ANALYSIS AND PRELIMINARY DETERMINATION
FOR THE PROPOSED REVISIONS TO PRELIMINARY DETERMINATION 10-JLH-224

FOR THE
OPERATION PERMIT FOR A WASTEWATER TREATMENT PLANT

FOR
MADISON METROPOLITAN SEWERAGE DISTRICT,
NINESPRINGS
LOCATED AT
1610 MOORLAND ROAD,
MADISON, DANE COUNTY, WISCONSIN

Construction Permit Nos:	10-JLH-224
Operation Permit No:	113002230-F01
Facility Identification No:	113002230

This review was performed by the Wisconsin Department of Natural Resources, Air Management Program in accordance with Chapter 285, Wis. Stats., and Chapters NR 400 to NR 499, Wis. Adm. Code.

Reviewed by: Susan Lindem [signature] Date: November 16, 2012

Peer review conducted by: [signature] Date: 11-16-12

Preliminary Determination Approved by:	Signature	Date
Regional Supervisor:	[signature]	11/16/12
Stationary Source Modeling Team Leader:		
Compliance Engineer (reviewed/approved):	[signature]	11-16-12

cc: Jennifer L. Hamill - South Central Region Headquarters Compliance
Madison Public Library 201 W. Mifflin Street, Madison, WI 53703
Facility File – AM/7

INTRODUCTION

Stationary sources that are not specifically exempt from the requirement to obtain a construction permit under s. 285.60(5), Wis. Stats. or ch. NR 406, Wis. Adm. Code may not commence construction, reconstruction, replacement, relocation or modification unless a construction permit for the project has been issued by the Department of Natural Resource's (DNR's) Air Management Program. Owners or operators subject to the construction permit requirements must submit a construction and operation permit applications to the DNR. The applications are reviewed following the provisions set forth in ss. 285.60 to 285.67, Wis. Stats. The criteria for permit issuance vary depending on whether the source is major or minor and whether the source is or proposed to be located in an attainment or nonattainment area.

Subject sources are to be reviewed with respect to the equipment and facility description provided in the applications and for the resulting impact upon the air quality. The review ensures compliance with all applicable rules and statutory requirements. The preliminary determination will show why the source(s) should be approved, conditionally approved, or disapproved. It will encompass emission calculations and an air quality analysis using US EPA models, if applicable. Emissions from volatile organic compound (VOC) sources and small sources whose emissions are known to be insignificant are normally not modeled. As a precautionary note, the emission estimates are based on US EPA emission factors (AP-42) or theoretical data and can vary from actual stack test data.

The sources included in this construction permit are also required to obtain an operation permit under s. 285.60(1)(b), Wis. Stats. This review constitutes the Department's review of applications for both the construction permit and the operation permit for these units.

A final decision on the construction permit and operation permit will not be made until the public has had an opportunity to comment on the Department's analysis, preliminary determination and draft permit. The United States Environmental Protection Agency will be given the opportunity to comment on the operation permit revision of any Part-70 source. The conditions proposed in the draft permit may be revised in any final permit issued based on comments received or further evaluation by the Department.

GENERAL APPLICATION INFORMATION

Owner/Operator: Madison Metropolitan Sewerage District
1610 Moorland Road
Madison, WI 53713-3324

Responsible Official: Paul Nehm - Director of Operations and Maintenance
608-222-1201

Application Contact Person: Dave Taylor -
608-222-1201 ext 276
davet@madsewer.org

Project Consultant: David J. Fox – TRS - Project Manager,
608-831-4444

Information Submitted: August 02, 08, 24, 2012 (supplemental application materials)

Date of Complete Application: August 24, 2012

PROJECT DESCRIPTION

Madison Metropolitan Sewerage District (District) operates the Nine Springs Wastewater Treatment plant to treat the wastewater generated in a 180 square mile service area including the city of Madison in Dane County. Primary sludge from the primary settling tanks and the excess biological culture from the activated sludge system are treated in anaerobic digesters. Biogas, a byproduct of the anaerobic digestion process is used as the primary fuel in boilers for plant heating, two (2) generators engines located in the Sludge Control Building #2 as well as fueling a 650 hp blower engine (B05), which provides air to aeration tanks. Whenever the combustion equipment is not able to consume the total amount of biogas generated the biogas will be flared in an on-site candlestick style flare.

The District operates seven (7) anaerobic digesters, six (6) boilers fired on biogas, three (3) boilers filed on natural gas, two (2) biogas fired engine generator sets, one (2) biogas fired engine to power a blower and a flare. The District is constructing two (2) additional digesters and four (4) biogas/natural gas fired boilers and a flare under permit 11-SML-090 issued December 19, 2011.

The existing emission units at the facility operate without an air pollution control permit.

The District applied for an after the fact permit for the existing operations November 08, 2010. A preliminary decision on the draft permit was made October 13, 2011 and the draft permit made available for comment. Significant comments were received from the District.

The District requested to hold issuance of the permit under s. 285.61(8), Wis. Stats in January 20, 2011 and again on May 18, 2012. Madison Met Sewerage District (District) and the DNR came to an agreement regarding issuance of construction permit 10-JLH-224 in conformance with s. 285.61(8), Wis. Stats.

The District submitted a revised set of comments to the Preliminary Decision on draft permit 10-JLH-224 and a request to revise Construction permit 11-SML-090 on August 02 and August 08, 2012. The District requests:

Comment 1: to modify the permit language to allow the District to conduct an evaluation of the oxidation catalyst identified as best available control technology, BACT for emissions of formaldehyde from combustion of biogas in the engines;

Comment 2: increase the emission rate of formaldehyde from the biogas fired boilers based on data obtained from onsite stack emission tests;

Comment 3: increase the allowable hydrogen sulfide content in the biogas sent to the flare covered under permit 11-SML-090;

Comment 4: increase to the emission limits for particulate matter, sulfur dioxide and carbon monoxide for each biogas combustion unit; Boilers B01, B02, B03, B06, Engines B05 and B06;

Decrease in the stack height of Stack S01 exhausting the East Boilers, B01 from 34 feet to 26 feet;

Decrease in the maximum heat input capacity of the East Boilers, B01 from 10.33 to 8.0 mmBTU/hr each;

Comment 5: change in the parameter(s) to be monitored to indicate biogas quality.

It is proposed the public be given an opportunity to provide comment on the changes made to the permit limitations in response to comments submitted. These changes include increases in emission rates, revised air quality analysis and new compliance demonstration methods.

Unit operations covered under the after the fact construction permit no.: 10-JLH-224 include: the original seven (7) digesters, and the following combustion equipment: (6) biogas fired boilers, two (2) biogas fired generator and blower engine B05. Note the three (3) natural gas fired boilers were constructed as exempt emission units.

The proposed changes to the Flare, Process P08 and emission increases for Boiler B06 are considered a significant revision to construction permit 11-SML-090.

The facility is required to obtain a construction permit because maximum theoretical emissions of particulate matter ($PM10/PM_{2.5}$), carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO_2), hydrogen sulfide (H_2S) and formaldehyde are above threshold values in s. NR 406.04(2), Wis. Adm. Code. In addition, the generators are subject to a standard under section 112, the National Emission Standard for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines, 40 CFR Part 63, subpart ZZZZ.

Other Actions:

The revisions to permit 11- SML-090 will be included in permit 10-JLH-224. This review will also be processed as the operation permit; permit number 113002230-F01 which will cover all air pollution emission sources located at the facility.

The facility requests to limit emissions to below Part 70 major source thresholds under Title V and be classified as an EPA Class Code SM80 source.

SOURCE DESCRIPTION

Madison Metropolitan Sewerage District (District) –Nine Springs Wastewater Treatment Plant is a 50 million gallon per day (MGD) wastewater treatment facility serving Madison, Wisconsin and surrounding communities. The treatment processes include screening and grit removal, settling tanks, an activated sludge system and secondary clarifiers. The area around the plant is fenced and all roads and parking areas within the treatment plant boundary are paved.

The projected future biogas generation potential will be limited to 52,000 cubic feet per hour and 455.5 million cubic feet per year.

Significant sources of air pollutant emissions include combustion sources; thirteen (13) boilers, two (2) engine generators, one (1) blower engine, one (1) flare, nine (9) anaerobic digesters and unit operations of the waste water treatment process. The majority of the combustion sources fire both biogas generated by the anaerobic digesters and natural gas.

The facility is located at 1610 Moorland Road at the intersection of South Towne Drive and Moorland Road in the City of Madison, Dane County, Wisconsin and operates under wastewater discharge permit WI-0024597-08-0, issued by the Department September 30, 2010.

Dane County is a county considered in attainment for all criteria pollutants.

Description of Emission Units

A. Process P10 — Anaerobic Digesters: Nine (9) Anaerobic Digesters with Treatment System C10
B. Boiler B01, Stack S01 — East Boilers: three (3) 8.0 mmBTU/hr Hot Water Boilers; constructed 2007
C. Boiler B02, Stack S02 – West Boilers: three (3) 4.18 mmBTU/hr Hot Water Boilers; constructed 1982
D. Boiler B03, Stack S03 – Bryan Boilers: three (3) 1.45 mmBTU/hr Steam Boilers; constructed 1986 (nat.gas)
E. Boiler B06, Stack S06 – Fulton Boilers: four (4) 6.235 mmBTU/hr Steam Boilers, constructed 2011 [11-SML-090]
F. Process B04, Stack S04 – Biogas Fired Engine Generator: two (2) 700 kW Waukesha engines; constructed 1991
G. Process B05, Stack S05 – Blower Engine: one (1) 700 kWatt/650 hp (4.8 mmBTU/hr) Waukesha engine used to power blower; model year 1989, installed 1991
H. Process P07, Stack S07 – Waste Gas Burner/Flare – to be removed prior to June 19, 2013

   Process P08, Stack S08 – Waste Gas Burner/Flare; [11-SML-090]
I. Process P06, Fugitive F06 – Waste Water Treatment Plant Operations

I. Anaerobic Digesters

Emission Unit Information.	
Process number:	**P10**
Unit description:	9 Anaerobic Digesters
Total Working volume Capacity:	7.11 million gallons
Control technology status:	Controlled
Biogas generation rate (maximum estimate):	768,000 ft3/day 280.3 million ft3/year
Fuel Value:	550 Btu/ft3

West Digester Complex:

West Digester Complex: Tank parameters:	
Identification:	**Digester 1**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	0.639
Height above ground (ft):	Top exposed; 22 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	existing
Construction Permit Requirements:	10-JLH-224

West Digester Complex: Tank parameters:	
Identification:	**Digester 2**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	0.639
Height above ground (ft):	Top exposed; 22 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	existing
Construction Permit Requirements:	10-JLH-224

West Digester Complex: Tank parameters:	
Identification:	**Digester 3**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	0.639
Height above ground (ft):	15 in. soil cover; 0 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	
Construction Permit Requirements:	10-JLH-224

East Digester Complex:

East Digester Complex: Tank parameters:	
Identification:	**Digester 4**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	1.014
Height above ground (ft):	18 in. soil cover; 0 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	existing
Construction Permit Requirements:	10-JLH-224

East Digester Complex: Tank parameters:	
Identification:	**Digester 5**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	1.014
Height above ground (ft):	18 in. soil cover; 0 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	existing
Construction Permit Requirements:	10-JLH-224

East Digester Complex: Tank parameters:	
Identification:	**Digester 6**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	1.014
Height above ground (ft):	Insulated; 18 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	existing
Construction Permit Requirements:	10-JLH-224

East Digester Complex: Tank parameters:	
Identification:	**Digester 7**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	1.076
Height above ground (ft):	9 in. soil cover; 0 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	
Construction Permit Requirements:	10-JLH-224

East Digester Complex: Tank parameters:

East Digester Complex: Tank parameters:	
Identification:	**Digester 8**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	1.076
Height above ground (ft):	TBD < 25 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	Constructed 2011/2012
Construction Permit Requirements:	11-SML-090

East Digester Complex: Tank parameters:	
Identification:	**Digester 9**
Tank description:	Circular Concrete vessels located below ground
Capacity (million gallons):	1.076
Height above ground (ft):	TBD < 25 feet
Tank Design:	Fixed concrete roof with high pressure relief valve
Date of construction:	Constructed 2011/2012
Construction Permit Requirements:	11-SML-090

II. Combustion Units:

Emission Unit Information.	
Boiler number:	**B01**
Unit description:	East Boilers – 3 boilers, Multipass Flexible Watertube Hot Water Boilers
Control technology status:	Uncontrolled
Maximum continuous rating (mmBTU/hr):	24 MMBTU/hr combined (8.0 MMBTU/hr each)
Manufacturer:	Unilux Boiler Corp
Model number:	ZF1000W
Date of construction or last modification:	Originally installed January 02, 2007
Construction Permit Requirements:	10-JLH-224

Stack Information.

Stack identification number:	S01
Exhausting unit(s):	B01
This stack has an actual exhaust point:	Yes-single stack
Discharge height above ground level (ft):	26.0~~35.0~~
Inside dimensions at outlet (ft):	1.5
Exhaust flow rate (ACFM):	2100
Exhaust gas temperature (maximum) (°F):	350

Stack Information.

Exhaust gas discharge direction:	vertical
Stack equipped with any obstruction:	no

Fuels and Firing Conditions.

	Fuel name	Higher heating value (BTU per cubic foot)	Max. hourly consumption (cubic feet per hour)	Annual consumption (million cubic feet)
Primary	Digester Gas	550	44,000	382.25
Backup fuel	Natural Gas	1050	22,857	200.2

Emission Unit Information.	
Boiler number:	**B02**
Unit description:	West Boilers – 3 boilers, Hot Water Boilers
Control technology status:	Uncontrolled
Maximum continuous rating (mmBTU/hr):	12.54 MMBTU/hr combined (4.18 MMBTU/hr each)
Manufacturer:	Cleaver Brooks
Model number:	CB200X-125
Date of construction or last modification:	Originally installed January 15, 1982
Construction Permit Requirements:	10-JLH-224

Stack Information.

