		
		CO	0.035 lb/MMBtu		
		VOC	0.03 lb/MMBtu		
Boilers ≥250 MMBtu	Natural Gas	NO _x	0.011 lb/MMBtu	Ultra Low NO_x burners, Low NO_x burners, FGR, SCR	US EPA RBLC Database
		PM	0.002 lb/MMBtu		
		CO	0.015 lb/MMBtu		
		VOC	0.015 lb/MMBtu		
Boilers ≥250 MMBtu	Ultra Low Sulfur Distillate 0.0015 %	NO _x	0.100 lb/MMBtu	Ultra Low NO_x burners, Low NO_x burners, FGR, SCR	US EPA RBLC Database
		PM	0.015 lb/MMBtu		
		CO	0.035 lb/MMBtu		
		VOC	0.035 lb/MMBtu		
Boilers ≥250 MMBtu	Coal	NO _x	0.030 lb/MMBtu	- Low NO_x burners, FGR - SCR - Oxidization catalyst - FF/Baghouse - FGD (wet or dry at 98-99 % removal efficiency)	US EPA EIA Database
		PM	0.0100 lb/MMBtu		
		CO	0.050 lb/MMBtu		
		VOC	0.035 lb/MMBtu		
		SO ₂	0.080 lb/MMBtu		
		NH ₃	2 ppmvd at 3% O ₂		

Key to Abbreviations

lb/MMBtu = pounds per million British thermal units

ppmvd = parts per million volume dry

% = weight percent

NO_x = nitrogen oxides

SO₂ = sulfur dioxide

PM = particulate matter (including condensables)

O₂ = oxygen

CO = carbon monoxide

NH₃ = ammonia

VOC = volatile organic compounds

FF = fabric filter/baghouse

SCR = selective catalytic reduction technology

CEMS = continuous emissions monitoring system

FGD = flue gas desulfurization

FGR = flue gas recirculation

RBLC = RACT BACT LAER Clearinghouse

INCINERATORS (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations*	Control Technology	BACT Determination
Municipal Waste	Municipal solid waste (household, commercial, and institutional waste)	NO _x	2 ppmvd	- Gasification of MSW to SynGas - Combustion of SynGas via Combustion Turbine Technology (or equivalent combustion methodology). - Pollutant emissions may be controlled during syngas production and/or post-combustion.	- LA County Conversion Technology Evaluation Report – Phase II – Assessment (October 2007) - NYC Focused Verification and Validation of Advanced SW Management Conversion Technologies – Phase 2 Study (March 2007)
		NH ₃	2 ppmvd		
		CO	2 ppmvd		
		VOC	2 ppmvd		
		Cd	**		
		Pb	**		
		Hg	**		
		SO ₂ **	**		
		HCl**	**		
		Dioxin/Furan (CDD/CDF)	**		
Medical Waste (for all incinerator sizes)	Medical and pathological waste	NO _x	250 ppmvd	- dry scrubber, wet scrubber - good combustion control Practices - carbon injection	US EPA 40 CFR Part 60 Subpart Ec
		PM	0.015 gr/dscf		
		CO	40 ppmvd		
		SO ₂	55 ppmvd		
		Pb	0.07 mg/dscm or 98% removal efficiency		
		Cd	0.04 mg/dscm or 90% removal efficiency		
		Hg	0.55 mg/dscm or 85%		

INCINERATORS (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations*	Control Technology	BACT Determination
			removal efficiency		
		Dioxin/Furan Total	25 ng/dscm		
		Dioxin/Furan TEQ	0.6 ng/dscm		
Crematoria (Human bodies and body parts)	Natural Gas	PM	0.06 gr/dscf	• Secondary chamber design retention time and temperature, 1 second at 1,800 degrees °F • Secondary chamber minimum operating temperature, 1,600 °F • Opacity Monitor	310 CMR 7.02 Plan Approval, Transmittal Number X227136
		CO	100 ppmvd		
		Opacity	10 percent		

*all emission limitations are corrected to 7 percent O₂

**Emissions of metals (Cd, Hg, Pb, etc.), dioxin/furans (CDD/CDF) and acid gases (HCl and H₂SO₄/SO₂) are to be determined on a case-by-case basis, consistent with the MassDEP BACT Guidelines, NESCAUM BACT Guidelines, and US EPA NSR BACT requirements. Ambient air quality modeling will be required to demonstrate compliance with MassDEP “[Ambient Air Exposure Limits for Chemicals in Massachusetts](#)”.

Key to Abbreviations

mg = milligram

ng = nanogram

gr = grains

dscf = dry standard cubic foot

dscm = dry standard cubic meter

ppmvd = part per million volume dry

% = weight percent

NO_x = nitrogen oxides

SO₂ = sulfur dioxide

PM = particulate matter (including condensables)

O₂ = oxygen

Pb = lead

Cd = cadmium

Hg = mercury

CO = carbon monoxide

HCl = hydrogen chloride

FF = fabric filter

ESP = electrostatic precipitator

SNCR = selective non catalytic reduction

CEMS = continuous emissions monitoring system

FGD = flue gas desulfurization

TEQ = toxic equivalent

BIOMASS FUEL FIRED STEAM ELECTRIC GENERATION UNITS (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations	Control Technology	BACT Determination
EGUs ≥ 25 MW	Biomass	NO _x	0.015 lbs/MMBtu	• SCR • Oxidization Catalyst • FF/Baghouse • AERSRCEEN or AERMOD for Toxics Modeling • Metals testing for C&D and possibly other biomass • PM testing must also included condensable PM • FGD	MassDEP BACT Guidance for Biomass Projects, April 2007
		PM	0.012 lbs/MMBtu		
		CO	0.01 lbs/MMBtu		
		VOC	0.01 lbs/MMBtu		
		SO ₂	0.02 lbs/MMBtu		
		NH ₃	2 ppmvd at 3 percent O ₂		
		Opacity	5 percent		
		HCl	20 ppmvd at 3 percent O ₂		
EGUs Equal to or > 10 MW and < 25 MW	Biomass	Toxics*	• 85% Hg RE • 99% Heavy Metal RE • AALs and TELs compliance modeling demonstration	• SCR • Oxidization Catalyst • FF/Baghouse • AERMOD for Toxics Modeling • Metals testing for C&D and possibly other	MassDEP BACT Guidance for Biomass Projects, April 2007
		NO _x	0.015 lbs/MMBtu		
		PM	0.012 lbs/MMBtu		
		CO	0.01 lbs/MMBtu		
		VOC	0.01 lbs/MMBtu		
		SO ₂	0.02 lbs/MMBtu		
		NH ₃	2 ppmvd at 3 percent O ₂		
		Opacity	5 percent		

BIOMASS FUEL FIRED STEAM ELECTRIC GENERATION UNITS (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations	Control Technology	BACT Determination
		HCl	20 ppmvd at 3 percent O ₂	biomass - PM testing must also include condensable PM - FGD	
		Toxics*	85% Hg RE 99% Heavy Metal RE - AALs and TELs compliance modeling demonstration		
EGUs Equal to or > 1 MW and < 10 MW	Biomass	NO _x	0.093 lbs/MMBtu	- SCR - Oxidization Catalyst - FF/Baghouse - AERMOD for Toxics Modeling - Metals testing for C&D and possibly other	MassDEP BACT Guidance for Biomass Projects, April 2007
		PM	0.012 lbs/MMBtu		
		CO	0.25 lbs/MMBtu		
		VOC	0.01 lbs/MMBtu		
		SO ₂	0.02 lbs/MMBtu		
		NH ₃	10 ppmvd at 3 percent O ₂		
		Opacity	5 percent		
		HCl	20 ppmvd at 3 percent O ₂		

BIOMASS FUEL FIRED STEAM ELECTRIC GENERATION UNITS (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations	Control Technology	BACT Determination
		Toxics*	• 85% Hg RE • 99% Heavy Metal RE • AALs and TELs compliance modeling demonstration	biomass • PM testing must also included condensable PM • FGD	

*Ambient air quality modeling will be required to demonstrate compliance with MassDEP “[Ambient Air Exposure Limits for Chemicals in Massachusetts](#)”. for projects where: 1. construction and demolition wood is burned; 2. boilers that are major source of Criteria Air Contaminants or Hazardous Air Pollutants.

