



**Massachusetts Department of Environmental Protection (MassDEP)
Top Case Best Available Control Technology (BACT) Guidelines
for Anaerobic Digester Biogas to Electricity Facilities**

This information is maintained by the MassDEP, Bureau of Air and Waste, Air Pollution Control Program, and is subject to change. The following Top Case BACT guidelines for anaerobic digester biogas-to-electricity systems in non-major air contaminant-emitting projects were previously issued separately.

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.

Massachusetts Department of Environmental Protection
November 21, 2017

**CURRENT BEST AVAILABLE CONTROL TECHNOLOGY (BACT) REQUIREMENTS
FOR COMMERCIAL (NON-FARM) FACILITIES**

**For air emissions from commercial anaerobic digester-gas-to-electricity (AD) operations
(involving internal combustion engines and flares) located in
Massachusetts performing anaerobic digestion of source-separated organic (SSO) (and other digestible) material**

Source Type	Fuel	Pollutant	Emission Limitations (lb/MW-hr)
IC Engines	Biomass Digester Gas	NO _x	0.50
		CO	0.60
		PM 2.5/ PM10	0.030
		CO ₂	1000 See Note 4
		VOC	0.30
		SO ₂	0.50
		H ₂ S	See Note 5

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Source Type	Fuel	Pollutant	Emission Limitations (lb/1000 scfm gas flared)
Flares See Note 2	Biomass Digester Gas	NO _x	2.70
		CO	13.70
		PM 10/ PM2.5	0.15
		CO ₂	7105
		VOC	0.55
		SO ₂	See Note 5
		H ₂ S	See Note 5

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Massachusetts performing anaerobic digestion of source-separated organic (SSO) (and other digestible) material**

Key Abbreviations:

lbs/hr = pounds per hour

NO_x = nitrogen oxides

CO = carbon monoxide

CO₂ = carbon dioxide

PM₁₀ = particulate matter 10.0 microns or less

PM_{2.5} = particulate matter 2.5 microns or less

VOC = volatile organic compounds

SO₂ = sulfur dioxide

H₂S = hydrogen sulfide

lb/MW-hr = pounds per megawatt hour output

scfm = standard cubic feet per minute

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FOR COMMERCIAL (NON-FARM) FACILITIES**

**For air emissions from commercial anaerobic digester-gas-to-electricity (AD) operations
(involving internal combustion engines and flares) located in
Massachusetts performing anaerobic digestion of source-separated organic (SSO) (and other digestible) material**

Notes

1. This policy applies to either any commercial AD facility digesting/processing SSO or any AD facility with an electrical output capacity of greater than 500 kilowatts (kw).
2. All digester gas generating sources shall be totally enclosed and vented to either the IC engine or “back-up” flare. All sources with odor potential shall be controlled to prevent nuisance odor conditions. SSO, and any other material to be digested, shall be delivered to the facility in a completely sealed manner; and shall be pumped from the delivery trucks to the digestion system in a closed loop manner.
3. Back-up flares must be utility flare design with the flame shielded such that there is no exposed flame. Emission limits in Table are “not to be exceeded” values. MassDEP will set individual flare limits on a case-by-case basis, depending upon actual flare rating and inlet gas flow rate.
4. Facility-wide CO₂ caps are undefined for this source category. The CO₂ emission limit for the engine is based upon CO₂ emissions resulting from combustion of methane only.
5. H₂S emissions are regulated by restricting the inlet H₂S emissions to the IC engine and flare to less than or equal to 200 ppm. SO₂ emissions are based upon 99.5 percent oxidation of 200 ppm H₂S inlet emissions to the IC engine and flare.
6. MassDEP will set individual facility-wide limits on a case-by-case basis depending upon actual engine and flare ratings.

**TOP-CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDANCE
for farm-based facilities with generation greater than 500 kW but less than 1,000 kW**

For air emissions from digester-gas-to-electricity operations (including internal combustion engines and flares) at Massachusetts farms engaged in “agriculture” or “farming” as defined in M.G.L. c. 128, section 1A, managing manure waste through anaerobic digestion or anaerobic digestion of manure with other, source-separated organic material

Source Type	Fuel	Pollutant	Emission Limitation (g/bhp-hr)
Reciprocating internal combustion engine-generator set or sets totaling less than 1,000 kW rated electric power output at the facility	Manure and source-separated organic waste digester gas	NO _x	0.6
		CO	0.13
		PM _{2.5} /PM ₁₀	0.02
		VOC	0.10
		SO ₂	See note 3

**TOP-CASE BEST AVAILABLE CONTROL TECHNOLOGY (BACT) GUIDANCE
for farm-based facilities with generation greater than 500 kW but less than 1,000 kW**