Stack identification number:	S02
Exhausting unit(s):	B02
This stack has an actual exhaust point:	Yes-single stack
Discharge height above ground level (ft):	20.2
Inside dimensions at outlet (ft):	1.33
Exhaust flow rate (ACFM):	1600
Exhaust gas temperature (maximum) (°F):	400
Exhaust gas discharge direction:	Vertical
Stack equipped with any obstruction:	no

Fuels and Firing Conditions.

	Fuel name	Higher heating value (BTU per cubic foot)	Max. hourly consumption (cubic feet per hour)	Annual consumption (million cubic feet)
Primary Fuel	Digester Gas	550	22,800	199.7
Backup fuel	Natural Gas	1050	11,943	104.6

Emission Unit Information.	
Boiler number:	**B03**

Emission Unit Information.	
Unit description:	Bryan Boilers – 3 boilers, Natural gas steam Boilers
Control technology status:	Uncontrolled
Maximum continuous rating (mmBTU/hr):	4.35 MMBTU/hr combined (1.45 MMBTU/hr each)
Manufacturer:	Bryan Steam Corp
Model number:	L20-W-FD
Date of construction or last modification:	Originally installed May 15, 1986
Construction Permit Requirements:	None/exempt

Stack Information.

Stack identification number:	S03
Exhausting unit(s):	B03
This stack has an actual exhaust point:	Yes
Discharge height above ground level (ft):	34.0
Inside dimensions at outlet (ft):	1.35
Exhaust flow rate (ACFM):	1400
Exhaust gas temperature (maximum) (°F):	400
Exhaust gas discharge direction:	horizontal
Stack equipped with any obstruction:	Yes

Fuels and Firing Conditions.

	Fuel name	Higher heating value (BTU per cubic foot)	Max. hourly consumption (cubic feet per hour)	Annual consumption (million cubic feet)
Primary Fuel	Natural Gas	1050	4143	36.3
Backup fuel	none		none	

Emission Unit Information.	
Boiler number:	**B06**
Unit description:	Fulton Boilers – 4 boilers, Horizontal fire tube steam boilers
Control technology status:	Uncontrolled
Maximum continuous rating (mmBTU/hr):	24.94 MMBTU/hr combined (6.235 MMBTU/hr each)
Manufacturer:	Fulton
Model number:	FBS
Date of construction or last modification:	New
Construction Permit Requirements:	11-SML-090

Stack Information.

Stack identification number:	S06

Stack Information.

Exhausting unit(s):	B06
This stack has an actual exhaust point:	Yes
Discharge height above ground level (ft):	70.0
Inside dimensions at outlet (ft):	2.67
Exhaust flow rate (ACFM):	7200
Exhaust gas temperature (maximum) (°F):	400
Exhaust gas discharge direction:	Vertical
Stack equipped with any obstruction:	no

Fuels and Firing Conditions.

	Fuel name	Higher heating value (BTU per cubic foot)	Max. hourly consumption (cubic feet per hour)	Annual consumption (million cubic feet)
Primary Fuel	Digester Gas	550	45,000	397.2
Backup fuel	Natural Gas	1050	24,000	208

Emission Unit Information.	
Boiler/furnace number [or process line, etc.]:	**B04**
Unit description:	(2) Waukesha Engine Generators
Control technology status:	Controlled
Maximum continuous rating (mmBTU/hr):	9.6 combined; 4.8 each (580 bhp each)
Manufacturer:	Waukesha Power Systems
Model number:	VHP7100G
Date of construction or last modification:	installed January 12, 1991 (model year 1989)
Construction Permit Requirements:	10-JLH-224

Stack Information.

Stack identification number:	S04
Exhausting unit(s):	B04
This stack has an actual exhaust point:	Yes- 2 stacks
Discharge height above ground level (ft):	40.0
Inside dimensions at outlet (ft):	0.83
Exhaust flow rate (ACFM):	1800
Exhaust gas temperature (°F):	1020
Exhaust gas discharge direction:	Vertical
Stacks equipped with any obstruction:	No

Fuels and Firing Conditions.

	Fuel name	Higher heating value (BTU per cubic foot)	Max. hourly consumption (cubic feet per hour)	Annual consumption (million cubic feet)
Primary Fuel	Digester Gas	550	17,450	153
Backup fuel	Natural Gas	1050	9143	80

Emission Unit Information.	
Boiler/furnace number [or process line, etc.]:	**B05**
Unit description:	Blower Engine Waukesha engine used to power a blower
Control technology status:	Controlled
Maximum continuous rating (mmBTU/hr):	4.8 (580 bhp)
Manufacturer:	Waukesha Power Systems
Model number:	VHP7042GU
Date of construction or last modification:	installed June 17, 1991 (model year 1989)
Construction Permit Requirements:	10-JLH-224

Stack Information.

Stack identification number:	S05
Exhausting unit(s):	B05
This stack has an actual exhaust point:	Yes
Discharge height above ground level (ft):	50.2
Inside dimensions at outlet (ft):	0.83
Exhaust flow rate (ACFM):	1800
Exhaust gas temperature (maximum) (°F):	1000
Exhaust gas discharge direction:	Vertical
Stack equipped with any obstruction:	No

Fuels and Firing Conditions.

	Fuel name	Higher heating value (BTU per cubic foot)	Max. hourly consumption (cubic feet per hour)	Annual consumption (million cubic feet)
Primary Fuel	Digester Gas	550	8730	76.45
Backup fuel	Natural Gas	1050	4571	40.0

Emission Unit Information.	
Process number:	**P08**
Unit description:	Waste Gas Flare
Control technology status:	Uncontrolled

Emission Unit Information.	
Maximum continuous rating (mmBTU/hr):	48.5
Manufacturer:	Varec
Model number:	244W Series auto re-ignition stociohmetric pilot – natural gas pilot
Date of construction or last modification:	new
Construction Permit Requirements:	11-SML-090

Stack Information.

Stack identification number:	S08
Exhausting unit(s):	P08
This stack has an actual exhaust point:	Yes
Discharge height above ground level (ft):	25.0
Inside dimensions at outlet (ft): -adjusted for heat release	4.0
Exhaust flow rate (CFM):	1470
Exhaust gas combustion temperature (maximum) (°F):	1830
Exhaust gas discharge direction:	Up
Stack equipped with any obstruction:	No

Fuels and Firing Conditions.

	Fuel name	**Higher heating value (BTU per cubic foot)**	**Max. hourly consumption (cubic feet per hour)**	**Annual consumption (million cubic feet)**
Primary Fuel	Digester Gas	550	88,182	772
Backup fuel	none		none	

III. Miscellaneous / Fugitive Units:

Emission Unit Information.	
Process number:	**P06**
Unit description:	Waste Water Treatment Plant operations
Control technology status:	Uncontrolled
Date of construction or last modification:	Last modified: January 2007
Construction Permit Requirements:	10-JLH-224

Stack Information.

Stack identification number:	F06
Exhausting unit(s):	P06
This stack has an actual exhaust point:	No - fugitive

Stack Parameter Summary.

Stack ID	Type of Exhaust Point	Stack Shape	Discharge Direction	Exhaust Obstacle	Height	Diameter	Temp.	Flow Rate
					ft (m)	ft (m)	°F	acfm
S01	Actual	circular	Vertical	No	26.0 ft (7.924 m)	1.5 ft (0.46 m)	350	2,100
S02	Actual	circular	Vertical	No	20.2 ft (6.15 m)	1.33 ft (0.41 m)	400	1,600
S03	Actual	circular	horizontal	yes	34.0 ft (10.36)	1.35 ft (0.41 m)	400	1,400
S04	(2) Actual	circular	Vertical	No	40.0 ft (12.0 m)	0.82 ft (0.25 m)	1,020	1,800
S05	Actual	circular	Vertical	No	51.2ft (15.3m)	0.83 ft (0.25 m)	1,000	1,800
S06	Actual	circular	Vertical	No	70.0 ft (21.3 m)	2.66 ft (0.81 m)	400	7,200
S08	Actual	flare	Vertical	No	25 ft. (7.62	2.0 ft (0.61 m)	1,000	1,70
F06	Fugitive	---	---	---	---	---	---	---

Stack and Process Index.

Process P10	Stack S10	Anaerobic Digesters: Nine (9) Anaerobic Digesters <controlled> C10 biogas treatment system
Boiler B01	Stack S01	East Boilers: (3) Boilers each rated at 8.0 mmBTU/hr <uncontrolled> biogas & natural gas
Boiler B02	Stack S02	West Boilers: (3) Boilers each rated at 4.18 mmBTU/hr <uncontrolled> biogas & natural gas
Boiler B03	Stacks S03	Bryan Boilers: (3) Boilers each rated at 1.45 mmBTU/hr <uncontrolled> natural gas fired
Boiler B06	Stack S06	Fulton Boilers: (4) Boilers each rated at 6.235 mmBTU/hr <uncontrolled> biogas & nat gas
Process B04	Stacks S04	Waukesha Generator: (2) Engine Generators each rated at 4.8 mmBTU/hr <controlled> biogas & natural gas
Process B05	Stack S05	Blower Engine: (1) Waukesha Engine rated at 4.8 mmBTU/hr <controlled> biogas & natural gas
Process P06	Fugitive F06	Wastewater Treatment Plant Unit Operations
Process P08	Stack S08	Waste Gas Flare <uncontrolled> biogas

Insignificant Emissions Units.

<u>General Units</u>

Maintenance of grounds, equipment, buildings
Boiler & HVAC System Maintenance
Fire Control Equipment
Internal combustion engines for warehousing
Janitorial and office activities
Convenience water and space heating

<u>Units Specific to Nine Springs WWTP</u>

Fuel Oil Storage Tanks (<10,000 gallons)
- 4,000 gallon underground gasoline tank
- 10,000 gallon diesel tank
- 200 gallon kerosene tank

Three (3) Parts Washers each with
- 15 gallon Petroleum naphtha reservoir

Purging of Natural gas lines
Sanitary sewer and plumbing venting
Demineralizing & Oxygen scavenging for Boilers

EMISSION CALCULATIONS and APPLICABLE REQUIREMENTS

The biogas production rate at the conclusion of the District's 11th Addition Project is estimated to be 768,000 cubic feet per day equivalent to an annual production rate of 280.3 million cubic feet per year. The District projects a maximum production rate of 1.248 million cubic feet per day or 455.5 million cubic feet per year by year 2030.

Please see the Emission Calculations and Applicable Requirements for permits 10-JHL-224, 11-SML-090.

Only the changes as requested from the previous preliminary determination will be highlighted here:

Estimates of the maximum theoretical emissions from the digesters are calculated prior the gas going to any of the combustion devices and based on a maximum gas production capacity of **768,000 cubic feet per day.**

Emission Estimates are based on the following assumptions:

Biogas properties:

Property:	**Raw Biogas**	**Treated Biogas**
Hydrogen sulfide (H_2S) concentration (ppmv)	500 ppm (average) *and* 600 ppm hourly maximum	40 ppm maximum
Methane content (%)	53	55 minimum
Heat content (BTU/ cubic foot)		550 minimum

Summary of changes from the preliminary determination noticed November 07, 2011 with 10-JLH-224/11-SML-090 and 113002230-F01

Permit Reference	Process/Stack ID	Description	Change	previous	Requested or Proposed
I.A. *(both)*	**General**	Anaerobic Digesters; gas treatment system	Hydrogen sulfide content in Treated Biogas;	20 ppm	40 ppm
			Siloxane concentration		50 ppbv
I.C. *(10-JLH-224)*	**B01 /S01**	East Boilers	Capacity decrease:	10.33mmBTU/ hr each	8.0mmBTU/hr each
			Stack height:	35.0	26.0 ft
			formaldehyde	0.004 lb/hr	0.013 lb/hr 0.29 lb/cf6
			PM10	0.43 lb/hr	0.64 lb/hr
			CO	4.76 lb/hr	7.14 lb/hr

					0.3 lb/cf6
			SO2	0.13 lb/hr	0.26 lb/hr 40 ppmv
I.C. *(10-JLH-224)*	**B02 /S02**	West Boilers	formaldehyde	0.002 lb/hr	0.007 lb/hr 0.29 lb/cf6
			PM10	0.17 lb/hr	0.34 lb/hr
			CO	1.90 lb/hr	2.86 lb/hr 0.3 lb/cf6
			SO2	0.055 lb/hr	0.11 lb/hr 40 ppmv
I.D. *(11-SML-090)*	**B06 /S06**	Fulton Boilers	formaldehyde	0.003 lb/hr	0.013 lb/hr 0.29 lb/cf6
			PM10 $PM_{2.5}$	0.34 lb/hr	0.68 lb/hr 0.26 lb/hr
			CO	3.8 lb/hr	5.7 lb/hr 0.3 lb/cf6
			SO2	0.03 lb/hr	0.06 lb/hr 40 ppmv
	B03 /S03	Bryan Boilers	PM10	0.03 lb/hr	0.06 lb/hr
		Nat gas only	SO2	neg	0.002 lb/hr
I.E. *(10-JLH-224)*	**B04 /S04**	2-Engine Generators	PM10	0.09 lb/hr each	0.18 lb/hr each, 0.38 lb/hr total
			SO2	0.04 lb/hr	0.08 lb/hr 40 ppmv
			Formaldehyde	BACT	Implementation schedule for BACT
I.E. *(10-JLH-224)*	**B05 /S05**	Blower Engine	PM10	0.09 lb/hr	0.18 lb/hr
			SO2	0.02 lb/hr	0.04 lb/hr 40 ppmv
			Formaldehyde	BACT:	Implementation schedule for

				0.58	BACT
I.B.4. *(11-SML-090)*	**P08 /S08**	Waste gas Flare	Hydrogen Sulfide concentration	250 ppm	500 ppm ave *and* 600 ppmv short term s. NR 440.18 (NSPS) compliant
			SO2	0.02 lb/hr	0.04 lb/hr

EMISSION ESTIMATES and APPLICABLE REQUIREMENTS

I. Estimates of Raw Biogas Emissions from Flare (P08)

Waste Gas Flare, Control C10/Process P08, Stack S08: Waste gas Burner (Flare):

When the gas from the anaerobic digesters is not vented to the boilers or engines, the biogas is controlled by a waste gas burner. Waste gas is vented to the waste gas burner (flare) prior to undergoing any pretreatment. Emissions from the Flare are based on Flare Efficiency Study; EPA-600/2-83-052 July 1983 and AP-42 Fifth edition factors for Particulate matter and PM/PM10 for flares at solid waste disposal facilities (11/1998). The emission factors supplied in AP-42 table 2.4-2 for municipal landfills.