Key to Abbreviations

lb/MMBtu = pounds per million British thermal units

% = weight percent

ppmvd = parts per million volume dry

NO_x = nitrogen oxides

SO₂ = sulfur dioxide

PM = particulate matter (including condensables)

O₂ = oxygen

CO = carbon monoxide

NH₃ = ammonia

HCl = hydrogen chloride

FF = fabric filter/baghouse

RE = removal efficiency

SCR = selective catalytic reduction technology

CEMS = continuous emissions monitoring system

FGD = flue gas desulfurization

AAL = Allowable Ambient Limit

TEL = Threshold Effects Exposure Limit

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – COMBUSTION SOURCES

RECIPROCATING INTERNAL COMBUSTION ENGINES (June, 2011)				
Source Type	Fuel	Air Contaminant	Emission Limitations	BACT Determination
IC Engines equal to or > 50 kW (On or after 1/1/08)	Natural Gas	NOx	0.3 lbs/MW-hr	310 CMR 7.26(43)(b): Table 2 and 4 IPS Regulations
		CO	2 lbs/MW- hr	
		CO ₂	1900 lbs/MW-hr	
IC Engines equal to or > 50 kW (On or after 1/1/08)	Ultra Low Sulfur Distillate 0.0015 %	NOx	0.3 lbs/MW-hr	310 CMR 7.26(43)(b): Table 2 and 4 IPS Regulations
		PM	0.07 lbs/MW-hr	
		CO	2 lbs/MW- hr	
		CO ₂	1900 lbs/MW-hr	
IC Engines equal to or > 50 kW (On or after 1/1/12)	Natural Gas	NOx	0.15 lb/MW-hr	310 CMR 7.26(43)(b): Table 2 and 4 IPS Regulations
		PM	0.03 lb/MW-hr	
		CO	1 lb/MW-hr	
		CO ₂	1650 lb/MW-hr	
IC Engines equal to or > 50 kW (On or after 1/1/12)	Ultra Low Sulfur Distillate 0.0015 %	NOx	0.15 lb/MW-hr	310 CMR 7.26(43)(b): Table 2 and 4 IPS Regulations
		PM	0.03 lb/MW-hr	
		CO	1 lb/MW-hr	
		CO ₂	1650 lb/MW-hr	
IC Engines equal to or > 37 kW (Emergency Engines)	Natural Gas or Ultra Low Sulfur Distillate 0.0015 %	Must comply with the applicable emission limitations set by US EPA for non-road engines at 40 CFR 89.		310 CMR 7.26(42)(b)1. IPS Regulations

Key to Abbreviations:

lbs/MW-hr = pounds per megawatt hour

NO_x = nitrogen oxides

PM = particulate matter (including condensables)

CO = carbon monoxide

CO₂ = carbon dioxide

MW = megawatt

kW = kilowatt

% = weight percent

IPS = Industrial Performance Standards

COMBUSTION TURBINES (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations	BACT Determination	Control Technology
Combined Cycle Turbine > 10 MW/hr	Natural Gas	NO _x	2.0 ppmvd at 15 % O ₂	Plan Approval, Transmittal Number W004632	• Dry Low NO_x Combustor • SCR • Oxidation catalyst • NO_x, CO, NH₃ CEMS
		NH ₃	2.0 ppmvd at 15 % O ₂		
		CO	2.0 ppmvd at 15 % O ₂		
		VOC	1.7 ppmvd at 15 % O ₂		
		CO ₂	Contact Regional Office		
Combined Cycle Turbine > 10 MW/hr	Ultra Low Sulfur Distillate Oil 0.0015 %	NO _x	6.0 ppmvd at 15 % O ₂	Plan Approval, Transmittal Number W004896	• Dry Low NO_x Combustor • SCR • Oxidation catalyst • NO_x, CO, NH₃ CEMS
		NH ₃	2.0 ppmvd at 15 % O ₂		
		CO	7.0 ppmvd at 15 % O ₂		
		VOC	7.0 ppmvd at 15 % O ₂		
		CO ₂	Contact Regional Office		
Simple Cycle Turbine > 10 MW/hr	Natural Gas	NO _x	2.5 ppmvd @15 % O ₂	Plan Approval, Transmittal Number W120701	• Dry Low NO_x Combustor • SCR • Oxidation catalyst • NO_x, CO, NH₃ CEMS
		NH ₃	5.0 ppmvd @ 15 % O ₂ with an optimization program to achieve 2.0 ppmvd @15 % O ₂		
		CO	5.0 ppmvd @15 % O ₂		
		VOC	2.5 ppmvd @15 % O ₂		
		CO ₂	Contact Regional Office		
Simple Cycle Turbine	Ultra Low Sulfur Distillate	NO _x	5.0 ppmvd at 15 % O ₂	Plan Approval, Transmittal Number W120701	• Dry Low NO_x

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – COMBUSTION SOURCES

COMBUSTION TURBINES (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations	BACT Determination	Control Technology
> 10 MW/hr	Oil 0.0015 %	NH ₃	5.0 ppmvd at 15 % O ₂		Combustor • SCR • Oxidation catalyst • NO _x , CO, NH ₃ CEMS
		CO	5.0 ppmvd @15 % O ₂		
		VOC	4.5 ppmvd @15 % O ₂		
		CO ₂	Contact Regional Office		
Combustion Turbine Less than 1 MW	Natural Gas	NO _x	0.47 lbs/MW-hr	310 CMR 7.26(43) IRP Regulation	
		CO	0.47 lbs/MW-hr		
		CO ₂	NA		
Combustion Turbine 37 kW to ≤1 MW (Emergency Only)	Ultra Low Sulfur Distillate Oil 0.0015 %	NO _x	0.60 lbs/MW-hr	310 CMR 7.26(42) IRP Regulation	
		CO ₂	Contact Regional Office		
Combustion Turbine 1 MW to 10 MW	Natural Gas	NO _x	0.14 lbs/MW-hr	310 CMR 7.26(43) IRP Regulation	• SCR • Oxidation catalyst • (possible required technology)
		NH ₃	2.0 ppmvd @ 15 % O ₂		
		CO	0.09 lbs/MW-hr		
		CO ₂	1900 lbs/MW-hr		
Combustion Turbine 1 MW to 10 MW	Ultra Low Sulfur Distillate Oil 0.0015 %	NO _x	0.34 lbs/MW-hr	310 CMR 7.26(43) IRP Regulation	• SCR • Oxidation catalyst • (possible required technology)
		NH ₃	2.0 ppmvd @ 15 % O ₂		
		CO	0.18 lbs/MW-hr		
		CO ₂	1900 lbs/MW-hr		
Combined Cycle Combustion Turbine Coal Gasification	Coal	NO _x	2.0 ppmvd at 15 % O ₂	See Combined Cycle Turbine Transmittal Numbers above	• Gasification of coal with gas cleaning technology • Post-combustion GT
		NH ₃	2.0 ppmvd at 15 % O ₂		
		CO	2.0 ppmvd at 15 % O ₂		

COMBUSTION TURBINES (June, 2011)					
Source Type	Fuel	Air Contaminant	Emission Limitations	BACT Determination	Control Technology
IGCC Technology		VOC	2.0 ppmvd at 15 % O ₂		gas cleaning
		CO ₂	Contact Regional Office		

Key to Abbreviations:

lbs/MW-hr = pounds per megawatt hour

lb/MMBtu = pounds per million British thermal unit

ppmvd = part per million volume dry

NO_x = nitrogen oxides

CO = carbon monoxide

CO₂ = carbon dioxide

O₂ = oxygen

VOC = volatile organic compounds

NO_x = nitrogen oxides

NH₃ = ammonia

MW = megawatt

SCR = selective catalytic reduction

CEMS = continuous emissions monitoring system

% = weight percent

GT = gas turbine

kW = kilowatt

IGCC = integrated gasification combined cycle

*Emission Limitations – Output Based shall incorporate the heat rate component necessary to evaluate energy efficiency. At this time BWP should evaluate only the specific combustion unit or system (simple cycle turbine, combined cycle turbine, etc.), however BWP should request the project proponent to evaluate the proposed project as a “whole” and provide a facility output based emission rate (BACT) for the project to incorporate the use of energy efficient of ancillary equipment.

