

DEPARTMENT OF ENVIRONMENTAL QUALITY  
AIR QUALITY DIVISION  
ACTIVITY REPORT: Off-site Inspection

M364157356

<b>FACILITY:</b> UNIVERSITY OF MICHIGAN FLINT		<b>SRN / ID:</b> M3641
<b>LOCATION:</b> 502 MILL STREET, FLINT		<b>DISTRICT:</b> Lansing
<b>CITY:</b> FLINT		<b>COUNTY:</b> GENESEE
<b>CONTACT:</b> Michael Malik , Systems Analyst		<b>ACTIVITY DATE:</b> 03/19/2021
<b>STAFF:</b> Michelle Luplow	<b>COMPLIANCE STATUS:</b> Compliance	<b>SOURCE CLASS:</b> SM OPT OUT
<b>SUBJECT:</b> Scheduled, announced Virtual Inspection to determine compliance with UM-Flint's PTI for 2 boilers.		
<b>RESOLVED COMPLAINTS:</b>		

**Inspected by:** Michelle Luplow

**UM Flint Personnel:** Mike Lane, Director of Environment, Health & Safety (mjlane@umich.edu)

Michael Malik, Systems Analyst (mmalik@umich.edu)

Rocco Nardi, Boiler Operations (roccona@umich.edu)

**Purpose:** Conduct an announced, scheduled, partial compliance evaluation (PCE) inspection by determining compliance with University of Michigan – Flint’s (UM-Flint) Permit No. 140-13 for two 33.6 MMBtu/hr boilers. This inspection was conducted as part of a full compliance evaluation (FCE) and also was conducted virtually via the State of Michigan iPhone’s FaceTime app, for COVID-19 safety purposes.

**Facility Background/Regulatory Overview:** UM-Flint is a university located in downtown Flint. They operate multiple boilers campus-wide which are used for domestic hot water and heat. The two permitted boilers, EUBOILER1 and EUBOILER2, are the largest boilers present on campus. EUBOILER1 operates only on natural gas, EUBOILER2 is dual-fuel fired with natural gas as the primary fuel and fuel oil No. 2 (diesel) used for emergency backup purposes. These two units replaced four existing boilers that were permitted under PTI No. 32-12. The remaining boilers throughout campus are natural gas-fired and much smaller, all rated under 5 MMBtu/hr.

There are also multiple generator sets located throughout campus used as backup power in emergency situations where the campus has lost power from the grid. Some operate on natural gas while others operate on diesel fuel.

This facility has been flagged as an opt-out facility in MACES; however, there are no facility-wide restrictions on HAPs or criteria air pollutants to opt UM Flint out of Title V, ROP requirements. Additionally, this is not a synthetic minor source, as the emission limits in place for NOx were not used to limit emissions but were rather based on PSD increment analysis. The evalform for PTI 140-13 states that UM Flint is a true minor source that is not subject to PSD requirements.

UM-Flint provided a Potential to Emit Demonstration in April 2017. At that time we were able to further determine that UM-Flint was a true minor source, as the Potential to Emit of all criteria pollutants was less than the major source thresholds; however, NOx emissions were totaling at approximately 91 tons/year source-wide. Because the tons reported are very close to the 100-ton major source threshold, and because they have added additional

fuel-burning equipment between 2017 and 2021, I am requesting that UM-Flint recalculate their Potential to Emit to include the new pieces of equipment to verify that they are still under 100 tpy NOx.

The 2 boilers are subject to the New Source Performance Standards (NSPS) Subpart Dc for steam-generating units with a maximum design heat input capacity of less than 100 MMBtu/hr, but greater than 10 MMBtu/hr.

**Inspection:** Prior to the virtual inspection I held a Microsoft Teams call with Michael Malik and Rocco Nardi on March 16, 2021 to discuss the exempt equipment located throughout UM-Flint's campus, emission factors for NOx, flow meter calibrations, etc. At approximately 7:30 a.m. on March 19, 2021, I began a FaceTime call with Rocco Nardi to conduct a virtual inspection of the 2 permitted boilers. Tables 2 & 3 contains a list of all exempt boilers and emergency engines at the UM-Flint campus as of March 2021.

### **FGBOILERS1&2 (EUBOILER1 and EUBOILER2)**

FGBOILERS1&2 consist of two, 33.6 MMBtu/hr natural gas-fired fire tube boilers. Table 1 contains the serial numbers (verified the same as the serial numbers recorded during the 2017 inspection), instantaneous natural gas flow rate, and associated load% recorded during the virtual inspection. I also observed during the virtual inspection that no opacity was seen from either of the boiler stacks. Natural gas was the only fuel being combusted in the boilers during the virtual inspection.