The maximum amount of biogas which can be consumed by the flare:

(48.5 mmBTU/hr)(million cubic feet/550 mmBTU) = 88,000 ft3/hr

Maximum amount of biogas consumed if the flare operated on a continuous basis

(0.088 cf6/hr)(8760 hr/yr) = 772.47 million cubic feet of biogas per year

Assuming 53 percent methane: (0.088 cf6/hr biogas)(0.53 CH_4) = 0.0466 cf6 CH_4/hr

Emission estimates were supplied with the application materials. The emission rates are calculated using emission factors from USEPA AP-42 section 2.4.

Pollutant emission rates: while firing Biogas

Pollutant	Emission Factor (lb/CF6 methane)	Maximum Theoretical Emission Rate		PTE
		(lb/hr)	(TPY)	(TPY)
PM total w/condensable	17	0.79	3.48	1.02
PM10/$PM_{2.5}$	17	0.79	3.48	1.02
NOx	40	1.87	8.19	2.4
CO	750	35.0	**153.2**	44.7
VOC*	595 ppm	0.31	1.38	0.41
SO2*	600 ppm 500 ppm ave	7.91	34.6	34.8
Formaldehyde	29	1.35	5.9	1.7

Acetaldehyde	4.6	0.22	0.95	0.28
Total HAPs		1.6	6.9	2.0

The emission factors supplied in AP-42 table 2.4-2 for municipal landfills. Emissions of VOC and SO2 are derived from the molecular weights and concentration of those compounds in the biogas.

Sample calculations:

NOx: (40 lb/cf6 CH4)(0.53 lb CH4/lb gas)(0.088 CF6/hr) = 1.87 lb/hr
Maximum theoretical emission rate:
(1.87 lb/hr)(8760 hr/yr)(ton/2000 lb) = 8.19 TPY

PTE emission rates are based on limiting the amount of biogas flared to maintain status as synthetic minor Part 70 source for CO..

Particulate Matter (PM/PM10):

Allowable Emissions:

The flare is limited under s. NR 415.06(2)(a), Wis. Adm. Code to 0.15 lb/mmBTU heat input
(48.5 mmBTU/hr)(0.15 lb/mmBTU) = 7.275 lb/hr
However at this emission rate the facility is not able to attain air quality standards, the facility requests to limit emissions of particulate matter emissions to 0.79 pounds per hour PM10, see section on Air Quality Standards.

Sulfur Dioxide (SO_2) and Hydrogen Sulfide (H_2S):

The emission estimates for sulfur compounds are calculated from the maximum hydrogen sulfide concentration in the biogas. The concentration of hydrogen sulfide as measured in the untreated biogas ranges up to 600ppm. Gas is routed to the Flare *prior* to any pretreatment. It is assumed that all the hydrogen sulfide will be consumed in the combustion reaction resulting in emissions of sulfur dioxide from the flare.

Hydrogen sulfide (H_2S):

Emissions exhausting the Anaerobic Digesters -prior to Gas Treatment Unit

Assuming 600 ppm hydrogen sulfide in the biogas:

H_2S: (88,000 ft^3/hr)(600 part H_2S/E06 gas)(0.074 lb gas/ft^3) = 3.9 lb H_2S/hr
(3.9 lb/hr)(8760 hr/yr)(ton/2000 lb) = 17.1 TPY (MTE)
(3.9 lb/hr)(24 hr/day)= 93.6 lb/day

Allowable Emissions:

Hydrogen sulfide is regulated under ch. NR 445, Wis. Adm. Code. Under ch. NR 445, Wis. Adm. Code.

Assuming the biogas would be exhausted un-combusted through the Flare, the threshold value for stacks with a height equal to or greater than 25 feet but less than 40 feet is 2.91 pounds per hour as averaged over each 24 hour period. This is equivalent to a daily limit of 2.91 lb/hr x 24 hr/day is 69.84 pounds per day (12.75 TPY).

The maximum theoretical emission rate of hydrogen sulfide from the generation of biogas is above the threshold value in ch. NR 445, Wis. Adm. Code for this stack height category. Therefore, the permittee will be required to operate the flare in accordance with s. NR 440.18, Wis. Adm. Code – *General Control Device Requirements*

Control devices that are used to comply with applicable sections of the NSPS or ch. NR 445, Wis. Adm. Code, are required to meet the design requirements and visible emission limitations under s. NR 440.18(2)-(6), Wis. Adm. Code.

Sulfur Dioxide (SO_2)

Calculations based on potential of 500 ppm H_2S in biogas
Reaction when H_2S is combusted: $2\ H_2S + 3\ O_2 \rightarrow 2\ SO_2 + 2\ H_2O$
Molecular volume of gas 24.465 cubic meters (m^3)
Emission rate = (% comp)(Q m^3/hr)(n/V):

Where Q is the flow rate of biogas in cubic meters per hour = 2497 m^3/hr
n/V is the ratio of molecular weight of each component

Using the molecular weight of each component in the biogas to determine n/V ratio:
CH_4: (16 g/mol)/24.465 = 0.65 kg/m^3
CO_2: (44 g/mol)/24.465 = 1.80 kg/m^3
N_2: (28 g/mol)/24.465 = 1.14 kg/m^3
O_2: (32 g/mol)/24.465 = 1.31 kg/m^3
H_2S: (34 g/mol)/24.465 = 1.38 kg/m^3

The percent composition is the pretreated gas
CH_4: (53/100)(2497 m^3/hr)(0.65 kg/m^3)(2.02 lb/kg) = 1737.6 lb/hr
CO_2: (39/100)(2497 m^3/hr)(1.80 kg/m^3)(2.02 lb/kg) = 3530.8 lb/hr
N_2: (6.2/100)(2497 m^3/hr)(1.14 kg/m^3)(2.02 lb/kg) = 356.5 lb/hr
O_2: (1.7/100)(2497 m^3/hr)(1.31 kg/m^3)(2.02 lb/kg) = 112.3 lb/hr
H_2S: (500/1 E06)(2497 m^3/hr)(1.38 kg/m^3)(2.02 lb/kg) = 3.48 lb/hr
(3.48 lb/hr)(24 hr/day) = 83.5 lb / 24 hour period
Max hourly at 600 ppm
(600/1 E06)(2497 m^3/hr)(1.38 kg/m^3)(2.02 lb/kg) = 4.18 lb/hr

As Sulfur: (32 g S/34 g H2S)(3.48 lb/hr) = 3.275 lb S/hr
SO2: (64 g SO2/32 g S)(3.275 lb S/hr) = 6.55 lb /hr SO_2
(6.55 lb/hr)(8760 hr/yr)(ton/2000 lb) = 28.7 TPY
Max hourly at 600 ppm
As Sulfur: (32 g S/34 g H2S)(4.18 lb/hr) = 3.93 lb S/hr
SO2: (64 g SO2/32 g S)(3.93 lb S/hr) = 7.87 lb /hr SO_2 (max hourly rate)

Allowable Emissions:

The facility is able to attain and maintain ambient air quality standards for sulfur dioxide under s. NR 404.04(2), Wis. Adm. Code at an emission rate of 7.9 pounds per hour and 6.6 pounds per hour as averaged over each 24 hour period.

Hydrogen sulfide is regulated as a hazardous air pollutant under ch. NR 445, Wis. Adm. Code. For purposes of this review the hydrogen sulfide concentration in the biogas is assumed to be consumed in the combustion reaction and emitted as sulfur dioxide.

II. Estimates of Emissions from Boilers:

The District fires biogas in three sets of boilers, B01 (East Boilers), B02 (West Boilers), and B06 (Fulton Boilers).

Boilers B03 only fire natural gas. Emission estimates for sources firing natural gas can be found in the preliminary determination for 11-SML-090. Please see this previous review for details.

Summary of Boiler Heat Inputs

Unit	Stack	total heat input (mmBTU/hr)	biogas consumption (CF6/hr)	annual biogas consumption (CF6/yr)
B01	S01	24	0.044	385.44
B02	S02	12.54	0.0228	199.73
B06	S06	24.94	0.045	397.23
		61.48	0.11	982.39

Assumptions:

Biogas Properties:	value	
Maximum hydrogen sulfide content	40 ppmv	
Minimum heat content in biogas	550 BTU/ cubic foot	
Emission Factors:		
PM/PM10/PM2.5; NOx, VOC, HAPs	USEPA AP-42 section 1.4 adjusted for the lower heat content of biogas	
SO_2	Ideal gas law and concentration of H_2S	
CO	Stack emission tests 2/2012 and 5/2012	163 lb/CF6 ave
Formaldehyde	Stack emission tests 2/2012 and 5/2012	0.29 lb/hr

**notes regarding emission factor derivation:*

The emission factor for carbon monoxide (CO) is based on site specific emission tests performed in February 2012 and May 2012. Emission factors are the average of the two tests plus half a standard deviation to account for the variability between the test results.

Emission rate for formaldehyde was requested by the permittee as 0.29 pounds per million cubic feet of biogas.

Pollutant emission rates: while firing Biogas

Emission calculations are based on maximum combined heat inputs to each stack

		B01		B02		B06		
	Emission Factor (lb/CF^6 CH_4)	Emission Rate (lb/hr)	Emission Rate (TPY)	Emission Rate (lb/hr)	Emission Rate (TPY)	Emission Rate (lb/hr)	Emission Rate (TPY)	Total (TPY)
PM10	7.6	0.33	1.45	0.17	0.76	0.34	1.51	3.72
PM2.5	7.6	0.33	1.45	0.17	0.76	0.34	1.51	3.72
NOx	26	1.13	4.97	0.59	2.59	1.18	5.16	12.72
CO	**163**	**7.11**	31.2	**3.70**	16.2	**7.39**	32.4	79.75

SO2	40ppm	0.26	1.13	0.11	0.48	0.34	1.5	3.1
VOC	5.5	0.24	1.05	0.13	0.55	0.25	1.09	2.69
HAP								
HCOH	0.29	0.013	0.055	0.007	0.029	0.013	0.058	0.142

Sample calculation - CO

(163 lb/cf6)(cf6/550mmBTU/hr)(24 mmBTU/hr) = 7.11 lb/hr

(7.11 lb/hr)(8760 hr/yr)(ton/2000lb) = 31.15 TPY

Applicable Requirements:

s. NR 415.06(2), Wis. Adm. Code, requiring particulate matter emissions be controlled to 0.15 pounds per million BTU heat input;

s. NR 431.05, Wis. Adm. Code, requiring control of Opacity to 20%

s. NR 404, Wis. Adm. Code, ambient air quality standards

s. NR 445, Wis. Adm. Code, hazardous air pollutants

note: These boilers are not considered affected sources under s. NR 440.207, Wis. Adm. Code, New Source Performance Standards for Small Institutional Commercial boilers because the heat input capacity of each boiler is less than 10 mmBTU per hour.

Particulate Matter Emissions (PM/PM10/$PM_{2.5}$):

Particulate matter emissions from the boiler are subject to s. NR 415.06(2), Wis. Adm. Code. The code limits emissions of particulate matter to 0.15 lb PM/PM10 per mmBTU heat input:

At these emission rates, the facility is not able to attain or maintain air quality standards. B01 and B02 are existing sources, only emissions from new sources (B06, B08) were modeled to determine if the impact was below the significant impact level (SIL) for fine particulate matter PM2.5, the permittee requests to limit emissions of particulate matter to attain air quality standards:

Unit	Stack	total heat input (mmBTU/hr)	Emission Rates (lb/hr)			
				Modeled		
			NR 415.06	PM10	$PM_{2.5}$	MTE
B01	S01	24	3.6	0.64	n/a	0.33
B02	S02	12.54	1.88	0.34	n/a	0.17
B06	S06	24.94	3.74	0.68	0.26	0.34
		61.48				0.84

Sulfur Dioxide Emissions (S02):

Sulfur dioxide emissions from combustion are limited to under s. NR 417.07(4), Wis. Adm. Code and require the facility to meet ambient air quality standards in s. NR 404.04 & 05, Wis. Adm. Code.

The facility is able to attain and maintain ambient air quality standards under s. NR 404.04(2), Wis. Adm. Code at the emission rates listed above. These rates assume the maximum hydrogen sulfide content in the biogas as fired is 40 ppmv.

Hydrogen sulfide (H_2S):

Hydrogen sulfide is regulated as a hazardous air pollutant under ch. NR 445, Wis. Adm. Code. For purposes of this review, it is assumed all the hydrogen sulfide is combusted and emitted as sulfur dioxide.

Opacity:
Each boiler stack is limited to 20% opacity per s. NR 431.05, Wis. Adm. Code.

Nitrogen Oxides (NOx);

The facility is subject to the general limitations for NOx in addition to meeting ambient air quality standards and increment in s. NR 404.04, Wis. Adm. Code.

Carbon Monoxide (CO):

The facility is subject to the general limitations for carbon monoxide in addition to meeting ambient air quality standards and increment in s. NR 404.04, Wis. Adm. Code.