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

PRINTING* (June, 2011)				
Source Type	Air Contaminant	Minimum Requirements	Control Technology	BACT Determination
Non-heatset Lithographic Printing	VOC	- Fountain solutions: - Web-fed - No Alcohol allowed - Sheet-fed - unrefrigerated $\leq 5\%$ VOC refrigerated ($< 60^{\circ}\text{F}$) and $\leq 8\%$ VOC (by weight, including alcohol) - Cleanup Solution $\leq 30\%$ VOC by weight, or VOC composite partial pressure of 10 mmHg at 20°C or less - Adhesive Standard (Midsized and large printers) - ≤ 300 g VOC per liter of product, less water, as applied - Record keeping in accordance with 310 CMR 7.26(28)	- Fountain solution tanks covered - Clean-up Solution in covered containers - Shop towels with solvent kept in covered containers	310 CMR 7.26(24) IPS Regulation

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

PRINTING* (June, 2011)				
Graphic Arts Printing Gravure, Letterpress and Flexographic	VOC	- Standards – Midsize and Large Printers - Ink – ≤ 300 g VOC per liter of product, less water, as applied - Coating – ≤ 300 g VOC per liter of product less water, as applied - Adhesive – ≤ 150 g VOC per liter of product, less water, as applied - Clean-up solution standard – VOC composite partial pressure of ≤ 25 mm Hg (at 20 °C) - Record keeping in accordance with 310 CMR 7.26(28)	- Clean-up solution in covered containers - Shop towels with solvent kept in covered containers	310 CMR 7.26(25) IPS Regulation

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

PRINTING* (June, 2011)				
Screen Printing		- Standards – Midsize and Large Printers - Ink – ≤ 400 g VOC per liter of product, less water, as applied - Coating – ≤ 400 g VOC per liter of product less water, as applied - Adhesive – ≤ 400 g VOC per liter of product, less water, as applied - Extreme Performance Ink/Coating – ≤ 800 g VOC per liter of product, less water, as applied - Metallic Ink - ≤ 400 g VOC per liter of product, less water, as applied - Conductive Ink - ≤ 850 g VOC per liter of product, less water, as applied - Clean-up solution standard – VOC composite partial pressure of ≤ 5 mm Hg (at 20 °C) - Record keeping in accordance with 310 CMR 7.26(28)	- Clean-up Solution in covered containers - Shop towels with solvent kept in covered containers	310 CMR 7.26(26) IPS Regulation
Printers with: Heatset Presses or Non-conforming Operations	VOC	See Regulation 310 CMR 7.26(27) for minimum BACT Requirements		310 CMR 7.26(27) IPS Regulation

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

PRINTING* (June, 2011)				
All Printers	HAPs	Facilities may obtain a federally enforceable approval to cap HAPs below MACT major source thresholds to < 25 tons of total HAPs per rolling 12 month period and to < 10 tons of any individual HAPs per rolling 12 month period		

*Printers that **exceed** the facility emissions/usage thresholds contained in Regulation 310 CMR 7.26 are subject to Best Available Control Technology (BACT). The BACT determinations require the installation of PTE and VOC destruction/removal efficiency of 98-99% utilizing regenerative thermal oxidation, thermal oxidation, catalytic oxidation, etc. **See Miscellaneous VOC Source BACT.**

Key to Abbreviations

VOC = volatile organic compounds
HAPs = Hazardous Air Pollutants
PTE = Permanent Total Enclosure
IPS = Industrial Performance Standards
% = weight percent
@ = at
kPa = kilopascal
< = less than
≤ = less than or equal to
> = greater than
≥ = greater than or equal to

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

CMR = Code of Massachusetts Regulations

CFR = Code of Federal Regulations

ft² = square feet

m³/min = cubic meters per minute

m/min = meters per minute

g = grams

°F = degrees Fahrenheit

°C = degrees Celsius

mm Hg = millimeters of mercury

Painting – Enclosed Painting (June, 2011)				
Source Type	Air Contaminant	Minimum Requirements	Control Technology	BACT Determination
Enclosed Painting < 670 gallons materials containing VOC per month or < 2.5 tons of VOC per month and < 2,000 gallons material containing VOC per 12 month rolling period or <18 tons VOC per 12 month rolling period Sources having VOC emissions or coating usage greater than the thresholds listed above, must capture and control VOC emissions	VOC	- Painting must be conducted in spray booth - Coatings must comply with 310 CMR 7.18 source specific requirements - Exempt (See 310 CMR 7.18 source specific requirements) coating cannot exceed 55 gallons per 12 month rolling period - Spray guns must be either: electrostatic, high volume low pressure (HVLP), or other having equal or better transfer efficiency than electrostatic or HVLP and approved by MassDEP in writing. - Spray gun cleaning activities to minimize evaporation, maximize solvent re-use, collect spent solvent into air tight containers	- Coating formulations - Maximized transfer efficiency - TO, RTO, CA or other air pollution control technology to achieve collection/destruction efficiency $\geq 98\%$ for sources ≥ 18 tons of VOC per rolling 12 month period - Project proponent must evaluate all P2 opportunities before resorting to “end of pipe” control of VOC	310 CMR 7.03(16)

Painting – Enclosed Painting (June, 2011)				
	HAPs	• See 40 CFR Part 63 • Facilities may obtain a federally enforceable approval to cap HAPs below MACT major source thresholds to < 25 tons of total HAPs per rolling 12 month period and to < 10 tons of any individual HAPs per rolling 12 month period	• See 40 CFR Part 63 • Facilities may obtain a federally enforceable approval to cap HAPs below MACT major source thresholds to < 25 tons of total HAPs per rolling 12 month period and to < 10 tons of any individual HAPs per rolling 12 month period	40 CFR Part 63
	PM	• Particulate control efficiency $\geq 99\%$ • Face velocity ≤ 200 ft/min	• Dry filter media $\geq 97\%$ collection efficiency	310 CMR 7.03(16)
	Opacity	• no visible emissions (zero percent opacity)		
	All Pollutants	• stack must discharge vertically • stack rain protection which impedes vertical discharge is NOT allowed • stack velocity > 40 ft/s • minimum stack exit height: 35 ft above ground or 10 ft above roof level • No nuisance odors		

Key to Abbreviations

VOC = volatile organic compounds

HAPs = hazardous air pollutants

PM = particulate matter

TO = thermal oxidizer

RTO = regenerative thermal oxidizer

CA = carbon adsorption

% = weight percent

> = greater than

≥ = greater than or equal to

< = less than

≤ = less than or equal to

CFR = Code of Federal Regulations

CMR = Code of Massachusetts Regulations

m/hr = meters per hour

ft = feet

ft/min = feet per minute

ft/s = feet per second

P2 = pollution prevention

Painting – Outdoor Painting (June, 2011)				
Source Type	Air Contaminant	Minimum Requirements	Control Technology	BACT Determination
Outdoor Painting Ship Painting VOC $\geq$ 18 tons per 12 month rolling period	VOC	• Painting must be conducted in an enclosed/shrouded area, 99% capture efficiency (i.e. APACTS or similar) • Coatings must comply with 310 CMR 7.18 source specific requirements • Exempt (See 310 CMR 7.18 source specific requirements) coating cannot exceed 55 gallons per 12 month rolling period • Spray guns must be either: electrostatic, high volume low pressure (HVLP), or other having equal or better transfer efficiency than electrostatic or HVLP • Spray gun cleaning activities to minimize evaporation, maximize solvent re-use, collect spent solvent into air tight containers	• Coating formulations • Maximized transfer efficiency • VOC collection (99% capture efficiency) and control system (98+% control efficiency), i.e. APACTS, or similar • Project proponent must evaluate all P2 opportunities before resorting to “end of pipe” control of VOC	310 CMR 7.02 Plan Approval Transmittal Number W210062