For air emissions from digester-gas-to-electricity operations (including internal combustion engines and flares) at Massachusetts farms engaged in “agriculture” or “farming” as defined in M.G.L. c. 128, section 1A, managing manure waste through anaerobic digestion or anaerobic digestion of manure with other, source-separated organic material

Notes

1. All digester gas generating sources shall be totally enclosed and vented to either the engine or “back-up” flare. All sources with odor potential shall be controlled to prevent nuisance odor conditions
2. The Permittee shall equip engine exhaust with an oxidation catalyst designed to reduce CO and VOC emissions by 95 and 85 percent or greater, respectively.
3. The Permittee shall treat digester gas to maintain H₂S concentration not to exceed 200 ppm, daily average. Permitted SO₂ emissions shall be calculated based upon 99.5 percent oxidation of 200 ppm H₂S inlet emissions to the engine and flare.
4. The Permittee shall provide an enclosed flare or flares rated at 100 percent of the design digester gas flow rate and energy content. The Permittee shall operate flares so as to minimize visible emissions.
5. Nominal facility potential-to-emit is less than 10 tons NO_x per year.
6. The engine-generator set shall be located in a noise suppression enclosure or building with equivalent noise mitigation.

Key Abbreviations:

g/hp-hr	=	grams per horsepower-hour
NO _x	=	nitrogen oxides
CO	=	carbon monoxide
PM ₁₀	=	particulate matter with aerodynamic particle diameter less than or equal to 10.0 microns, including condensibles
PM _{2.5}	=	particulate matter with aerodynamic particle diameter less than or equal to 2.5 microns, including condensibles
VOC	=	volatile organic compounds
SO ₂	=	sulfur dioxide
H ₂ S	=	hydrogen sulfide
kW	=	kilowatt
ppm	=	parts per million

**CURRENT BEST AVAILABLE CONTROL TECHNOLOGY (BACT) REQUIREMENTS
for farm-based facilities with generation not to exceed 500 kW**

For air emissions from digester-gas-to-electricity operations (including internal combustion engines and flares) at Massachusetts farms engaged in “agriculture” or “farming” as defined in M.G.L. c. 128, section 1A, managing manure waste through anaerobic digestion or anaerobic digestion of manure with other, source-separated organic material

Source Type	Fuel	Pollutant	Emission Limitations (lb/MW-hr)
IC Engines ≤ 500 kW	Biomass Digester Gas	NO _x	2
		CO	6
		PM 2.5/ PM10	0.001
		CO ₂	1900 See Note 3
		VOC	3.4
		SO ₂	3.4
		H ₂ S	See Note 4

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Source Type	Fuel	Pollutant	Emission Limitations (lb/hr)
Flares ≤ 350 scfm See Note 2	Biomass Digester Gas	NO _x	0.9
		CO	4.7
		PM 10/ PM2.5	0.05
		CO ₂	2450
		VOC	0.18
		SO ₂	See Note 4
		H ₂ S	See Note 4

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Source Type	Fuel	Pollutant	Maximum Emissions (tons per 12 month rolling period)
Facility-wide See Note 5	Biomass Digester Gas	NO _x	5.0
		CO	13.0
		PM10/ PM2.5	0.018
		CO ₂	See Note 3
		VOC	7.3
		SO ₂	1.6
		H ₂ S	See Note 4

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PM₁₀ = particulate matter 10.0 microns or less

PM 2.5 = particulate matter 2.5 microns or less

VOC = volatile organic compounds

SO₂ = sulfur dioxide

H₂S = hydrogen sulfide

kW = kilowatt

lb/MW-hr = pounds per megawatt hour output

scfm = standard cubic feet per minute

ppm = parts per million

≤ = less than or equal to

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Notes

1. All digester gas generating sources shall be totally enclosed and vented to either the IC engine or “back-up” flare. All sources with odor potential shall be controlled to prevent nuisance odor conditions.
2. Back-up flares must be utility flare design with the flame shielded such that there is no exposed flame. Emission limits in Table are “not to be exceeded” values. MassDEP will set individual flare limits on a case-by-case basis, depending upon actual flare rating and inlet gas flow rate.
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4. H₂S emissions are regulated by restricting the inlet H₂S emissions to the IC engine and flare to less than or equal to 200 ppm. SO₂ emissions are based upon 99.5 percent oxidation of 200 ppm H₂S inlet emissions to the IC engine and flare.
5. Facility-wide limits include engine and flare only and are “not to be exceeded” values. MassDEP will set individual facility-wide limits on a case-by-case basis depending upon actual engine and flare ratings.