Emissions of carbon monoxide are further limited to maintain synthetic minor source status under Part 70. See section on Facility wide limitations.

Combined Maximum Emission Rates for Boilers:

The following table summarizes the calculated worst case emission estimates for each pollutant from all boiler operations.

	$PM/PM10/PM_{2.5}$		NOx		CO		S02		VOC	HCOH
	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(TPY)	(TPY)
East B01	0.64	2.8	2.3	10.1	7.1	31.15	0.26	1.14	1.05	1.27
West B02	0.34	1.5	1.2	5.2	3.7	16.2	0.11	0.48	0.55	1.27
Bryan B03	0.06	0.26	0.41	1.81	0.35	1.52	0.002	0.01	0.10	
Fulton B06	0.68	3.0	2.4	10.4	7.4	32.4	0.34	1.5	1.1	1.27
Total:		7.5		27.5		84.1		3.13	2.8	3.81

III. Emission Estimates from the Generators:

The District operates three engines each rated at 580 horsepower which fire biogas generated from the digesters as the primary fuel. For details on the properties of the biogas, please refer to the beginning of the Emission Calculation and Applicable Requirements Section above.

Summary of Engine Generator Heat Inputs

Unit	Stack	power input (bhp)	total heat input (mmBTU/hr)	biogas consumption (CF6/hr)	annual biogas consumption (CF6/yr)
B04	S04	1160	9.6	0.017	152.90
B05	S05	580	4.8	0.009	76.45
Total			14.4	0.026	229.35

The District performed a stack emission test on engine B05, Waukesha engine model VHP7042GU in January 2011 to determine the emission rates of nitrogen oxides (NOx), carbon monoxide (CO), formaldehyde and acetaldehyde. The results of these tests will be used to develop emission factors for estimating emissions of these pollutants from each of the engines. The following table is a summary of the emission factors developed from the test.

Pollutant	Emission rate (lb/hr)	Emission Factor (g/bhp-hr)
Nitrogen Oxides (NOx)	3.93	3.1
Carbon monoxide (CO)	1.36	1.4
Formaldehyde	0.54	0.45*
Acetaldehyde	0.001	0.001

* represents the highest emission rate recorded during the January 2011 stack emission test

Pollutant emission rates: while firing Biogas

Emission calculations are based on maximum combined heat inputs to each stack

		B04 (2 generators)		B05		
	Emission Factor (lb/mmBTU biogas)	Emission Rate (lb/hr)	Emission Rate (TPY)	Emission Rate (lb/hr)	Emission Rate (TPY)	total (TPY)
PM total	0.019	0.182	0.80	0.091	0.40	1.20
PM10	0.019	0.182	0.80	0.091	0.40	1.20
PM2.5	0.019	0.182	0.80	0.091	0.40	1.20
NOx*	3.1 g/bhp-hr	7.93	34.7	3.964	17.36	52.08
CO*	1.4 g/bhp-hr	3.58	15.68	1.79	7.84	23.52
CO2	110 lb/mmBTU nat gas	2016	8,830	528	2313	6938
VOC	0.22	2.11	9.25	1.056	4.63	13.88
SO2	40 ppm H_2S	0.08	0.35	0.04	0.18	0.53
Formaldehyde*	0.45 g/bhp-hr	1.15	5.04	0.575	2.52	7.56
Acetaldehyde*	0.001 g/bhp-hr	0.003	0.01	0.001	0.01	
Total HAPs	0.103	1.0	4.3			

* *indicates the emission calculations are based on site specific emission factors derived from stack emission test January 2011 on these engines.*

Emission factors not marked are from AP-42 table 3.2-2 for natural gas adjusted to the lower heat content of biogas. Biogas generated at MMSD has a maximum heat content of 550 mmBTU per million cubic feet

The maximum sulfur content in the biogas is limited to 40 ppm
Example Calculation – PM:
(0.01 lb/mmBTU nat gas)(1050mmBTU nat gas/550 mmBTU biogas) = 0.019 lb/mmBTU bgheat input
(9.6 mmBTU/hr)(0.019 lb PM/mmBTU) = 0.18 lb/hr
(0.18 lb/hr)(8760 hr/yr)(ton/2000 lb) = 0.80 TPY

Applicable Requirements:

s. NR 415.06(2), Wis. Adm. Code, requiring particulate matter emissions be controlled to 0.15 pounds per million

BTU heat input;
s. NR 431.05, Wis. Adm. Code, requiring control of Opacity to 20%
s. NR 404, Wis. Adm. Code, ambient air quality standards
ch. NR 445, Wis. Adm. Code, Control of Hazardous Air Pollutants

40 CFR Part 63, subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engines.

Particulate Matter Emissions (PM/PM10/$PM_{2.5}$):

Particulate matter emissions from are subject to s. NR 415.06(2), Wis. Adm. Code. Emissions are limited to 0.15 lb PM/PM10 per mmBTU heat input:

At these emission rates, the facility is not able to attain or maintain air quality standards. The engines are existing sources, only emissions from new sources (B06, B08) were modeled to determine if the impact was below the significant impact level (SIL) for fine particulate matter PM2.5. The permittee requests to limit emissions of particulate matter to attain air quality standards:

Unit	Stack	total heat input (mmBTU/hr)	Emission Rates (lb/hr)			
			NR 415.06	Modeled		MTE
				PM10	$PM_{2.5}$	
P04	S04	9.6	1.44	0.64	n/a	0.18
P05	S05	4.8	0.72	0.34	n/a	0.09
		14.4		0.98		0.27

Opacity:

Each generator stack is limited to 20% opacity per s. NR 431.05, Wis. Adm. Code.

Sulfur Dioxide Emissions (S02):

Sulfur dioxide emissions from combustion are limited to under s. NR 417.07(4), Wis. Adm. Code and require the facility to meet ambient air quality standards in s. NR 404.04 & 05, Wis. Adm. Code.

The facility is able to attain and maintain ambient air quality standards under s. NR 404.04(2), Wis. Adm. Code at an emission rates in the table above.

Hydrogen sulfide (H_2S):

Hydrogen sulfide is regulated as a hazardous air pollutant under ch. NR 445, Wis. Adm. Code. For purposes of this review it is assumed all the hydrogen sulfide is combusted and emitted as sulfur dioxide.

Hazardous Air Pollutants (HAPs) and Formaldehyde (HCOH):

Formaldehyde is regulated as a hazardous air pollutant under section 112 of the Clean Air Act and ch. NR 445, Wis. Adm. Code.

The engines are considered existing stationary spark ignition reciprocating internal combustion engines (SI-RICE) located at an Area source of HAPs under 40 CFR Part 63, subpart ZZZZ (RICE). Under the Standard, EPA has determined generally available control technology (GACT) for this class of source. GACT is control of emissions of hazardous air pollutants through work practice standards. See section on Hazardous Air Pollutant Emissions for additional details.

Because the NESHAP does not contain an emission standard for formaldehyde, the control requirements of ch. NR 445, Wis. Adm. Code are also applicable. The control requirement under s. NR 445.04, Wis. Adm. Code for emissions of formaldehyde greater than the threshold value listed in Table A is Best Available Control Technology (BACT).

See section on Hazardous Air Pollutant Emissions for additional details.

Nitrogen Oxides (NOx); Carbon Monoxide (CO) Emissions:

The facility is subject to the general limitations for NOx and carbon monoxide in addition to meeting ambient air quality standards and increment in s. NR 404.04, Wis. Adm. Code.

The emission estimates indicate emissions of NOx from firing natural gas are greater than the emissions while firing biogas generated from the Digesters. However, the generators primarily fire biogas. It will be assumed that the most accurate estimate of emissions are based on the site specific emission factors. The permittee requests to limit emissions of NOx to 3.1 g/bhp-hr and CO to 1.4 g/bhp-hr. At maximum power, the calculated emissions are 7.95 pounds per hour of NOx and 3.60 pounds per hour of carbon monoxide. These emission rates allow the permittee is to attain air quality standards. See section on Air Quality Review.

New Source Performance Standards (NSPS):

These engines are not considered affected sources under the New Source Performance Standards, 40 CFR Part 60, subpart JJJJ for Spark Ignition Internal Combustion Engines, therefore the Standard is not applicable. The date construction commenced (the date the engine was ordered) is prior to any of the applicability dates in the Standard.

Combined Maximum Emission Rates for Engines:

The following table summarizes the worst case emission rates for each criteria pollutant from all engines.

	PM/PM10		NOx		CO		S02		VOC
	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(TPY)
Generators B04	0.36	1.58	7.95	34.8	3.6	15.8	0.08	0.35	9.25
Blower B05	0.18	0.8	4.0	17.4	1.8	7.9	0.04	0.18	4.63
Total:		2.38		52.2		23.7		0.3	13.9

The following table summarizes the hazardous air pollutant emission rates

	Formaldehyde			Acetaldehyde	
	(lb/hr)	(lb/yr)	(TPY)	(lb/hr)	(TPY)
Generators B04	1.15	10,074	5.05	0.003	0.01
Blower B05	0.58	5,080	2.52	0.0001	0.007
Total:		15,155	7.57		0.011

IV. Facility Wide Synthetic Minor Requirements:

Carbon Monoxide (CO):

The maximum theoretical emission rate for carbon monoxide is 154 tons per year if all the biogas produced in the digesters is flared. he permittee requests to limit emissions to below 100 tons per year, the Title V major source threshold and be classified as a EPA Class Code SM80.

To limit the emissions of carbon monoxide, the permittee requests to limit the amount of biogas fired in the boilers and flare giving priority to the engines.

The maximum theoretical emission rate from the engines is 23.7 tons per year. Allowing 1 ton of emissions from miscellaneous activities, the annual allotment of carbon monoxide emissions available for the boilers and flare will be the maximum theoretical annual emissions from the engines subtracted from the total facility wide cap:

100tons $\leq$ 1 ton + 23.7 tons + X tons; where X represents annual amount of CO emitted from the boilers and flare
X $\leq$ 73.3 tons per year
On a monthly basis: (73 tons/year)(2000 lb/ton)(year/12 months) = 12,500 pounds per month

Emissions from combustion of natural gas and biogas in the boilers and flares will be limited to 12,500 pounds per month calculated from monthly records of the quantity of each fired, heat content of the fuel and site specific emission factors. Emission factors are dependent on the quality of the biogas measured in terms of the methane content. It is assumed the heat content of the biogas is equivalent to the methane content.

For the Flare:
the emission factor is 750 pounds CO per million cubic feet of methane based on AP-42, section 2.4.
The permittee will be required to monitor the amount and percent methane in the raw biogas sent to the flare
Emissions = (750 lb/cf6 CH4)(% CH4/ gas)(Q cf6/month)

For the Boilers:
the emission factor is 163 pounds CO per million cubic feet biogas with a heat content of 550 BTU per cubic foot. This factor is derived from site specific emission tests.
The permittee will be required to monitor and determine the heat content of the biogas fired in the boilers.
(163 lb/cf6)(cf6/550 mmBTU) = 0.3 lb CO per mmBTU heat input

Summary of emission factors for determining source status:

Unit	Emission Factor	
	Biogas	Natural gas
Boilers:	0.3 lb CO/mmBTU heat input	84 lb/ cf6 natural gas
Flare:	750 lb CO/million cubic feet methane	not/applicable

The permittee will be required to determine compliance with the emission factors through a compliance emission test while firing biogas.

Wastewater Treatment Plant Unit Operations, Process P06:

Municipal wastewater Treatment Facilities consist of several unit operations. The air pollutants emitted from these units will vary due to the constituents of the incoming waste streams. Evaporative losses of VOC and volatile hazardous air pollutants are estimated based on influent sampling collected at the facility in June 1992 and emission factors published in the Joint Powers Agencies for Pooled Emission Estimation Program, PEEP Study dated 1990. The table below is a summary of the information provided with the application materials.

Pollutant	Maximum Theoretical Emission Rates		
	(lb/hr)	(lb/year)	(TPY)
VOC	0.41	3,626	1.81
Benzene	0.04	334	0.17
Carbon tetrachloride	0.04	349	0.17
Chloroform	0.03	285	0.14
Dichlorobenzene	0.03	256	0.13
Methylene chloride	0.03	225	0.11
Tetrachloroethylene	0.05	405	0.20
Tetrachloro ethane	0.07	635	0.32
Trichloroethylene	0.05	406	0.20
Toluene	0.04	382	0.19

Combined Maximum Emission Rates for Engines:

The following table summarizes the worst case emission rates for each criteria pollutant from all engines.

	PM/PM10		NOx		CO		S02		VOC
	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(TPY)
Generators B04	0.36	1.58	7.95	34.8	3.6	15.8	0.08	0.35	9.25
Blower B05	0.18	0.8	4.0	17.4	1.8	7.9	0.04	0.18	4.63
Total:		2.38		52.2		23.7		0.3	13.9

The following table summarizes the hazardous air pollutant emission rates

	Formaldehyde			Acetaldehyde	
	(lb/hr)	(lb/yr)	(TPY)	(lb/hr)	(TPY)
Generators B04	1.15	10,074	5.05	0.003	0.01
Blower B05	0.58	5,080	2.52	0.0001	0.007
Total:		15,155	7.57		0.011

IV. Facility Wide Synthetic Minor Requirements:

Carbon Monoxide (CO):

The maximum theoretical emission rate for carbon monoxide is 154 tons per year if all the biogas produced in the digesters is flared. he permittee requests to limit emissions to below 100 tons per year, the Title V major source threshold and be classified as a EPA Class Code SM80.

To limit the emissions of carbon monoxide, the permittee requests to limit the amount of biogas fired in the boilers and flare giving priority to the engines.