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

	HAPs	• See 40 CFR Part 63 • Facilities may obtain a federally enforceable approval to cap HAPs below MACT major source thresholds to < 25 tons of total HAPs per rolling 12 month period and to < 10 tons of any individual HAP per rolling 12 month period	• See 40 CFR Part 63 • Facilities may obtain a federally enforceable approval to cap HAPs below MACT major source thresholds to < 25 tons of total HAPs per rolling 12 month period and to < 10 tons of any individual HAP per rolling 12 month period	
	PM	• Particulate control efficiency >99% • Face velocity $\leq$200 ft/min or APACTS	• Dry filter media >99% collection efficiency (may also utilize an APACTS for PM control)	
	Opacity	• No visible emissions (zero percent opacity)		
	All Air Contaminant	• No nuisance odors		

Key to Abbreviations

VOC = volatile organic compounds

PM = particulate matter

HAPs = hazardous air pollutants

% = weight percent

> = greater than

≥ = greater than or equal to

< = less than

≤ = less than or equal to

CFR = Code of Federal Regulations

CMR = Code of Massachusetts Regulations

m/hr = meters per hour

ft/min = feet per minute

ft/s = feet per second

P2 = pollution prevention

APACTS = automated paint application, containment and treatment system

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

VOC COATING SOURCES (June, 2011)				
Source Type	Air Contaminant	Minimum Control Efficiency	Control Technology	BACT Determination
VOC Coating Sources VOC emissions $\geq$ 18 tons per 12 month rolling period	VOC	100% Capture Efficiency (PTE-Method 204)* 99% Destruction Efficiency	Regenerative Thermal Oxidizer (RTO)	In general, MassDEP considers proposed VOC coating operations which propose to meet the requirements of this Table as complying with Top Case BACT as required by 310 CMR 7.02(8)
		100% Capture Efficiency (PTE-Method 204)* 99% Destruction Efficiency	Thermal Oxidizer (TO)/Afterburner (AB)	
		100% Capture Efficiency (PTE-Method 204)* 98% Destruction Efficiency	Catalytic Oxidizer (CatOx)) – may be utilized only if the effluent exhaust stream contains no substituents which could cause catalyst poisoning	
		100% Capture Efficiency (PTE-Method 204)* 98% Collection Efficiency	- Adsorption Technology or equivalent (including nitrogen blanketing and condensation strategies) - Project proponent must evaluate all P2 opportunities before resorting to “end of pipe” control of VOC	

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

	HAPs	As above, in addition to requirements specified by 40 CFR 63 if facility is a major source for HAPs	As above, in addition to requirements specified by 40 CFR 63 if facility is a major source for HAPs	40 CFR 63
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*Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:

- any natural draft opening (NDO) is at least four equivalent opening diameters from each VOC emitting point;
- the total area of all NDO's shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling;
- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all VOC and/or HAPs emissions are captured and contained for discharge through a control device.

Key to Abbreviations

VOC = volatile organic compounds

PTE = Permanent Total Enclosure

% = weight percent

> = greater than or equal to

NDO = Natural Draft Opening

m/hr = meters per hour

fpm = feet per minute

P2 = pollution prevention

CFR = Code of Federal Regulations

HAPs = hazardous air pollutants

MISCELLANEOUS VOC EMITTING SOURCES				
Source Type	Air Contaminant	Minimum Control Efficiency	Control Technology	BACT Determination
Miscellaneous VOC emitting Sources VOC emissions $\geq$ 18 tons per 12 month rolling period	VOC	100% Capture Efficiency (PTE-Method 204)* 99% Destruction Efficiency	Regenerative Thermal Oxidizer (RTO)	In general, MassDEP considers proposed miscellaneous VOC operations which propose to meet the requirements of this Table as complying with Top Case BACT as required by 310 CMR 7.02(8)
		100% Capture Efficiency (PTE-Method 204)* 99% Destruction Efficiency	Thermal Oxidizer (TO)/Afterburner (AB)	
		100% Capture Efficiency (PTE-Method 204)* 98% Destruction Efficiency	Catalytic Oxidizer (CatOx)	
		100% Capture Efficiency (PTE-Method 204)* 98% Collection Efficiency	- Adsorption Technology (AT) or equivalent (may also include nitrogen blanketing and condensation strategies) - Project proponent must evaluate all P2 opportunities before resorting to “end of pipe” control of VOC	

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

	HAPs	• < 10 tons per year, single HAP • < 18 tons per year, total HAPs	• RTO or TO/AB or CatOx or AT or equivalent (may also include nitrogen blanketing and condensation strategies) • Project proponent must evaluate all P2 opportunities before resorting to “end of pipe” control of VOC	
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*Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:

- any natural draft opening (NDO) is at least four equivalent opening diameters from each VOC emitting point;
- the total area of all NDO’s shall not exceed 5 percent of the surface area of the enclosure’s four walls, floor, and ceiling;
- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all VOC and/or HAPs emissions are captured and contained for discharge through a control device.

Key to Abbreviations

VOC = volatile organic compounds

HAPs = Hazardous Air Pollutants

HAP = Hazardous Air Pollutant

PTE = Permanent Total Enclosure

% = weight percent

< = less than

> = greater than or equal to

NDO = Natural Draft Opening

m/hr = meters per hour

fpm = feet per minute

P2 = pollution prevention

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

Cleaning and Degreasing Operations (June, 2011)				
Source Type	Air Contaminant	Minimum Requirements	Control Technology	BACT Determination
Hand Wipe Solvent Cleaning Operations	VOC	• Use of low vapor pressure solvents (i.e. <15 mm Hg) • Minimize use of solvents to employees • Use of controlled flow solvent dispensers (squeeze bottles) • Use of closed containers for non-active solvent and papers/cloths • Cleaning performed in hood, booth or room vented to air pollution control device (if possible) having a capture efficiency >90%	• Carbon adsorption technology, condensation technology, or thermal oxidation at >95% destruction/collection efficiency for facilities $\geq$ 10 tons per year • Good Housekeeping to address spills and routine operation	310 CMR 7.18(8) Solvent Metal Degreasing 310 CMR 7.03(8) Plan Approval Exemptions - Degreasers
	HAPs*	• See 40 CFR Part 63	• See 40 CFR Part 63	

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

Cold Solvent Cleaning Operations	VOC	• Be equipped with a cover • Be equipped with an internal drain • Cleaned parts are enclosed for 15 seconds or until dripping ceases • Designed with a freeboard ratio of ≥ 0.75 • Designed with a water blanket (if solvent insoluble with water and is heavier than water) • Covers are closed when parts are not being handled or when unit is not in use • Open area drafts are < 40 m/min • Leaks must be immediately addressed and degreaser shutdown • Solvent v.p. ≤ 4.3 kPa @ 38 degrees Celsius • Sink-like work area < 100 cm²	• Carbon adsorption technology or condensation technology at $> 95\%$ collection efficiency for facilities ≥ 10 tons per year • Good housekeeping to address spills and routine operation (see 310 CMR 7.18(8)(a))	
	HAPs*	• See 40 CFR Part 63, Subpart T	• See 40 CFR Part 63, Subpart T	

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

IPA Cleaning and Degreasing	VOC	• Be equipped with a cover • Be equipped with an internal drain • Cleaned parts are enclosed for 15 seconds or until dripping ceases • Designed with a freeboard ratio of ≥ 0.75 • Covers are closed when parts are not being handled or when unit is not in use • Open area drafts are ≤ 40 m/min • Leaks must be immediately addressed and degreaser shutdown	• Carbon adsorption technology or condensation technology at $>95\%$ collection efficiency for facilities ≥ 10 tons per year • Good housekeeping to address spills and routine operation (see 310 CMR 7.18(8)(a))	
Vapor Degreasing Operations	VOC	• Equipped with cover that will not disturb vapor zone • Degreaser covered at all times except: loading, unloading and degreasing • Equipped with safety switches (see 310 CMR 7.18 (8)(b)3) • Freeboard ratio ≥ 0.75 if open area $>10\text{ft}^2$ or refrigerated chiller, or enclosed system vented to carbon adsorption system with outlet VOC concentration $<6\text{ppmv}$ • Solvent carry-out minimized • Open air drafts ≤ 40 m/min	• Carbon adsorption or condensation technology at $\geq 95\%$ collection efficiency • Good Housekeeping Practices (see 310 CMR 7.18(8)(b)) • Best Management and Operating Practices (see 310 CMR 7.18(8)(b))	

