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EMISSIONS FROM BIOGAS-FUELED DISTRIBUTED GENERATION UNITS

Part 2: What are the current emission regulations for New York State?

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CLEAN AIR ACT

The seminal U.S. air quality statute, the Clean Air Act (CAA), authorized the U.S. Environmental Protection Agency (EPA) to protect public health and welfare by establishing National Ambient Air Quality Standards (NAAQS) and regulating Hazardous Air Pollutants (HAPs). The 1990 CAA amendments added pollutants, imposed acid rain controls and established volatile organic carbon (VOC priority) threshold emission limits[1]. *States must meet or surpass Federal air emissions standards.*

NAAQS

Six 'criteria' pollutants are regulated under NAAQS: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM) and sulfur dioxide (SO_2). Primary standards are health-based. Secondary standards are welfare-based and include "effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility and climate…" (Table 1)[2]. Except for lead these pollutants can all be generated by biogas combustion.

HAPs

The EPA regulates 187 HAPs or toxic air pollutants known or suspected to cause cancer or other serious health and environmental effects. Some potential biogas combustion emissions, such as acrolein, acetaldehyde, formaldehyde and methanol are considered HAPs. Currently, there are no National Emissions Standards for HAPs generated from the combustion of biogas in engine-generator sets or boilers.

6 NYCRR PART 222 DISTRIBUTED GENERATION SOURCES

According to the New York State Dept. of Environmental Conservation (DEC), "distributed generation (DG) sources are engines used by a site to supply electricity outside that which is supplied by the electrical grid." This regulation is intended to bring DG sources into attainment with NAAQS, targeting specifically NO_2 and PM emissions, and the reduction of hazardous ground level ozone. According to the DEC, the intent of 6 NYCRR Part 222 is to regulate fossil fuel fired DG sources and not

Table 1 Summary of NAAQS

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon monoxide (CO)	primary	1 hour	35 ppm	not to be exceeded more than once per year
		8 hours	9 ppm	
Lead (Pb)*	primary and secondary	rolling 3 months ave.	0.15 µg/m^3	not to be exceeded
Nitrogen dioxide (NO_2)	primary	1 hour	100 ppb	3-year average of the annual 98th percentile of the daily maximum 1-hour average concentration
	primary and secondary	1 year	53 ppb	annual mean
Ozone (O_3)	primary and secondary	8 hours	0.070 ppm	annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Matter (PM) < 2.5 µm	primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
	secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
	primary and secondary	24 hours	35 µg/m^3	averaged over 3 years
PM 2.5µm ≤ 10 µm	primary and secondary	24 hours	150 µg/m^3	not to be exceeded more than once per year on average over 3 years
Sulfur dioxide (SO_2)	primary	1 hour	75 ppb	3-year average of the annual 99th percentile of the daily maximum 1-hour average concentrations
	secondary	3 hours	0.5 ppm	not to be exceeded more than once per year

* Not found in combustion emissions of biogas.

sources using biogas. In Subpart 227-2 Rural Area Flexibility Analysis, it states "Biogas-fired DG sources will not be subject to Part 222." It goes on to say "New biogas-fired sources are subject to 40 CFR 60 Subpart JJJJ," a federal regulation[3].

40 CFR, Part 60, Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (SI ICE)

According to Subpart JJJJ §60.4233, operators of digester gas-fueled stationary SI ICE must comply with emission standards depending on engine type, maximum engine power and manufacturing date (Table 2)[4]. When applicable, operators of DG sources can comply to these standards by 1) purchasing engines certified by the manufacture to meet emission standards (biogas SI ICE are rarely certified), or 2) by using standardized emissions testing methods to prove compliance and reporting these results to EPA.

Due to its complexity, biogas quality can impact biogas combustion emissions. For certain emissions, biogas upgrading (overviewed in the Part 3) is a viable strategy to reduce generation.

Table 2. Performance standards for stationary spark ignition internal combustion engines

Engine type and fuel	Maximum engine power	Manufactured date[1]	Emission standards[2]					
			g/HP-hr			ppmvd at 15 percent O_2		
			NO_x	CO	VOC[3]	NO_x	CO	VOC[3]
Landfill/Digester Gas (except lean burn 500 ≤ HP < 1,350)	HP < 500	7/1/2008 - 12/31/2010	3.0	5.0	1.0	220	610	80
		1/1/2011 or later	2.0	5.0	1.0	150	610	80
	HP ≥ 500	7/1/2007 - 6/30/2010	3.0	5.0	1.0	220	610	80
		7/1/2010 or later	2.0	5.0	1.0	150	610	80
Landfill/Digester Gas Lean Burn	500 ≤ HP < 1,350	1/1/2008 - 6/30/2010	3.0	5.0	1.0	220	610	80
		7/1/2010 or later	2.0	5.0	1.0	150	610	80

[1] Operators of biogas SI ICE manufactured before these dates are voluntarily obligated to meet performance standards. [2] Owners and operators of stationary non-certified SI engines may choose to comply with the emission standards in units of either g/HP-hr or parts per million by volume, dry basis (ppmvd) at 15 percent O_2. [3] When calculating emissions of volatile organic compounds, emissions of formaldehyde should not be included.

FACT SHEET SERIES

Emissions from biogas-fueled distributed generation sources

Part 1: What are the potential emissions from engine-generation sets?
Part 2: What are the current emission regulations for New York State?
Part 3: Greenhouse gas reduction and other benefits of biogas upgrading.
Part 4: How do operators of engine-generation sets meet applicable emission regulations?

Authors

Jason P. Oliver, PhD jpo53@cornell.edu (607) 227-7943
Curt Gooch, PE cag26@cornell.edu (607) 225-2088

References

[1] U.S. Environmental Protection Agency (EPA). 1990. Clean Air Act. U.S. Environmental Protection Agency. Title 42, Chapter 85. https://www.gpo.gov/fdsys/pkg/USCODE-2010-title42/pdf/USCODE-2010-title42-chap85.pdf **[2]** U.S. Environmental Protection Agency (EPA). 2016a. National Ambient Air Quality Standards. http://www3.epa.gov/ttn/naaqs/criteria.html **[3]** N.Y.S. Department of Environmental Conservation (DEC). 2016. Proposed Part 222, Distributed Generation Sources. http://www.dec.ny.gov/regulations/104487.html **[4]** U.S. Environmental Protection Agency (EPA). 2016b. Subpart JJJJ—Standards of Performance for Stationary Spark Ignition Internal Combustion Engines. http://www.ecfr.gov/cgi-bin/text-idx?node=sp40.7.60.jjjj