The maximum theoretical emission rate from the engines is 23.7 tons per year. Allowing 1 ton of emissions from miscellaneous activities, the annual allotment of carbon monoxide emissions available for the boilers and flare will be the maximum theoretical annual emissions from the engines subtracted from the total facility wide cap:

100tons ≤ 1 ton + 23.7 tons + X tons; where X represents annual amount of CO emitted from the boilers and flare

X ≤ 73.3 tons per year

On a monthly basis: (73 tons/year)(2000 lb/ton)(year/12 months) = 12,500 pounds per month

Emissions from combustion of natural gas and biogas in the boilers and flares will be limited to 12,500 pounds per month calculated from monthly records of the quantity of each fired, heat content of the fuel and site specific emission factors. Emission factors are dependent on the quality of the biogas measured in terms of the methane content. It is assumed the heat content of the biogas is equivalent to the methane content.

For the Flare:
the emission factor is 750 pounds CO per million cubic feet of methane based on AP-42, section 2.4.
The permittee will be required to monitor the amount and percent methane in the raw biogas sent to the flare
Emissions = (750 lb/cf6 CH_4)(% CH_4/ gas)(Q cf6/month)

For the Boilers:
the emission factor is 163 pounds CO per million cubic feet biogas with a heat content of 550 BTU per cubic foot. This factor is derived from site specific emission tests.
The permittee will be required to monitor and determine the heat content of the biogas fired in the boilers.
(163 lb/cf6)(cf6/550 mmBTU) = 0.3 lb CO per mmBTU heat input

Summary of emission factors for determining source status:

Unit	Emission Factor	
	Biogas	Natural gas
Boilers:	0.3 lb CO/mmBTU heat input	84 lb/ cf6 natural gas
Flare:	750 lb CO/million cubic feet methane	not/applicable

The permittee will be required to determine compliance with the emission factors through a compliance emission test while firing biogas.

Wastewater Treatment Plant Unit Operations, Process P06:

Municipal wastewater Treatment Facilities consist of several unit operations. The air pollutants emitted from these units will vary due to the constituents of the incoming waste streams. Evaporative losses of VOC and volatile hazardous air pollutants are estimated based on influent sampling collected at the facility in June 1992 and emission factors published in the Joint Powers Agencies for Pooled Emission Estimation Program, PEEP Study dated 1990. The table below is a summary of the information provided with the application materials.

Pollutant	Maximum Theoretical Emission Rates		
	(lb/hr)	(lb/year)	(TPY)
VOC	0.41	3,626	1.81
Benzene	0.04	334	0.17
Carbon tetrachloride	0.04	349	0.17
Chloroform	0.03	285	0.14
Dichlorobenzene	0.03	256	0.13
Methylene chloride	0.03	225	0.11
Tetrachloroethylene	0.05	405	0.20
Tetrachloro ethane	0.07	635	0.32
Trichloroethylene	0.05	406	0.20
Toluene	0.04	382	0.19

Vinyl chloride	0.04	349	0.175
Total HAP	0.34	2,991	**1.50**

HAZARDOUS AIR POLLUTANT REVIEW: Section 112 Clean Air Act and ch. NR 445, Wis. Adm. Code

There are several pollutants expected to be emitted from the operation of the facility. These pollutants are regulated on the federal level under section 112 of the Clean Air Act and on the state level under Chapter NR 445, Wis. Adm. Code.

Significant emissions of HAPs are expected from the following processes:

Anaerobic Digesters: Process P10. Emissions of hydrogen sulfide from raw biogas

Wastewater treatment plant operations: Process P06: miscellaneous organic HAPs

Spark Ignition internal combustion engines (RICE): emission units B04- two (2) 580 hp engines and B05- one (1) 580 hp engine. Each of these engines fire biogas and the primary fuel resulting in emission of formaldehyde and acetaldehyde

Boilers B01, B02 and B06: - Each of the boilers fire biogas as the primary fuel resulting in emission of formaldehyde.

Insignificant source of HAPs:

Boilers B03 – Bryan Boilers fire only natural gas. Natural gas is a virgin fossil fuel and emissions are exempt from review under ch. NR 445, Wis. Adm. Code.

Waste Gas Flare: P08 - No significant emissions of HAPs are expected from the flare

The maximum theoretical emission rate of HAPs regulated under section 112 of the Clean Air Act is less than 10 tons of any single pollutant and less than 25 tons per year combined. Therefore, the facility will be considered an Area source of HAP under section 112.

Summary of Formaldehyde Emission rates:

Stack	Stack Height (ft)	Emission Rates			Table A threshold (lb/year)
		MTE (tons/year)	(lb/hr)	(lb/year)	
S04	40.0 (12.2 m)	5.04	0.281	2,461.6	
S05	50.2 (15.3 m)	2.52	0.141	1,235.2	
S06	70.0 (21.34 m)	0.06	0.013	115.2	
Stack height total:				3,812	1,337 (40 <75 ft)
S01	26.0 (7.92 m)	0.03	0.013	110.85	562 (25 <40 ft)
S02	20.18 (6.15 m)	0.06	0.007	57.9	137 (<25 ft)
Facility Total:		7.7			

Anaerobic Digesters: Process P10

Section 112 Clean Air Act

The biogas generated by the eight digesters contains hydrogen sulfide, a HAP regulated under section 112. In the event that the biogas is vented directly to atmosphere, the maximum theoretical emission rate is 14.2 pounds per day and 2.6 tons per year. However, the permittee requests to control emissions from the Digesters and removes the

hydrogen sulfide in a gas pretreatment system and further combusts the biogas in engines or boilers to provide electricity. Treatment and combustion of the Biogas allows the facility to maintain status as an Area source of HAPs.
Emissions after Gas Treatment Unit:
According to the application materials, the hydrogen sulfide concentration in the biogas leaving the treatment system is less than 10 ppm. The concentration will be limited to 40ppm prior to combustion in the boilers or engines.

Ch. NR 445, Wis. Adm. Code:

The threshold value for stacks with a height less than 25 feet is 0.749 pounds per hour as averaged over each 24 hour period. This is equivalent to a daily limit of 0.749 lb/hr x 24 hr/day is 17.98 pounds per day (3.2 TPY). Each of the vent points on the digesters are below 25 feet above ground level, therefore maximum theoretical emission rate of hydrogen sulfide from the generation of biogas is less than the threshold value in ch. NR 445, Wis. Adm. Code.

Spark Ignition internal combustion engines (RICE): emission units B06, Stack S06 - two (2) 580 hp engines and B05, Stack S05- one (1) 580 hp engine.

Section 112 Clean Air Act

Each of the engines is considered an existing engine located at an Area Source under the National Emission Standard for Hazardous Pollutant Emissions (NESHAP) 40 CFR Part 63, subpart ZZZZ. The Standard requires engines which combust landfill or digester gas to follow the management practices listed below:

Every 1,400 hours of operation or annually, whichever comes first the facility shall:

Change the oil and filter, inspect spark plugs and inspect all hoses and belts and replace as necessary; and

Minimize the engine's time spent at idle to a period not to exceed 30 minutes; and

Develop a maintenance plan that specifies how the management practices will be met and provides to the extent practicable for the maintenance and operation of the engine in a manner consistent with good air pollution control practices for minimizing emissions; and

Each engine is to be equipped with a non-resettable hour meter.

The permittee is required to keep records to demonstrate the management practices are met.

Ch. NR 445, Wis. Adm. Code:

Because the federal NESHAP requires the engines meet a work practice requirement and does not require an emission standard, the requirements of ch. NR 445, Wis. Adm. Code also apply to the emissions of HAPs from these engines.

Each of the engines exhausts at a stack height in a separate threshold category in Table A. Emissions of formaldehyde are above the threshold value for both B04 and engine B05. Therefore, the applicable control requirement for formaldehyde is best available control technology, BACT.

EPA policy guidance (USEPA, 1989) stipulates that BACT must be determined in a "Top-Down" fashion. The "Top-Down" approach requires that the most stringent control technology available for a similar source or source category be identified for each pollutant. If the most stringent control technology is selected as BACT, no further BACT analysis is necessary. Otherwise, for each pollutant, the most stringent control technology is evaluated for its economic, technical, energy, and environmental feasibility with respect to the proposed project. If the technology is concluded to be technically not feasible for the proposed project the next technology is evaluated. If the technology is found to be technically feasible, it is evaluated for energy, environmental, or economic impacts. If any of these impacts are unacceptable, the next most stringent level of control is evaluated. This process continues until the control level under consideration cannot be eliminated on any substantial technical, energy, environmental, or economic basis.

The permittee submitted an assessment of best available control technologies on June 16, 2011. The methodology used in the assessment follows the EPA policy guidance 'top-down' review process. The evaluation of oxidation catalysts as control option follows the US EPA analysis used in support of the RICE NESHAP. A full copy of this report can be found at: http://www.epa.gov/ttn/atw/rice/ctrlcost_exist_si.pdf

Step 1: Identification of potential strategies:

a. Installation of a catalytic incinerator on the exhaust of each engine;

Catalytic incinerators operate very similarly to recuperative thermal incinerators. The exhaust gas, after passing through the flame area, passes through a catalyst bed. The catalyst has the effect of increasing the oxidation reaction rate, enabling conversion at lower reaction temperatures than in thermal incinerator units. In a catalytic incinerator, the gas stream is introduced into a mixing chamber where it is heated. The waste gas usually passes through a recuperative heat exchanger where it is preheated by post-combustion gas. The heated gas then passes through the catalyst bed. Oxygen and VOCs migrate to the catalyst surface by gas diffusion and are adsorbed onto the catalyst active sites on the surface of the catalyst where oxidation then occurs. The oxidation reaction products are then desorbed from the active sites by the gas and transferred by diffusion back into the gas stream

b. Replace the 1990 era engines with newer engines;

This option involves purchasing new engines of like size to replace the existing engines. New engines are subject to new source performance standards and emission limitations under the RICE NESHAP in section 112.

c. Adjust timing and carburetion of the engines;

d. Increase the frequency of maintenance activities on the engines;

Well maintained and tuned engines will perform with greatest efficiency and provide cleanest combustion. Higher efficiency of combustion leads to lower emissions of incomplete combustion. In natural gas or diesel fueled engines formaldehyde is a product of incomplete combustion.

e. Increase the methane content of the biogas;

Increasing the methane content of the biogas will increase the heat content and improve efficiency of combustion with fewer by products. Increasing the methane content would require changes to the gas treatment system and/or blending in natural gas to increase the heat content of the fuel prior to combustion.

f. Do not combust biogas in the engines – limiting the engines to natural gas

g. Control of exhaust with oxidation catalyst;

An oxidation catalyst, also known as a two-way catalyst, contains a honeycomb like structure with large surface area that is coated with a platinum-family element such as platinum or palladium to oxidize carbon monoxide and VOCs/formaldehyde to carbon dioxide and water:

1) $2CO + O2 \rightarrow 2CO2$
2) $C_xH_{2x}+2 + [(3x+1)/2]\ O_2 \rightarrow xCO_2 + (x+1)\ H_2O$

Combustion exhaust is routed through a catalyst-lined honeycomb channel, usually consisting of ceramic. The catalyzing element lines the surface of the honeycomb channel. As the gas stream passes through the catalyst-lined channels, CO and VOC are oxidized.

Step 2: Identification of options which are technically feasible:

All of the potential strategies are technically feasible.

Step 3: Rank the options in terms of control effectiveness

Controlling formaldehyde by installation of a catalytic incinerator or fitting the engine exhaust with an oxidation catalyst will provide the highest level of control. The permittee estimates a catalytic oxidation device can achieve 76 percent reduction in formaldehyde.

The exact amount of formaldehyde reductions in the remaining options is unknown. It is estimated emissions would be reduced by 15percent.

Step 4: Evaluation of the control strategies:

a. Catalytic Incinerator:

RMT on behalf of the permittee submitted an economic analysis of the cost to control 1,000 scfm of biogas. Roughly equivalent to a single engine. The analysis follows USEPA OAQPS cost of control methodologies. A summary of the cost estimate is presented in the table below:

Total Direct Cost ($/year)	30,600
Installation Cost ($/year)	7,400
Operating Cost ($/year)	51,976
Indirect Annual Cost ($/year)	38,400
Total Annualized Cost	90,376

Assuming a 76% removal efficiency. The cost of control is estimated as:
(2.53 tons HCOH/yr)(0.76) = 1.93 tons removed
($90,376/year)(year/1.93 tons removed) = $46,830 per year.

To control emissions of CO from these engines at a similar control efficiency results in a cost effectiveness in the range of $14,500 to $15,000 per ton carbon monoxide.

b. Replacement of the engines with new engines:

The permittee estimates the cost to replace each engine to be $500,000 per engine. New engines would be subject to the emission limitations contained in New Source Performance Standard, NSPS, 40 CFR Part 60, subpart JJJJ. The emission limit for formaldehyde is 5 g/bhp-hr. EPA has established carbon monoxide emission limits as surrogate for formaldehyde in NESHAP for Reciprocating IC Engines (RICE). New engines would not be subject to the requirements of ch. NR 445, Wis. Adm. Code and therefore a BACT analysis would not be applicable. Emission tests on the existing engines indicate emissions of carbon monoxide at 1.4 g/bhp-hr. This is the same emission rate as indicated by stack emission testing on the existing engine. Therefore this option may not result in a decrease emissions of carbon monoxide or formaldehyde.