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

	HAPs*	See 40 CFR Part 63	See 40 CFR Part 63	
Conveyorized Vapor Degreasing Operations	VOC	- Conveyorized degreaser >21.5 ft² must be equipped with either: refrigerated chiller, or vented at a rate ≥ 15 m³/min to an adsorption system with VOC outlet ≤ 6 ppm - Eliminate solvent carry-out - Equipped with safety switches (310 CMR 7.18(8)(c)3 - Open areas are minimized	- Carbon adsorption or condensation technology at $\geq 95\%$ collection efficiency - Good Housekeeping Practices (see 310 CMR 7.18(8)(c)) - Best Management and Operating Practices (see 310 CMR 7.18(8)(c))	
	HAPs*	See 40 CFR Part 63	See 40 CFR Part 63	
Aqueous Cleaning Operations	VOC	- All organic solvent in cleaning fluid is water soluble - Cleaning fluid is $\leq 5\%$ by weight organic material	- Good Housekeeping Practices - Best Management and Operating Practices	

* Facilities may obtain a federally enforceable approval to cap HAPs below MACT major source thresholds to < 25 tons of total HAPs per rolling 12 month period and to < 10 tons of any individual HAPs per rolling 12 month period.

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

Key to Abbreviations

VOC = volatile organic compounds

HAPs = Hazardous Air Pollutants

PTE = Permanent Total Enclosure

% = weight percent

@ = at

v.p. = vapor pressure

kPa = kilopascal

< = less than

≤ = less than or equal to

> = greater than

≥ = greater than or equal to

CMR = Code of Massachusetts Regulations

CFR = Code of Federal Regulations

ft² = square feet

mm Hg = millimeters of mercury

ppmv = parts per million volume

m³/min = cubic meters per minute

m/min = meters per minute

IPA = Isopropyl Alcohol

EXPANDABLE POLYSTYRENE FOAM (June, 2011)

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

Source Type	Air Contaminant	Minimum Control Requirements	Control Technology	BACT Determination
Expandable Polystyrene Foam Manufacturers	VOC (Pentane)	Pre-expanding activities (including steam expansion and curing/drying/aging with transfer to storage “bags”) with off-gassing: • 100% capture efficiency* for the curing/drying/aging activities to control device • 95% capture efficiency for the pre-expanders emissions sent to control device • 100% capture efficiency* for “aging bag” storage emissions collected by general ventilation and/or floor sweeps to control device • Rotary expanders are prohibited as BACT • New vertical batch expanders with 100% capture efficiency may utilize an existing boiler, having a VOC control efficiency of 97%, as a control device if ALL emission points are controlled (specifically targeting the product storage room), including off-gassing during final storage. Best Management Practices (BMP) to include at minimum no wrapping of product, and storing product for long duration to maximize off-gassing to be collected (100%) and controlled (97%-99%).	Thermal Oxidation or Regenerative Thermal Oxidation Technology at 99 % destruction efficiency Boilers may be utilized as an air pollution control device for VOC emissions at a 97 % destruction/removal efficiency (DRE), for new vertical batch expanders	310 CMR 7.02 Plan Approval Transmittal Number W093075 Transmittal Number W052874 Transmittal Number W028295

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

EXPANDABLE POLYSTYRENE FOAM (June, 2011)				
Source Type	Air Contaminant	Minimum Control Requirements	Control Technology	BACT Determination
		Molding activities emissions controlled under vacuum. 95% of polystyrene molding emissions are collected and delivered to the control device.		
		Molded polystyrene product storage emissions cannot exceed 8-10% of the pentane contained in the original polystyrene beads.		
		Halogenated blowing agents are prohibited.		
		Pentane content of styrene beads is limited to ≤5% by weight (based on a monthly average)		

*Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:

- any natural draft opening (NDO) is at least four equivalent opening diameters from each VOC emitting point;
- the total area of all NDO's shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling;
- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all VOC emissions are captured and contained for discharge through a control device.

Key to Abbreviations

VOC = volatile organic compounds

PTE = Permanent Total Enclosure

% = weight percent

NDO = Natural Draft Opening

m/hr = meters per hour

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

fpm = feet per minute

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

BULK GASOLINE TERMINALS (June, 2011)					
Source Type	Air Contaminant	Emission Limit	Minimum Control Requirements	Control Technology	BACT Determination
Bulk Gasoline Terminals	VOC	2 mg/l of gasoline loaded	Vacuum Assist, negative pressure (VANP) vapor collection system – 100% collection efficiency. Switch loading to occur only under VANP.	- Activated Carbon Adsorption Technology - Combustion Technology is prohibited, since the Department Regulations at 310 CMR 7.24 require vapor “recovery”, not vapor destruction technology.	310 CMR 7.02 Plan Approval, Transmittal Number W080267
			Continuously monitor and record system vacuum for the vapor collection system (at each loading lane).		
			Submerged filling.		
			Semi-annual tank truck leak testing per 40 CFR 60 Subpart XX – US EPA Method 27		

BULK GASOLINE TERMINALS (June, 2011)					
			Installation and operation of electronic interlocks and visible and audible alarms to prevent non-vapor-tight gasoline loading and fugitive emissions at the tank truck loading rack. Interlocks shall be maintained to ensure that vapor collection system under negative pressure continuously and vapor collection hose is connected properly between tank truck and facility during loading operations..		
			Installation and operation of CEMS to monitor inlet and outlet of ACAT.		
			Subject to 40 CFR 60 Subpart XX		
	HAPs	As above, in addition to requirements specified by 40 CFR 63 Subpart R if facility is a major source for HAPs	As above, in addition to requirements specified by 40 CFR 63 Subpart R if facility is a major source for HAPs	40 CFR 63 Subpart R	
		If facility is not major for HAPs, the facility may be subject to 40 CFR 63 Subpart BBBBBB.			

Key to Abbreviations

VOC = volatile organic compounds

HAPs = Hazardous Air Pollutants

mg/l = milligrams per liter

% = weight percent

CEMS = continuous emissions monitoring system

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

BULK GASOLINE STORAGE TANKS (June, 2011)				
Source Type	Air Contaminant	Minimum Requirements	Control Technology	BACT Determination
Bulk Gasoline Storage Tanks	VOC	• In addition to requirements specified in Regulations 310 CMR 7.24 and 40 CFR 60 Subpart Kb • All tanks shall be equipped with cable suspended full contact floating roofs (leg-supported floating roofs shall not be allowed) • Tanks designed such that there will be no standing liquid when emptied • Tanks must include a connection for a control device (98% VOC/HAPs control efficiency or 5000 ppmv VOC/HAPs tank concentration) that will control vapors when roofs are not floating (when tanks are emptied, cleaned, during seasonal fuel switching/tank landings, etc.) • Utilize 98% overall efficiency VOC/HAPs control device when seasonal fuel switching/tank landing event would cause potential VOC/HAPs emission of one or more tons	• Cable suspended full contact floating roof • Drain dry tank bottom • Vapor control device	• In addition to requirements specified in Regulations 310 CMR 7.24 and 40 CFR 60 Subpart Kb 310 CMR 7.02 Plan Approval, Transmittal Number W152661
	HAPs*	• As above, in addition to requirements specified by 40 CFR 63 Subpart R if facility is a major source for HAPs	• As above, in addition to requirements specified by 40 CFR 63 Subpart R if facility is a major source for HAPs	• As above, in addition to requirements specified by 40 CFR 63 Subpart R if facility is a major source for HAPs

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

Key to Abbreviations

VOC = volatile organic compounds

HAPs = hazardous air pollutants

% = weight percent

ppmv = parts per million volume

CFR = Code of Federal Regulations

CMR = Code of Massachusetts Regulations

*If not major for HAPs, the facility may be subject to 40 CFR 63 Subpart BBBBBB.

BIOTECHNOLOGY SURFACE DISINFECTION PROCESSES (June, 2011)				
Source Type	Air Contaminant	Minimum Requirements	Control Technology	BACT Determination
Surface disinfection processes used in drug, medical device, and biologic product production having: ≤ 15 tons per 12 month rolling period VOC or total/combined HAPs	VOC	≤ 15 tons of VOC per rolling 12 month period ≤ 2.5 tons of VOC per month	- Good housekeeping - Best Management Practices	310 CMR 7.03(25)
	HAPs	≤ 15 tons of total/combined HAPs per rolling 12 month period ≤ 3 tons of total/combined HAPs per month ≤ 2 tons of individual HAP per month ≤ 9 tons of individual HAPs per rolling 12 month period		
	VOC/HAPs	- VOC containing solutions kept in tightly closed containers - Spent cleaning cloths/wipes kept in tightly closed containers		
>15 tons per 12 month rolling period VOC and/or total/combined	VOC/HAPs	100% Capture Efficiency (PTE-Method 204)* 99% Destruction Efficiency	Regenerative Thermal Oxidizer (RTO)	See MISCELLANEOUS VOC EMITTING SOURCES

BIOTECHNOLOGY SURFACE DISINFECTION PROCESSES (June, 2011)				
HAPs**		100% Capture Efficiency (PTE-Method 204)* 99% Destruction Efficiency	Thermal Oxidizer (TO)	
		100% Capture Efficiency (PTE-Method 204)* 98% Destruction Efficiency	Catalytic Oxidizer (CatOx) – may be utilized only if the effluent exhaust stream contains no substituents which could cause catalyst poisoning	
		100% Capture Efficiency (PTE-Method 204)* 98% Removal Efficiency	Adsorption Technology or equivalent (including nitrogen blanketing and condensation strategies)	

*Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:

- any natural draft opening (NDO) is at least four equivalent opening diameters from each VOC emitting point;
- the total area of all NDOs shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling;
- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all VOC emissions are captured and contained for discharge through a control device.

**To avoid MACT, a facility may request a federally enforceable cap of < 25 tons per rolling 12 month period for total HAPs and < 10 tons per 12 month rolling period for individual HAP.

Key to Abbreviations

VOC = volatile organic compounds

HAPs = Hazardous Air Pollutants

PTE = Permanent Total Enclosure

% = weight percent

< = less than

≤ = less than or equal to

> = greater than

≥ = greater than or equal to

CMR = Code of Massachusetts Regulations

CFR = Code of Federal Regulations

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

CHEMICAL AND COATING MANUFACTURING SOURCES* (June, 2011)				
Source Type	Air Contaminant	Minimum Requirements	Control Technology	BACT Determination
Storage Tanks	VOC	- Submerged fill pipes - Vapor collection system to a control device*	- Vapor collection system must be at all times under negative pressure (100 % capture efficiency)* - VOC control device must achieve a control efficiency of $\geq 98\%$ (flares are Prohibited)* - Good housekeeping for cleaning and spill prevention - Waste coatings and cleaning solvents kept in closed containers when not in use - All covers, ports, hatches, etc. must be kept clean and in a tight fitting manner - All material and product loading must be done utilizing submerged fill pipes NOTE: Malodorous compounds may need to install technology that exceeds BACT to eliminate any nuisance odors generated from the process.	In general, MassDEP considers proposed chemical and coating manufacturing sources which propose to emit VOC and which propose to meet the requirements of this Table as complying with Top Case BACT as required by 310 CMR 7.02(8)
	HAPs	Compliance with 40 CFR 63 Subpart HHHHH (for major source of HAPs)		
Process Piping	VOC	All material transfers to be accomplished by hard piping, not by manual transfers		
	HAPs	Compliance with 40 CFR 63 Subpart HHHHH (for major source of HAPs)		
Mixers, Dispensers	VOC	- All units equipped with permanent, tightly fitted covers, minimum shaft clearance, and shaft boot - All tanks shall be equipped with a vapor collection system to a control device* - All cleaning activities will occur with emissions collected via the vapor collection system		
	HAPs	Compliance with 40 CFR 63 Subpart HHHHH (for major source of HAPs)		

CHEMICAL AND COATING MANUFACTURING SOURCES* (June, 2011)				
Letdown Tanks	VOC	- Tanks must have tightly fitting: covers, hatches and ports kept closed except for sampling and addition of materials - Tanks controlled by a vapor collection system to a control device		
	HAPs	Compliance with 40 CFR 63 Subpart HHHHH (for major source of HAPs)		
Product Packaging	VOC	Packaging must occur in a PTE** equipped with a vapor collection system to a control device		
	HAPs	Compliance with 40 CFR 63 Subpart HHHHH (for major source of HAPs)		

***For Chemical and Coating Manufacturing Sources $\geq$ 18 tons per twelve month rolling period, these sources must comply with the BACT Guidelines found in the above Table, for Minimum Requirements including add-on air pollution control technology. While sources $<$ 18 tons per twelve month rolling period may apply for a facility wide VOC emissions cap, these sources must still comply with the Minimum Requirements including Control Technology, however add-on air pollution control technology is not required.**

****Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:**

- any natural draft opening (NDO) is at least four equivalent opening diameters from each VOC emitting point;
- the total area of all NDO's shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling;

MassDEP TOP CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDELINES – VOC EMITTING SOURCES

- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all VOC and/or HAPs emissions are captured and contained for discharge through a control device.

Key to Abbreviations

VOC = volatile organic compounds

HAPs = Hazardous Air Pollutants

PTE = Permanent Total Enclosure

% = weight percent

NDO = Natural Draft Opening

m/hr = meters per hour

fpm = feet per minute

P2 = pollution prevention

CFR = Code of Federal Regulations

≥ = greater than or equal to

< = less than

AMMONIA STORAGE AND HANDLING (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Anhydrous Ammonia Storage and Handling	NH ₃	• A mitigation plan describing the methods and procedures used to reduce the risk of a catastrophic release of ammonia • A contingency plan that describes the corrective actions utilized to notify persons in the immediate area of the release of ammonia • Audio, Visual and Olfactory (AVO) inspections twice per day to monitor potential ammonia leaks • During transfers of ammonia, all ammonia vapors are vented back to the host storage tank, UNCONTROLLED AMMONIA RELEASES TO ATMOSPHERE ARE PROHIBITED • Relieving pressures from hoses and connectors must be bled to adequate volume of water • All valves, connectors, and hoses must be maintained in a leak proof condition at all times • Upon detection of any leak, the facility must implement immediate leak repair, if not possible, the use of a leak collection/containment system must be utilized until a repair may be implemented (i.e. automated water spray set to operate upon detection of NH₃ fumes.) • Reinforced containment constructed around the ammonia storage tank for safety • Method of operation and interlocks to prevent unauthorized release and operation of the ammonia storage and transferring system • US EPA Level 2 Controls	• US EPA Prevention Reference Manual: Chemical Specific, Volume 11, Control of Accidental Releases of Ammonia, EPA/600/8-87/034k

AMMONIA STORAGE AND HANDLING (June, 2011)			
Aqueous Ammonia Storage and Handling	NH ₃	Diked containment, release of spherical orbs to reduce surface area, etc.	