To replace the three engines the cost to the facility would be 1,500,000. Amortizing this investment over 10 years results in an estimated annual cost per year of $12,500 per month. The cost per ton of the equipment indexed by emissions of formaldehyde and carbon monoxide

($150,000/year)(year/2.53 tons HCOH) = $59,290 per ton formaldehyde
($150,000/year)(year/23.5 tons CO) = $6380 per ton carbon monoxide

c. Adjusting the timing and carburetion of the engines:

Emissions of nitrogen oxides and carbon monoxide can be changed by adjusting the cylinder ignition timing of internal combustion engines. However, changes to the timing result in opposite effects on the emission rates. As timing is adjusted to decrease the carbon monoxide, the emissions of nitrogen oxides increase. Retarding the timing will cause the engine to not perform as efficiently in term of power output and does not follow the engine manufacturer's recommendations. This option may result in a small decrease emissions of carbon monoxide or formaldehyde, however these are offset by increase in emissions of NOx.

d. Increased frequency of maintenance activities:

Maintenance activities include changing the oil, oil filters, sparkplugs, air filters, belts and hoses and adjusting the timing at the engine manufacturer's recommended intervals. Performing these activities is intended to optimize engine performance and may reduce overall emissions of formaldehyde.

e. Increase the methane content of the biogas:

This option requires increasing the BTU value of the gas combusted in the engine by blending in pipeline quality purchased natural gas. Assuming up to 50% of the flow rate can be natural gas the cost of this option is estimated based on the commercial cost of natural gas of \$0.65 per therm. Each engine is rated at 4.8 mmBTU/hr. Assuming a fuel with up to 50% natural gas, 2.4 mmBTU/hr fueled by natural gas:

(2.4 mmBTU/hr)(1 x 10^6 ft3/1050 mmBTU)(\$0.65/therm)(1.03 therm/100 ft3 nat gas) = \$15/hr

(\$15/hr)(8760 hr/yr) = \$134,050 /year

Assuming an approximate 50% reduction in formaldehyde emission rates, the amount of reduction is approximately 1.2 tons per year and 5 tons carbon monoxide. The cost of this option is:

(134,050 \$/year)(year/1.2 tons) = \$111,710/ton formaldehyde removed

(134,050 \$/year)(year/4 tons) = \$33,510/ton carbon monoxide removed

f. Other Options:

Combustion of biogas in the Flare: this option results in higher emissions of carbon monoxide and would not provide a beneficial use of the biogas.

Combustion of biogas in boilers: the facility currently combusts a large percent of the biogas in the boilers located on site. Four new steam boilers are proposed with this project. The site does not have enough demand for all the biogas produced to combust of it in boilers. This option would require the engines to fire natural gas. See cost above.

Replacement of engines with Turbines:

The cost of replacing the engines with Turbines is estimated at \$500,000 per unit. Annualizing this cost over 10 years results in an estimate cost per year of \$101,500 per year. Assuming that formaldehyde emissions from combustion turbines are 80 percent less than engines:

Cost effectiveness: (\$101,500/year)(year/2.0 ton HCOH) = \$50,750 per ton formaldehyde

g. 4SLB Oxidation Catalyst

EPA has determined that oxidation catalysts for two-stroke lean burn (2SLB) and four-stroke lean burn (4SLB) engines are applicable controls for HAP reduction from existing stationary SI RICE. To determine the capital and annual costs for these control technologies, EC/R Inc. provided EPA with equipment cost information was obtained from industry groups and vendors and manufacturers of SI engine control technology as part of the analysis to support the RICE NESHAP. That information is used here to estimate the cost of retrofitting the engines at MMSD.

A full copy of this report can be found at: http://www.epa.gov/ttn/atw/rice/ctrlcost_exist_si.pdf

The 4SLB oxidation catalyst is an effective control technology that reduces HAP emissions from a 4SLB SI engine by oxidizing organic compounds using a catalyst. The oxidation catalyst unit contains a honeycomb-like structure or substrate with a large surface area that is coated with a premium active catalyst layer, such as, platinum or palladium. The oxidation catalyst works by oxidizing CO and gaseous hydrocarbons (HAP) in the exhaust gas to CO2 and water. The reductions of CO and HAP vary depending on the type of catalyst used and the exhaust temperature of the pollutant stream.

The cost of adding oxidation catalysts to an existing 4SLB engine was estimated using cost data obtained from vendors and industry groups covering engines ranging from 400HP to 8,000 HP. An equipment life of 10 years and an interest rate of 7 percent were used to estimate the capital recovery of the control technology and the fuel penalty was assumed to be negligible. The cost equations are presented in 2009 dollars. The linear equation has a correlation coefficient of 0.9779, which shows the data fits the equation very closely. HP refers to the size of the engine in horsepower. For MMSD each engine is rated at 580 bhp.

The total annualized cost equation for retrofitting an oxidation catalyst on a 4SLB engine was estimated to be:

4SLB Oxidation Catalyst Total Annual Cost = $1.81 x HP + $3,442

For each engine at MMSD:
(1.81 x 580) + 3442 = $4492/year

The total capital cost equation for retrofitting an oxidation catalyst on a 4SLB SI engine was estimated to be:
4SLB Oxidation Catalyst Total Capital Cost = $12.8 x HP + $3,069
For each engine: (12.8 x 580) + 3069 = $10,493/year

Summary: cost to retrofit with oxidation catalyst:

Annual Cost	Capital Cost	Total Annual Cost ($/yr)	Cost to Control ($/ton)
4492	10,493	14,985	7,890 (ton formaldehyde)
			2,500 (ton CO)

A control efficiency of 75 percent is used to determine the cost effectiveness of this technology:
And each engine emits 2.52 tons/year of formaldehyde and 8 tons/year carbon monoxide, the amount of pollutant removed is calculated as:
(2.52 tpy)(0.75) = 1.9 tons removed per year (HCOH)
Cost effectiveness: ($14,985/year)(year/1.9 ton HCOH) = $7890 per ton formaldehyde
For comparison to criteria pollutants: carbon monoxide:
Cost effectiveness: ($14,985/year)(year/6 ton CO) = $2500 per ton carbon monoxide

Fitting the engine exhaust with oxidation catalysts appears to be the most cost effective option.

Step 5. Indentify BACT:

The control option with the greatest degree of reduction of formaldehyde and carbon monoxide installing an oxidation catalyst on each of the engine exhaust stacks. Assuming the emissions of formaldehyde are reduced by at least 75%, the cost of control is $7,890 per ton removed and $2,500 per ton of carbon monoxide removed. This level considered feasible and represents the best available control technology. For comparison, recent PSD BACT determinations have used a BACT maximum cost to control limit of $17,400 per ton. See NOx removal using SCNR http://hank.baaqmd.gov/pmt/bactworkbook/intro3.htm

Inhalation Impact Analyses

Several inhalation impact analyses for emissions of formaldehyde from Madison Metropolitan Sewerage District Nine Springs Wastewater Treatment Plant have been performed by the Department in support of the ch. NR 445, Wis. Adm. Code BACT analysis. For details on the methodology and modeling analyses please see the preliminary determination of for 11-SML-090. The only route of exposure considered was inhalation and the modeled hours of operation were 24 hours per day and 365 days per year. The inhalation risk was obtained by multiplying the receptor concentration by the appropriate risk factor. The risk factor for formaldehyde is 1.3E-5

The follow tables summarize those findings.

Scenario	Total Facility Emissions (TPY)	Upper bound inhalation cancer risk	
		maximum off property impact	Impact at closes residential receptor
Emissions Controlled to BACT:	1.88 (3758 pounds)	2.6 in one million	1.9 in one million
Uncontrolled Emissions	7.66 (15,321 pounds)	10.4 in one million	7.2 in one million
Uncontrolled Emissions *and* Boilers at elevated emission rates (0.29 lb/hr)	11.43 (22,864 pounds)	33.4 in one million	28.3 in one million

Best Available Control Technology (BACT):

The most cost effective option to reduce emissions of formaldehyde is to retrofit each engine exhaust with an oxidation catalyst. This option is consistent with the application this type of control on other projects in the state for engines firing biogas. The option will reduce the inhalation risk at the closest residential receptor to 1.86E-6 or about two in one million a reduction in the risk of 74 percent. Therefore the permittee will be required to retrofit each of the three engines with oxidation catalysts. The catalyst will be required to be maintained according to the manufacturer's recommendation.

Implementation: The permittee requests to implement the installation of the oxidation catalyst over the next year. Ch. NR 445.08(10)(a)2., Wis. Adm. Code allows existing sources constructed prior to July 2004 up to eighteen months to come into final compliance with the control requirements. A schedule for installation and testing shall be included in the permit. The permittee will be required to report progress on an interim basis.

Wastewater Treatment Unit Operations: P06, fugitive:

Fugitive emissions are expected from the wastewater treatment operations based on the information submitted. The total HAP emission rate is 1.5 TPY. The facility will be required to follow good engineering practices to minimize emissions of hazardous air pollutants.

COMPLIANCE AND TECHNOLOGY REVIEW

The proposed flare and boilers and the existing engines and boilers serve as both control devices and emission units for gas generated by the anaerobic digester systems. The flare serves as a backup control device for the anaerobic digester systems if the engine or the boilers are off-line.

P10: Anaerobic Digester System:

To maintain synthetic minor status under Part 70 for greenhouse gasses (C02e) the facility shall combust the biogas generated by the anaerobic digester systems. Records of fuel combusted in each unit will provide compliance for this requirement.

B01, B02, B06: Biogas Fired Boilers:

The permittee will be required to perform stack emission tests for fine particulate matter (PM10 and $PM_{2.5}$), carbon monoxide and formaldehyde while firing biogas to demonstrate the emission estimates accurately reflect the emission rates. Stacks exhausting the boilers will be exhausted vertically and unobstructed. Stack S06, venting the Fulton boilers, B06 shall be a minimum of 70 feet above ground level.

Emissions of sulfur dioxide will be limited by treatment of the biogas to limit the hydrogen sulfide concentration prior to combustion.

B04 and B05: Biogas Fired Engines:

The permittee will be required to perform stack emission tests for fine particulate matter (PM10 and $PM_{2.5}$), carbon monoxide and formaldehyde while firing biogas to demonstrate the emission estimates accurately reflect the emission rates. Stacks exhausting the boilers will be exhausted vertically and unobstructed.

Emissions of sulfur dioxide will be limited by treatment of the biogas to limit the hydrogen sulfide concentration prior to combustion.

For additional information on the details of compliance, requirements please see sections titled Emission Estimate/Applicable Requirements and Rule Applicability.

Facility Wide Condition – Synthetic Minor Conditions:

Carbon Monoxide Emissions

The emission rate of carbon monoxide from combustion of biogas is greater than 100 tons per year. The facility requests to limit emissions to below major source thresholds to maintain status as a synthetic minor source under Title V.

Facility wide emissions will be limited to 16,500 pounds per month as an average over each twelve month period. The permittee will be required to calculate the monthly emission rate of carbon monoxide from each of the combustion sources. The emission rates calculations will be based on the heat content of the biogas (percent methane) as measured on a monthly basis, the site specific emission factors developed through stack testing and the amount of gas combusted in each device.

To ensure the emission rates are below thresholds, the facility will be required to perform emission tests on at least one of the boilers and engines following the emission testing protocol in 40 CFR Part 63, subpart JJJJ.

Emission factors to be used for each category of combustion device:

Device	Carbon monoxide (CO)
Flare	1.36 lb/mmBTU
Boilers	0.3 lb/mmBTU

Engines	1.5 g/bhp-hr

Formaldehyde Emissions

The facility is requesting to limit emissions of Hazardous air pollutants regulated under section 112 of the Clean Air Act to below major source thresholds. Formaldehyde is a pollutant regulated under section 112 as a federal HAP.

To ensure the emission rate is below this threshold the facility will be required to perform emission tests on at least one of the engine generators following the emission testing protocol in 40 CFR Part 63, subpart JJJJ.

The emission test will be used to verify the site specific emission factor for these engines.

Hydrogen Sulfide Emissions

Biogas generated in the anaerobic digesters contains hydrogen sulfide, a hazardous air pollutant regulated under section 112 of the Clear Air Act. To maintain status as an area source of emissions, the biogas shall be treated to reduce the hydrogen sulfide concentration and the facility shall combust the gas in the engines and flares.

Green House Gas Emissions (GHG):

Biogas generated in the anaerobic digesters contains a minimum of 55 percent methane and 32 percent carbon dioxide, gasses regulated as green house gasses under the Clear Air Act. To maintain status as a minor source of emissions, the biogas shall be treated to reduce the hydrogen sulfide concentration and the facility shall combust the gas in the engines and flares.

AIR QUALITY REVIEW

A. INTRODUCTION

A revised air dispersion modeling analysis was completed on August 29, 2012 to assess the impact of the particulate matter, sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) emissions from the Nine Springs Treatment Plant of Madison Metropolitan Sewerage District (MMSD) in Madison (Dane County). This analysis was performed in support of construction permits 11-SML-090 and 10-JLH-224.

B. MODELING ANALYSIS

- MMSD supplied the emission parameters used in this analysis via a report from TRC Consultants. To establish parameters for the stationary flare, the procedure outlined in a July 1986 memo from USEPA Region V (commonly called the Koerber memo) was used. This procedure uses standard values for exit gas velocity and exit gas temperature but modifies stack diameter based on the total heat released. Building dimensions were determined using measurements taken on plot plans provided by the applicant. Please refer to the source table.
- Five years (2006-2010) of preprocessed meteorological data was used in this analysis. The surface data was collected in Madison, and the upper air meteorological data originated in Green Bay.
- The AERMIC Model (AERMOD) model was also used in the analysis. The model used rural dispersion coefficients with the regulatory default options. These allow for calm wind and missing data correction, buoyancy induced dispersion, and building downwash including recirculation cavity effects. Terrain effects were also accounted for, with elevation data derived from digitized USGS data sets.
- Regional background concentrations were found to be as follows:

BACKGROUND CONCENTRATIONS (Concentrations are in $\mu g/m^3$)		
Pollutant	Averaging Period	Concentration
SO_2	3 hour 24 hour Annual	43.2 30.5 8.6
NO_x	Annual	24.1
CO	1 hour 8 hour	1,362.7 1,191.2
$PM_{2.5}$	24 hr Annual	28.9 10.2
PM_{10}	24 hr	47.0

- Receptors used in this analysis followed USEPA and WDNR ambient air policy and consisted of a rectangular grid with 25-meter resolution extending 600 meters from the sources surrounded by a 50-meter spaced grid extending 1200 meters from the sources. Elevations were derived from the AERMOD terrain processor AERMAP, using the National Elevation Dataset.
- The Dane County PSD baselines for PM_{10}, SO_2, and NO_x were all set in 1998. Any increase of allowable emissions since that date consume increment. Several sources at MMSD Nine Springs consume increment but a review of the emissions inventory found no other sources in the immediate area.
- The Madison Gas & Electric Nine Springs turbine (FID 113016090) is located within the contiguous fence line of the MMSD Nine Springs facility, so was included in this analysis.
- This revised analysis was performed due to corrections to emission limits and a new height on S01.