Key to Abbreviations

NH₃ = ammonia

ASPHALT PROCESSING AND ASPHALT ROOFING (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Saturator/Coater/Sealant Applicator	THC	• Reduce THC mass emissions by 95% or to a THC emission limit ≤ 20 ppmvd @ 3 volume percent O₂ • Control all THC emissions via a TO or RTO having a CE of 100% (PTE-Method 204)* having a DRE of $\geq 99.5\%$ • Natural gas firing	40 CFR 60 Subpart UU 40 CFR 63 NESHAPS/MACT
	PM	• Control all PM emissions via a FF/BH having a RE of $\geq 99.9\%$ • ≤ 0.005 gr/dscf outlet emission limit • 0.04 kg/Mg of asphalt shingle or mineral-surfaces rolled roofing • 0.40 kg/Mg of saturated felt or smooth surfaced rolled roofing • Natural gas firing	
	Opacity	• ≤ 5 percent opacity at all times • Natural gas firing	
Storage Silo and Material Handling	PM	• Control all PM emissions via a FF/BH having a RE of $\geq 99.9\%$ • ≤ 0.005 gr/dscf outlet emission limit	

ASPHALT PROCESSING AND ASPHALT ROOFING (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
	Opacity	Zero percent opacity – no visible emissions	
	PM	0.67 kg/Mg from blow still when catalyst used 0.60 kg/Mg from blow still when catalyst not used - Fuel oils are prohibited – natural gas firing only	
Blow Still	HAPs/THC/VOC	- Reduce THC mass emissions by 95% or to a THC emission limit ≤ 20 ppmvd @ 3% O₂ - Control all THC emissions via a TO or RTO having a CE of 100% (PTE-Method 204)* DRE of $\geq 99.5\%$ - Natural gas firing	

* Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:

- any natural draft opening (NDO) is at least four equivalent opening diameters from each THC emitting point;
- the total area of all NDO's shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling;
- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all THC emissions are captured and contained for discharge through a control device.

Key to Abbreviations

VOC = volatile organic compounds

HAPs = hazardous air pollutants

THC = total hydrocarbons

PM = particulate matter

CE = capture efficiency

DRE = destruction/removal efficiency

RE = removal efficiency

$\leq$ = less than or equal to

$\geq$ = greater than or equal to

TO = thermal oxidizer

RTO = regenerative thermal oxidizer

% = weight percent

ppmvd = parts per million volume dry

@ = at

kg/Mg = kilograms per Megagram

gr/dscf = grains per dry standard cubic foot

FF/BH = fabric filter/baghouse

NESHAPS = National Emissions Standards for Hazardous Air Pollutants

MACT = maximum achievable control technology

BULK CEMENT SHIP UNLOADING (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Power Source to Pneumatic Unloading system	NO _x	Shore Utility Power – Electric Power [emergency power must comply with Engine & Turbine ERP Regulation at 310 CMR 7.26(42)]	
	SO ₂		
	CO		
	PM		
Material Handling	PM	- Enclosed, self-unloading ship with pneumatic conveyor system; receiving shore silos/containers/domes - Enclosed processing equipment vented to FF/BH having a PM collection efficiency of 99.99%. - Emission Limits range between 0.001 and 0.003 gr/acf, process equipment specific - System must be equipped with process flow interlocks, high level sensor interlocks in silos, containers, domes to ensure that over-loading of storage vessels and over-pressurization of delivery lines do not occur - Continuous process monitoring must occur during any loading or transferring events, the system shall record all system excursions and be equipped with audible and visual alarms.	310 CMR 7.02 Plan Approvals, Transmittal Number W154933, Transmittal Number W158294

Key to Abbreviations

PM = particulate matter

NO_x = nitrogen oxides

SO₂ = sulfur dioxide

CO = carbon monoxide

gr/acf = grains per actual cubic foot

% = weight percent

FF/BH = fabric filter/baghouse

CMR = Code of Massachusetts Regulations

CONCRETE BATCH PLANTS (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Permanent Concrete Batch Plants	PM	- Emission Limit ≤ 0.0002 gr/dscf - Dry material storage controlled with FF/BH $\geq 99.99\%$ collection efficiency - All aggregate material handling prewashed achieving $\geq 70\%$ reduction - Aggregate stockpiles controlled by continuous water spray systems to achieve $\geq 70\%$ reduction, aggregate storage piles must be maintained at a minimum moisture content of 4% by weight - Central mixer and/or truck drop point emissions controlled to $\geq 99\%$ or emission limit of ≤ 0.008 gr/dscf – use of suction shroud with minimum 5000 acfm flow rate - Visible emissions ≤ 5 percent opacity except up to 10 percent opacity for no more than 2 minutes during any one hour, not to exceed 10 percent opacity from any process point, internal roads, work areas, material storage areas or stockpiles	310 CMR 7.02 Plan Approval, Transmittal Number 002964

CONCRETE BATCH PLANTS (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Temporary Concrete Batch Plants	PM	- Emission Limit ≤ 0.008[should this also be 0.0002?] gr/dscf - Dry material storage controlled with FF/BH $\geq 99.99\%$ collection efficiency - All aggregate material handling prewashed achieving $> 70\%$ reduction - Aggregate stockpiles controlled by continuous water spray systems to achieve $\geq 70\%$ reduction, aggregate storage piles must be maintained at a minimum moisture content of 4% by weight - Central mixer and/or truck drop point emissions controlled to $\geq 99\%$ or emission limit of ≤ 0.008 gr/dscf – use of suction shroud with minimum 5000 acfm flow rate - Visible emissions ≤ 5 percent at any time from any process point, internal roads, work areas, material storage areas or stockpiles	

Key to Abbreviations

PM = particulate matter

gr/dscf = grains per dry standard cubic foot

% = weight percent

FF/BH = fabric filter/baghouse

> = greater than

≥ = greater than or equal to

< = less than

≤ = less than or equal to

acfm = actual cubic feet per minute

DRY BULK MATERIAL HANDLING AND UNLOADING (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Dry Bulk Material Handling and Unloading Activities	PM	• Pertains to dry, enclosed and open activities. • Dry and/or enclosed activities to include dry commodities such as gypsum, lime, soda ash, salt cake, etc. • Enclosed systems vented to a FF/BH having a collection efficiency of 99.99% or an emission limit of 0.001 to 0.003 gr/dscf activity specific. • Material handling by use of pneumatic transfer, bag unload, box unload, small container unload to achieve total enclosure (100% capture efficiency) • Open systems of stockpiles must achieve $\geq 70\%$ control of emissions, utilizing, water sprays, fogging, chemical suppressants and/or foam. • Zero Percent Opacity • Comply with MassDEP Noise Policy	310 CMR 7.02 Plan Approval, Transmittal Number W158294

Key to Abbreviations

PM = particulate matter

FF/BH = fabric filter/baghouse

gr/dscf = grains per dry standard cubic foot

% = weight percent

MATERIAL AND COAL HANDLING (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Material Handling	PM	• Pertains to dry, enclosed and open activities. • Dry and/or enclosed activities to include dry commodities such as gypsum, lime, soda ash, salt cake, etc. • Enclosed systems vented to a FF/BH having a collection efficiency of $\geq 99.99\%$ or an emission limit of 0.001 to 0.003 gr/dscf activity specific. • Open systems of stockpiles must achieve $\geq 70\%$ control of emissions, utilizing, water sprays, fogging, chemical suppressants and/or foam.	

MATERIAL AND COAL HANDLING (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Coal Handling	PM	• Enclosed systems, such as domes. • In cases where domes or enclosures are not permissible by local ordinances, or equivalent: stockpiles and internal roads must be treated with water sprays; stockpiles must also be treated with encrusting agents. • Transfer points must be treated with foam and/or surfactants. • Receiving and unloading must be conducted within enclosures and/or shrouding. Foaming sprays during receiving and unloading activities is required. • Conveying of coal must be fully enclosed. • Crushing of coal must be fully enclosed. • Screening of coal must be fully enclosed.	