C. MODEL RESULTS

Construction permit application 11-SML-090-R1 is for the proposed stacks S06 and S08. An analysis of these sources alone was performed and the impact of these emissions was found to be below the Significant Impact Level for $PM_{2.5}$, PM_{10}, SO_2, and CO. Therefore, emissions from these two stacks have no effect upon ambient air quality.

Modeling Analysis Results (All Concentrations in $\mu g/m^3$)			
	PM_{10} – 24 hour	$PM_{2.5}$ – 24 hour	$PM_{2.5}$ – Annual
Project Impact	3.51	1.19	0.094
SIL	5.0	1.2	0.3

Modeling Analysis Results (All Concentrations in $\mu g/m^3$)			
	SO_2 – 3 hour	SO_2 – 24 hour	SO_2 – Annual
Project Impact	1.59	0.48	0.045
SIL	25.0	5.0	1.0

BACKGROUND CONCENTRATIONS (Concentrations are in μg/m^3)		
Pollutant	Averaging Period	Concentration
SO_2	3 hour 24 hour Annual	43.2 30.5 8.6
NO_x	Annual	24.1
CO	1 hour 8 hour	1,362.7 1,191.2
$PM_{2.5}$	24 hr Annual	28.9 10.2
PM_{10}	24 hr	47.0

- Receptors used in this analysis followed USEPA and WDNR ambient air policy and consisted of a rectangular grid with 25-meter resolution extending 600 meters from the sources surrounded by a 50-meter spaced grid extending 1200 meters from the sources. Elevations were derived from the AERMOD terrain processor AERMAP, using the National Elevation Dataset.
- The Dane County PSD baselines for PM_{10}, SO_2, and NO_x were all set in 1998. Any increase of allowable emissions since that date consume increment. Several sources at MMSD Nine Springs consume increment but a review of the emissions inventory found no other sources in the immediate area.
- The Madison Gas & Electric Nine Springs turbine (FID 113016090) is located within the contiguous fence line of the MMSD Nine Springs facility, so was included in this analysis.
- This revised analysis was performed due to corrections to emission limits and a new height on S01.

C. MODEL RESULTS

Construction permit application 11-SML-090-R1 is for the proposed stacks S06 and S08. An analysis of these sources alone was performed and the impact of these emissions was found to be below the Significant Impact Level for $PM_{2.5}$, PM_{10}, SO_2, and CO. Therefore, emissions from these two stacks have no effect upon ambient air quality.

Modeling Analysis Results (All Concentrations in μg/m^3)			
	PM_{10} – 24 hour	$PM_{2.5}$ – 24 hour	$PM_{2.5}$ – Annual
Project Impact	3.51	1.19	0.094
SIL	5.0	1.2	0.3

Modeling Analysis Results (All Concentrations in μg/m^3)			
	SO_2 – 3 hour	SO_2 – 24 hour	SO_2 – Annual
Project Impact	1.59	0.48	0.045
SIL	25.0	5.0	1.0

Engines	1.5 g/bhp-hr

Formaldehyde Emissions

The facility is requesting to limit emissions of Hazardous air pollutants regulated under section 112 of the Clean Air Act to below major source thresholds. Formaldehyde is a pollutant regulated under section 112 as a federal HAP.

To ensure the emission rate is below this threshold the facility will be required to perform emission tests on at least one of the engine generators following the emission testing protocol in 40 CFR Part 63, subpart JJJJ.

The emission test will be used to verify the site specific emission factor for these engines.

Hydrogen Sulfide Emissions

Biogas generated in the anaerobic digesters contains hydrogen sulfide, a hazardous air pollutant regulated under section 112 of the Clear Air Act. To maintain status as an area source of emissions, the biogas shall be treated to reduce the hydrogen sulfide concentration and the facility shall combust the gas in the engines and flares.

Green House Gas Emissions (GHG):

Biogas generated in the anaerobic digesters contains a minimum of 55 percent methane and 32 percent carbon dioxide, gasses regulated as green house gasses under the Clear Air Act. To maintain status as a minor source of emissions, the biogas shall be treated to reduce the hydrogen sulfide concentration and the facility shall combust the gas in the engines and flares.

AIR QUALITY REVIEW

A. INTRODUCTION

A revised air dispersion modeling analysis was completed on August 29, 2012 to assess the impact of the particulate matter, sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) emissions from the Nine Springs Treatment Plant of Madison Metropolitan Sewerage District (MMSD) in Madison (Dane County). This analysis was performed in support of construction permits 11-SML-090 and 10-JLH-224.

B. MODELING ANALYSIS

- MMSD supplied the emission parameters used in this analysis via a report from TRC Consultants. To establish parameters for the stationary flare, the procedure outlined in a July 1986 memo from USEPA Region V (commonly called the Koerber memo) was used. This procedure uses standard values for exit gas velocity and exit gas temperature but modifies stack diameter based on the total heat released. Building dimensions were determined using measurements taken on plot plans provided by the applicant. Please refer to the source table.
- Five years (2006-2010) of preprocessed meteorological data was used in this analysis. The surface data was collected in Madison, and the upper air meteorological data originated in Green Bay.
- The AERMIC Model (AERMOD) model was also used in the analysis. The model used rural dispersion coefficients with the regulatory default options. These allow for calm wind and missing data correction, buoyancy induced dispersion, and building downwash including recirculation cavity effects. Terrain effects were also accounted for, with elevation data derived from digitized USGS data sets.
- Regional background concentrations were found to be as follows:

Modeling Analysis Results (All Concentrations in µg/m³)			
	CO – 1 hour	CO – 3 hour	NO_2 – Annual
Project Impact	97.2	46.1	1.68
SIL	2,000.0	500.0	1.0

Note: Tier II Ambient Ratio Method was applied where 75% of NO_x emissions are assumed to convert into NO_2

Since the impact of the emissions of the proposed sources is above SIL for NO_2, a full increment and facility NAAQS analysis was performed for NO_2. The results show that all increment and NAAQS are satisfied.

Modeling Analysis Results (All Concentrations in µg/m³)	
	NO_2 - Annual
New Source Impact	18.8
PSD Increment	25.0
% Increment Consumed	75.2
Facility Impact	31.6
Background Concentration	24.1
Total Concentration	55.7
NAAQS	100.0
% NAAQS	55.7

Note: Tier II Ambient Ratio Method was applied where 75% of NO_x emissions are assumed to convert into NO_2

D. CONCLUSION

The results of the modeling analysis demonstrate that the applicable air quality standards will be satisfied assuming the emissions rates and stack parameters listed in the source table.

MADISON METRO SEWERAGE DISTRICT NINE SPRINGS Stack Parameters					
ID	LOCATION (UTM83)	HEIGHT (M)	DIAMETER (M)	VELOCITY (M/S)	TEMP (K)
S01	308138, 4767228	**7.92**	0.46	6.04	450.0
S02	308022, 4767322	6.15	0.41	0.01	477.0
S03	308123, 4767583	10.36	0.41	0.01	477.0
S04	308126, 4767233	12.20	0.25	16.90	822.0
S05	307999, 4767475	15.30	0.25	16.90	811.0
S06[1]	308047, 4767214	21.34	0.81	6.55	477.0
S08[2]	308153, 4767285	7.62	*1.22*	*20.00*	*1273.0*
MGE	307856, 4767808	6.40	2.77	18.75	755.4

Notes
#1 – The single stack S06 vents four boilers, and all operating possibilities (i.e. one boiler, two boilers, three boilers, four boilers) were examined. The highest impact occurs with all four boilers operating, and these are the stack parameters and emission rates presented.
#2 - The parameters for the flare stack are derived using the procedure in the March 1986 Koerber memo. Exit gas velocity and temperature are set, but the stack diameter is adjusted based on the total heat released.

Revised Emission Rates for 11-SML-090-R1

MADISON METRO SEWERAGE DISTRICT NINE SPRINGS Emission Rates					
ID	PM/PM_{10} RATE (#/HR)	$PM_{2.5}$ RATE (#/HR)	SO_2 RATE (#/HR)	NO_x RATE (#/HR)	CO RATE (#/HR)
S01	0.64	n/a	0.26	5.63	7.14
S02	0.34	n/a	0.11	2.28	2.86
S03	0.06	n/a	0.002	0.41	0.35
S04	0.36	n/a	0.080	7.95	3.60
S05	0.18	n/a	0.040	4.00	1.80
S06[1]	0.68	0.26	0.060	4.52	5.70
S08[2]	0.79	0.79	1.00	1.87	35.10
MGE	3.10	n/a	0.80	82.20	21.10

n/a = not applicable; modeling for S06/S08 below SIL

Emission Rates for 11-SML-090 and 10-JHL-224: (originally modeled emission rates)

MADISON METRO SEWERAGE DISTRICT NINE SPRINGS Emission Rates					
ID	PM/PM_{10} RATE (#/HR)	$PM_{2.5}$ RATE (#/HR)	SO_2 RATE (#/HR)	NO_x RATE (#/HR)	CO RATE (#/HR)
S01	0.43	0.43	0.13	5.63	4.73
S02	0.17	0.17	0.055	2.28	1.91
S03	0.03	0.03	0.002	0.41	0.35
S04	0.18	0.18	0.040	7.95	3.60
S05	0.09	0.09	0.020	4.00	1.80
S06[1]	0.34	0.26	0.030	4.52	3.80
S08[2]	0.79	0.79	3.30	1.87	35.10
MGE	3.10	3.10	0.80	82.20	21.10

Note: these emission rates were provided with the original permit review for 11-SML-090. These rates are presented here for comparison.

EMISSIONS FROM NEW EQUIPMENT OR MODIFICATION

A. Stack Emissions

Boilers:

Stacks S01 - Criteria and Hazardous Air Pollutant Emissions (Stack Height -26.0 ft).

Pollutant	Potential to Emit (PTE) Pounds per hour	Potential to Emit (PTE) Tons per year
Particulate Matter (PM/PM10)	0.64	2.8
Particulate Matter ($PM_{2.5}$)	n/a	
Nitrogen Oxides (NOx)	5.63	24.7
Carbon Monoxide (CO)	7.14	31.3
Sulfur Dioxide (S02)	0.26	1.16
Volatile Organic Compounds (VOC)	0.31	1.36

Formaldehyde	0.013	110.9 pounds/yr
HAP (112 b)		0.001

Stacks S02 - Criteria and Hazardous Air Pollutant Emissions (Stack Height -20.2 ft).

Pollutant	Potential to Emit (PTE)	
	Pounds per hour	Tons per year
Particulate Matter (PM/PM10)	0.34	1.5
Particulate Matter ($PM_{2.5}$)	n/a	
Nitrogen Oxides (NOx)	2.28	9.99
Carbon Monoxide (CO)	2.9	12.7
Sulfur Dioxide (S02)	0.11	0.48
Volatile Organic Compounds (VOC)	0.13	0.55
Formaldehyde	0.007	57.9 pounds/yr
HAP (112 b)		0.0002

Stacks S03 - Criteria and Hazardous Air Pollutant Emissions (Stack Height -35.7 & 40.7 ft).

Pollutant	Potential to Emit (PTE)	
	Pounds per hour	Tons per year
Particulate Matter (PM/PM10)	0.03	0.14
Particulate Matter ($PM_{2.5}$)	0.03	0.14
Nitrogen Oxides (NOx)	0.41	1.81
Carbon Monoxide (CO)	0.35	1.52
Sulfur Dioxide (S02)	0.002	0.01
Volatile Organic Compounds (VOC)	0.02	0.10
Formaldehyde		exempt
HAP (112 b)		neg

Stacks S06 - Criteria and Hazardous Air Pollutant Emissions (Stack Height -70.0 ft).

Pollutant	Potential to Emit (PTE)	
	Pounds per hour	Tons per year
Particulate Matter (PM10/PM2.5)	0.68	3.0
Particulate Matter ($PM_{2.5}$)	0.26	1.14
Nitrogen Oxides (NOx)	4.53	19.9
Carbon Monoxide (CO)	5.7	25
Sulfur Dioxide (S02)	0.06	0.26
Volatile Organic Compounds (VOC)	0.25	1.1
Formaldehyde	0.013	115.2 pounds/yr
HAP (112 b)		0.0002

Generators:

Stacks S04 - Criteria and Hazardous Air Pollutant Emissions (Stack Heights -40.0 ft).

Pollutant	Potential to Emit (PTE)	
	Pounds per hour	Tons per year
Particulate Matter (PM/PM10)	0.36	1.58
Particulate Matter ($PM_{2.5}$)	n/a	
Nitrogen Oxides (NOx)	8.0	34.8
Carbon Monoxide (CO)	3.6	15.8

Sulfur Dioxide (S02)	0.04	0.18
Volatile Organic Compounds (VOC)	2.16	9.47
Formaldehyde	0.28	2461.6 pounds/yr
HAP (112 b)		5.06

Stack S05 - Criteria and Hazardous Air Pollutant Emissions (Stack Height -50.2 ft).

Pollutant	Potential to Emit (PTE)	
	Pounds per hour	Tons per year
Particulate Matter (PM/PM10)	0.18	0.79
Particulate Matter ($PM_{2.5}$)	n/a	
Nitrogen Oxides (NOx)	4.0	17.5
Carbon Monoxide (CO)	1.8	7.88
Sulfur Dioxide (S02)	0.04	0.18
Volatile Organic Compounds (VOC)	1.08	4.73
Formaldehyde	0.14	1235.2 pounds/yr
HAP (112 b)		3.53

Flare

Stack S08 - Criteria and Hazardous Air Pollutant Emissions (Stack Height -48.5 ft).

Pollutant	Potential to Emit (PTE)	
	Pounds per hour	Tons per year
Particulate Matter (PM10/PM2.5)	0.79	1.02
Nitrogen Oxides (NOx)	1.87	2.4
Carbon Monoxide (CO)	35.1	44.7
Sulfur Dioxide (S02)	1.0	4.38
Volatile Organic Compounds (VOC)	0.31	0.41
Formaldehyde		0.006
HAP (112 b)		0.08

B. Total Facility Emissions

Pollutant	Potential to Emit (PTE)	
	lbs/hour	tons/year
Particulate Matter (PM10)	3.05	13.4
Particulate Matter ($PM_{2.5}$)	1.05	4.6
Nitrogen Oxides (NOx)	26.7	91.1
Carbon Monoxide (CO)	56.5	99.0
Sulfur Dioxide (S02)	1.6	7.0
Volatile Organic Compounds (VOC)	--	17.7
Formaldehyde	0.45	3,980.75 pounds/yr
HAP (112 b)	--	5.9

EMISSIONS NETTING ANALYSIS

Not applicable as the facility is not considered in one of the PSD major source categories and emissions are below PSD source status threshold of 250 tons per year. Therefore, the facility is not a major source under ch. NR 405, Wis. Adm. Code, Prevention of Significant Deterioration, PSD

FACILITY AND PROJECT CLASSIFICATION

Greenhouse Gas Emissions

The potential emissions of greenhouse gas (GHGs) resulting from this project were determined to be less than 100,000 tons per year on a carbon dioxide equivalent basis, excluding the flare. The significance threshold under ch. NR 405, Wis. Adm. Code, for GHGs is 100,000 TPY on a carbon dioxide equivalent basis. Combustion of the methane generated by the digesters allows the proposed project and facility to be considered a major source for GHGs under ch. NR 405, Wis. Adm. Code.

1. **Existing Facility Status.**

Maximum theoretical emissions from the existing facility are above Title V major source thresholds. No air pollution control permits have been issued to this source.

2. **Project Status**

This project is a minor modification to a Title V major source. Emissions from the project are limited to below 100 tons of any criteria pollutant, 10 tons of any individual HAP and 25 tons combined. Emissions of greenhouse gasses are limited to less than 100,000 tons per year CO2e.

3. **Facility Status After the Permit is Issued.**

Upon issuance, the facility will be considered a synthetic minor source under Part 70 because emissions are limited to below major source thresholds. The facility is also a minor source for ch. NR 405, Prevention of Significant Deterioration, PSD.

4. **EPA Class Code After the Permit is Issued.**

x☒ **"SM80"** Means the source's maximum theoretical emissions of one or more pollutants are greater than major source thresholds and potential to emit is at least 80% but less than 100% of major source thresholds. The source is a non-major source (will have a FESOP)

5. **Summary.**

NSR Applicability	After Permit Issuance: Major	After Permit Issuance: Minor
PSD		X
Non-Attainment		n/a
Federal HAP		X

Part 70 Applicability	Facility After Permit Issuance: Part 70	FESOP (Syn. Minor)	non-part 70
Status		X	

EPA Class Code	EPA Class Code After Permit Issuance: A	SM80	SM	B
Status		X		

ENVIRONMENTAL ANALYSIS

The proposed project is a Type III action under Chapter NR 150, Wis. Adm. Code, because there is a potential increase in hazardous emissions and the potential to emit of the project is less than 100 TPY for each criteria pollutant.

A news release is required for this proposal and is included in the public comment notice. It is proposed that an environmental assessment not be completed.

RULE APPLICABILITY

Process P10, Control Device C10: Anaerobic Digesters:

Ch. NR 445, Wis. Adm. Code – Control of Hazardous Air Pollutants:

The digesters emit hydrogen sulfide and to maintain potential emissions below the threshold value in Table A the biogas is required to be treated in the waste gas pretreatment system, C10.

Ch. NR 429, Wis. Adm. Code – Malodorous Emissions

If not properly operated and vented to the engine generators or the flare, the anaerobic digester has the potential to generate significant malodorous emissions. The permittee will be required to prepare a malodorous emissions control plan to document the steps to be taken to control odors resulting from the operation of the anaerobic digester and address any complaints received. The permittee will be required to operate either the engine generators or a flare designed with s. NR 440.18, Wis. Adm. Code, to ensure compliance with the standard.

Greenhouse Gases (GHG):

Biogas generated in the Anaerobic Digesters shall be combusted in either the boilers, engines or waste gas flare to maintain emissions of GHG below major source thresholds.

Process P08, Stack S08: Waste Gas Flare:

Ch. NR 415, Wis. Adm. Code: – Control of Particulate Matter Emissions

The anaerobic digester does not produce particulate matter. However, the flare control device does produce particulate matter while operating. This control device is subject to the particulate matter restrictions under s. NR 415.06(2)(a), Wis. Adm. Code. Any fuel-burning installation of 250 MMBtu per hour or less installed after 1972, shall have a maximum emission from any stack of 0.15 pounds of particulate matter per MMBtu heat input. The allowable maximum emission rate for this emission unit is 0.79 pounds per hour. Based on refined modeling, no exceedance of the National Ambient Air Quality Standards or increment was predicted at this emission rate. See the Air Quality Review section for more information.

Control of Visible Emissions

Ch. NR 431, Wis. Adm. Code: Any emission unit installed after 1972 may not cause or allow emissions of shade or density greater than number 1 of the Ringlemann chart or 20% opacity.

Under s. NR 440.18, Wis. Adm. Code, the flare may not have visible emissions, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours. No visible emissions are expected from the flaring of biogas. In addition s. NR 440.18(3)(b), Wis. Adm. Code requires flares to be operated with a flame present at all times. The presence of a flame shall be monitored using a thermocouple. The waste gas flare will be equipped with a thermocouple and meets these requirements.

Control of Hazardous Pollutants – ch. NR 445, Wis. Adm. Code and section 112(b) Clean Air Act

No significant emissions of state or Federal HAPs are expected from the flare.

Processes B01, Stacks S01 and B02, Stack2 S02, B03, Stack S03 and B06, Stacks S06: Biogas Fired Hot waster and Steam Fired Boilers.

Ch. NR 415, Wis. Adm. Code: – Control of Particulate Matter Emissions

These boilers are subject to the particulate matter restrictions under s. NR 415.06(2)(a), Wis. Adm. Code. Any fuel-burning installation of 250 MMBtu per hour or less installed after 1972, shall have a maximum emission from any stack of 0.15 pounds of particulate matter per MMBtu heat input. Based on refined modeling, no exceedance of the National Ambient Air Quality Standards or increment was predicted at the maximum emission rates for these boilers. See the Air Quality Review section for more information.

Ch. NR 431, Wis. Adm. Code - Control of Visible Emissions

Any emission unit installed after 1972 may not cause or allow emissions of shade or density greater than number 1 of the Ringlemann chart or 20% opacity.

Control of Hazardous Pollutants – ch. NR 445, Wis. Adm. Code and section 112(b) Clean Air Act

No significant emissions of Federal HAPs are expected from the combustion of biogas in the boilers. Emission estimates of formaldehyde from combustion of biogas in the boilers are based on emission factors for boilers while firing natural gas. The permittee will be required to perform stack emission testing for formaldehyde.

Ch. NR 404.04(8) & (9), Wis. Adm. Code – Ambient Air Quality Standards for PM10 and PM2.5

Based on refined modeling, boilers B06, stack S06 are able to meet the significant impact level (SIL) with emissions exhausted through vertical unobstructed stack at a height of 70 feet with a particulate matter emission rate of 0.34 pounds per hour of PM10 and 0.26 pounds per hour of $PM_{2.5}$. This particulate matter emission rate is the estimated maximum theoretical emission rate but lower than the maximum allowable emission rate. See the Air Quality Review section for more information.

Ambient Air Quality Standards:

The facility is able to meet ambient air quality standards (NAAQS) for all criteria pollutants at the code or standard allowable emission rates. The permittee will be required to keep technical drawings and specifications of the stack parameters on site. See section on Air Quality Analysis.

Processes B04, Stacks S05 and B05, Stack S05: 580 bhp Biogas Fired Spark Ignition Engines.

Ch. NR 415, Wis. Adm. Code – Control of Particulate Emissions

These emission units are subject to particulate matter restrictions under s. NR 415.06(2)(a), Wis. Adm. Code. Any fuel-burning installation of 250 MMBtu per hour or less installed after 1972, shall have a maximum emission from any stack of 0.15 pounds of particulate matter per MMBTU heat input. The theoretical maximum emission rate for each engine is 0.019 pounds of particulate matter per MMBTU heat input, equivalent to 0.18 pounds per hour.

Ch. NR 404.04(8) & (9), Wis. Adm. Code – Ambient Air Quality Standards for PM10 and PM2.5

Based on refined modeling, these emission units are able to meet the significant impact level (SIL) with emissions exhausted through vertical unobstructed stacks at a particulate matter emission rate of 0.18 pounds per hour. This particulate matter emission rate is higher than the estimated maximum theoretical emission rate but lower than the maximum allowable emission rate. See the Air Quality Review section for more information. Because the incoming biogas to this emission unit is treated and filtered, no exceedance of this emission rate is expected.

Ch. NR 431, Wis. Adm. Code - Control of Visible Emissions

Any emission unit installed after 1972 may not cause or allow emissions of shade or density greater than number 1 of the

Ringlemann chart or 20% opacity. The exceptions under s. NR 431.05, Wis. Adm. Code, do apply to this emission unit. Because biogas is considered a clean burning fuel, no exceedance of the opacity limitations is expected while combusting this fuel. Restricting this emission unit to biogas or natural gas is adequate compliance demonstration for this emission unit.

40 CFR 63 Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (NESHAP)

The engines are subject to the requirements of 40 CFR 63 Subpart ZZZZ, compliance with the NESHAP requires the permittee to follow specific management practices on the engines.

Ch. NR 445, Wis. Adm. Code – Control of Hazardous Air Pollutant Emissions:

Emissions of formaldehyde are required to be controlled to Best Available Control Technology, BACT. BACT has been determined to be retrofitting the engines with catalytic oxidation units to reduce formaldehyde emissions. See Hazardous Air Pollutant Review for details.

Waste Water Treatment Plant Operations:

Ch. NR 429, Wis. Adm. Code – Malodorous Emissions
If not properly operated the waste water treatment plant operation have the potential to generate significant malodorous emissions. The permittee will be required to prepare a malodorous emissions control plan to document the steps to be taken to control odors resulting from the operation of the treatment plant and address any complaints received.

NEW SOURCE PERFORMANCE STANDARDS (NSPS) APPLICABILITY

For proposed construction of a source:

1. Is the proposed source in a source category for which there is an existing or proposed NSPS?
   ☒ No

2. Is the proposed source an affected facility?
   No ☐

For the proposed modification of an existing source:

1. Is the existing source, which is being modified, in a source category for which there is an existing or proposed NSPS?
   Not applicable.

2. Is the existing source, which is being modified, an affected facility (prior to modification)?
   ☒ Not applicable.

3. Does the proposed modification constitute a modification **under NSPS** to the existing source?
   ☒ Not applicable.

4. Will the existing source be an affected facility after modification?
   ☒ Not applicable.

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAPS) APPLICABILITY

Part 61 NESHAPS:

1. Will the proposed new or modified source emit a pollutant controlled under an existing or proposed NESHAPS?
   ☒ No

2. Is the proposed new or modified source subject to an existing or proposed NESHAPS?
   ☒ No

Part 63 NESHAPS:

1. Will the proposed new or modified source emit a pollutant controlled under an existing Part 63 NESHAPS?
   ☒ Yes formaldehyde

2. Is the proposed new or modified source subject to an existing Part 63 NESHAPS?
   ☒ Yes 40 CFR Part 63, subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines.

3. Is the proposed project subject to s. 112(g) of the Clean Air Act?
   ☒ No.

CAM - COMPLIANCE ASSURANCE MONITORING.

Not applicable as the facility is not a Title V major source.

CRITERIA FOR PERMIT APPROVAL

Section 285.63, Wis. Stats., sets forth the specific language for permit approval criteria. The Department finds that:

1. The source will meet emission limitations.
2. The source will not cause nor exacerbate a violation of an air quality standard or ambient air increment.
3. The source is operating or seeks to operate under an emission reduction option. Not Applicable.
4. The source will not preclude the construction or operation of another source for which an air pollution control permit application has been received.

PRELIMINARY DETERMINATIONS FOR CONSTRUCTION PERMIT NO. 10-JLH-224 and 11-SML-090 AND OPERATION PERMIT NO. 113002230-F01

The Wisconsin Department of Natural Resources has reviewed the construction permit applications and other materials submitted by Madison Metropolitan Sewerage District and hereby makes a preliminary determination that this project, when constructed and operated consistent with the application and subsequent information submitted, will be able to meet the emission limits and conditions included in the attached Draft Permit. Furthermore, the Department hereby makes a preliminary determination that an operation permit may be issued with the following Draft Applicable Limits and Draft Permit Conditions. A final decision regarding emission limits and conditions will be made after the Department has reviewed and evaluated all comments received during the public comment period. The proposed emission limits and other proposed conditions in the Draft Permit are written in the same form that they will appear in the construction permit and the operation permit. These proposed conditions may be changed as a result of public comments or further evaluation by the Department. The United States Environmental Protection Agency will be given the opportunity to comment on the operation permit of any Part-70 source prior to the Department making a final decision on the operation permit.