Key to Abbreviations PM = particulate matter

FF/BH = fabric filter/baghouse

gr/dscf = grains per dry standard cubic foot

=greater than or equal to

% = weight percent

ROCK CRUSHING			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Rock Crushers	PM-10/PM-2.5	• ≤ 0.014 gr/dscf (emission limit) • use of charges “water fog” sprays of transfer points, conveyors • water spray with chemical suppressants for material storage piles • enclosure of jaw/cone crushers, screens, and associated material transfer points and vent to baghouse(s) having a PM removal efficiency of $\geq 99.99\%$ or proper application of water sprays to achieve an equivalent $\geq 99.99\%$ overall PM control efficiency • water sprays for road surfaces • visible emissions not to exceed seven percent opacity	40 CFR 60 Subpart OOO

Key to Abbreviations

PM-10 = particulate matter 10 microns or less

PM-2.5 = particulate matter 2.5 microns or less

$\leq$ = less than or equal to

$\geq$ = greater than or equal to

Gr/dscf = grains per dry standard cubic foot

% = weight percent

HOT MIX ASPHALT - BATCH PLANTS AND DRUM MIX PLANTS (June, 2011)				
Source Type	Fuel	Air Contaminant	Minimum Requirements	BACT Determination
Batch Plants And Drum Mix Plants	Reserved			310 CMR 7.02 Plan Approval, Transmittal Number X227251
	Ultra Low Sulfur Distillate Fuel Oil (0.0015 % S)	PM(filterable)	• ≤ 0.01 gr/dscf	
		PM(condensable)	• 0.0194 lbs/ton	
		NOx	• ≤ 0.113 lb/MMBtu	
		CO	• ≤ 0.39 lb/MMBtu	
		VOC	• ≤ 0.032 lbs/ton product produced	
	Natural Gas	PM	• ≤ 0.01 gr/dscf	
		NOx	• ≤ 0.044 lb/MMBtu	
		CO	• ≤ 0.30 lb/MMBtu	
		VOC	• ≤ 0.032 lbs/ton product produced	
	All Fuels	Opacity	• ≤ 5 percent, except $\leq 20\%$ for ≤ 2 minutes during any one hour period	

HOT MIX ASPHALT - BATCH PLANTS AND DRUM MIX PLANTS (June, 2011)				
Source Type	Fuel	Air Contaminant	Minimum Requirements	BACT Determination
	All Fuels	Other	• Emissions Testing for new facilities • Visilite testing of FF/BH – once at start-up of “season”, and once per month thereafter during the operating season • Ultra Low-NO_x Burner(s), FGR as necessary • 80% PM reduction – All aggregate must be prewashed • Baghouse outlet temperature and pressure differential monitoring system, with instantaneous readings in control room; audible and visual alarms to alert operator to need for corrective actions • Top of silo controls to collect and control 90 percent minimum of exhaust gases displaced from filling of silos	

Key to Abbreviations

VOC = volatile organic compounds

S = sulfur

PM = particulate matter

NO_x = oxides of nitrogen

< = less than

≤ = less than or equal to

≥ = greater than or equal to

% = weight percent

@ = at

FGR = flue gas recirculation

lbs/ton = pounds per ton

lb/MMBtu = pounds per million British thermal units

gr/dscf = grains per dry standard cubic foot

FF/BH = fabric filter/baghouse

CMR = Code of Massachusetts Regulations

CHROME PLATING AND ANODIZING OPERATIONS USING CHROMIC ACID (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Hard Chrome Plating Tank	PM and Chrome	Small Existing Tanks: 1. 100% capture efficiency (PTE-Method 204)* 2. Emission Limit ≤ 0.03 mg/dscm - or 3. Wetting agent fume suppressant in plating tank with plating solution surface tension not exceeding 45 dynes/cm (stalagmometer) or 35 dynes/cm (tensiometer), and good housekeeping for spills. All Other Hard Chromium Tanks: 1. 100% capture efficiency (PTE-Method 204)* 2. Emission Limit ≤ 0.015 mg/dscm - or 3. Wetting agent fume suppressant in plating tank with plating solution surface tension not exceeding 45 dynes/cm (stalagmometer) or 35 dynes/cm (tensiometer), and good housekeeping for spills.	40 CFR 63 Subpart N MACT/NESHAPS
Decorative Chrome Plating Tank	PM and Chrome	1. 100% capture efficiency (PTE-Method 204)* 2. Emission Limit ≤ 0.01 mg/dscm - or 3. Wetting agent fume suppressant in plating tank with plating solution surface tension not exceeding 45 dynes/cm (stalagmometer) or 35 dynes/cm (tensiometer), and good housekeeping for spills.	

CHROME PLATING AND ANODIZING OPERATIONS USING CHROMIC ACID (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Chromic Acid Anodizing	PM and Chrome	1. 100% capture efficiency (PTE-Method 204)* 2. Emission Limit ≤ 0.01 mg/dscm or 3. Wetting agent fume suppressant in plating tank with plating solution surface tension not exceeding 45 dynes/cm (stalagmometer) or 35 dynes/cm (tensiometer), and good housekeeping for spills.	

*Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:

- any natural draft opening (NDO) is at least four equivalent opening diameters from each pollutant emitting point;
- the total area of all NDO's shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling;
- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all PM and chrome emissions are captured and contained for discharge through a control device.

Key to Abbreviations

PM = particulate matter

gr/dscf = grains per dry standard cubic foot

% = weight percent

m/hr = meters per hour

ft/min = feet per minute

FF/BH = fabric filter/baghouse

$\leq$ = less than or equal to

mg/dscm = milligrams per dry standard cubic meter

dynes/cm = dynes per centimeter

CFR = Code of Federal Regulations

MACT = Maximum Achievable Control Technology

NESHAPS = National Emission Standards for Hazardous Air Pollutants

ETHYLENE OXIDE STERILIZATION (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Sterilizers and Aerators	ETO (VOC/HAPs)	- Sterilization and/or aeration process vessels or rooms must be constructed to achieve and maintain 100% Capture Efficiency at minimum, per Method 204* - All ETO exhaust emissions from the sterilizer and/or aerator must be ducted to a control device (Thermal Oxidizer, Catalytic Oxidizer, or Wet Chemical Scrubber) achieving and maintaining a Destruction Efficiency of $\geq$ 99.9% or ETO emissions, post control, of $\leq$ than 0.2 ppm. - No by-pass stacks are permitted.	310 CMR 7.02 Plan Approval Transmittal Number W058285 MACT - 40 CFR 63, Subpart O

* Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:

- any natural draft opening (NDO) is at least four equivalent opening diameters from each VOC emitting point;
- the total area of all NDO's shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling;
- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all VOC and/or HAPs emissions are captured and contained for discharge through a control device.

Key to Abbreviations

VOC = volatile organic compounds

HAPs = hazardous air pollutants

ETO = ethylene oxide

$\geq$ = greater than or equal to

$\leq$ = less than or equal to

ppm = part per million

% = weight percent

CMR = Code of Massachusetts Regulations

CFR = Code of Federal Regulations

MACT = Maximum Achievable Control Technology

GALVANIZING OPERATIONS (June, 2011)			
Source Type	Air Contaminant	Minimum Requirements	BACT Determination
Zinc Kettle	PM	95% Capture Efficiency (PTE-Method 204)* 99.99% collection efficiency, achieved with a FF/BH equipped with lime pre-coated bags. - Emission Limit ≤ 0.003 gr/dscf - No Opacity from stack exhaust (0 percent) - Separate ammonia chloride preflux tank.	MACT 40 CFR 63 Subpart CCC
HCl Tanks	HCl	98% control efficiency utilizing fume suppressant or equivalent	

*Capture efficiency determined by US EPA Method 204 for Permanent Total Enclosures (PTE). PTE criteria:

- any natural draft opening (NDO) is at least four equivalent opening diameters from each pollutant emitting point;
- the total area of all NDO's shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling;
- the average face velocity (FV) of air through all NDOs shall be at least 3600 m/hr (200 fpm). The direction of air flow through all NDOs shall be into the enclosure;
- all access doors and windows whose areas are not included in the method and are not included in the calculation are closed at all times during routine operation of the process;
- all PM and HCl emissions are captured and contained for discharge through a control device.

Key to Abbreviations

PM = particulate matter

HCl = hydrochloric acid

gr/dscf = grains per dry standard cubic foot

% = weight percent

m/hr = meters per hour

fpm = feet per minute

FF/BH = fabric filter/baghouse