The biggest load on the boilers is domestic hot water. Because the student on-campus population has decreased as a result of COVID-19 precautions, the boilers have been running much less than the years pre-COVID19.

**Table 1.** Boiler identification and operating parameters

<b>Hurst Boilers</b>	<b>Serial #</b>	<b>Instantaneous scf/hr</b>	<b>% Load</b>	<b>Manufacture Date</b>	<b>Federal Regulation</b>
EUBOILER1	S4000 150-42	39,554	10	2012	NSPS Dc
EUBOILER2	S4000 150-43	13,540	42	2013	NSPS Dc

*There are currently no Testing/Sampling requirements for FGBOILERS1&2.*

#### **Emission Limits & Monitoring/Recordkeeping**

UM-Flint is limited to 23.16 tpy NOx on a 12-month rolling period for EUBOILER1 and EUBOILER2 emissions combined, and they are required to monitor and record the monthly fuel use and keep monthly NOx emission

calculations for both boilers for natural gas and diesel fuels. M. Malik provided me with the “Boilers 1 and 2 NOx Emissions Tracking Sheet” (attached) which contains fuel usage for each type of fuel used, NOx emissions on a monthly and 12-month rolling basis, and the emission factors used for NOx and diesel.

I reviewed monthly and 12-month rolling NOx emissions data from January 2018 through December 2020. The highest 12-month rolling totals for both boilers combined, were seen at the end of March – August 2019 at 1.88 tons NOx per 12-month time period, which is within the 23.16 tpy NOx emission limit.

The permit does not specify the appropriate emission factors to calculate NOx emissions. During followup to the 2017 inspection, Michael Lane, Director of EHS at UM-Flint, provided me with a copy of Appendix A (attached for reference) from UM-Flint’s Permit to Install application for the 2 boilers, which appears to originate from the manufacturer of the burners (Weishaupt) and outlines the NOx ppm and lb/cubic foot emission rate for both natural gas and diesel (diesel EF is in lb/cubic foot flu gas). These emission factors are used to calculate emissions for compliance with the permit and are much lower than the MAERS/Webfire emission factors that UM-Flint uses to report their emissions for MAERS annual reporting. (Manufacturer’s emission factors: 3.870E-5 lb/scf for natural gas; 0.01647 lb/gal for diesel. MAERS emission factors: 1.0E-4 lb/scf for natural gas; 0.02 lb/gal for diesel.) Using the MAERS emission factors to calculate NOx emissions from both boilers yields an increase of approximately 2-3 tons NOx per 12-month rolling period compared to the emissions calculated based on manufacturer emission factors. I will bring this to the attention of M. Malik and offer the opportunity to correct the 2020 MAERS reported NOx emissions for the 2 boilers, using the manufacturer-cited emission factors, rather than the MAERS emission factor.

#### Material Limits & Monitoring/Recordkeeping

UM-Flint is limited to burning pipeline quality natural gas in EUBOILER1 and pipeline quality natural gas or diesel fuel in EUBOILER2; however, diesel fuel is only permitted to be burned during periods of gas curtailment, gas supply interruption, startups, or periodic testing on liquid fuel. Periodic testing with liquid fuel should not exceed a combined total of 48 hours per calendar year. Diesel fuel is also limited to a maximum sulfur content of 0.5% by weight.

M. Malik stated that fuel oil has not been used during periods of gas curtailment or gas supply interruption. He said that they have only used diesel when conducting their CSD-1 testing, which Rocco Nardi stated occurs once per year. They did note that they were not able to conduct CSD-1 testing during the 2020 calendar year due to unavailability of contractors to conduct the test. Therefore, fuel oil was not used during calendar year 2020, and only during 2019 CSD-1 testing, as demonstrated in their emission calculations records (350 gallons in July 2019). They plan to conduct CDS-1 testing in 2021.

Rocco Nardi provided further information that the length of time diesel is used, and therefore the amount of diesel used, is minimal: During CSD-1 testing, the boiler will only use diesel for about 5 minutes of the entire test cycle, which he said equates to approximately 250 gallons of diesel. Based on this information, diesel is used for approximately 5 minutes per year for CSD-1 testing only. During the virtual inspection, R. Nardi showed me the 1000-gallon day tank that UM-Flint uses to fuel EUBOILER2. The float device which measures how full the tank is was reading at  $\frac{3}{4}$  of a tank during the virtual inspection, indicative that approximately 250 gallons of diesel had been used within the past 18 months (R. Nardi said the tank was filled 18 months ago).

Fuel supplier certification records or fuel sample test data are required to be kept for each delivery of diesel fuel oil. M. Malik provided me with the fuel sample test data for the last 2 shipments of fuel (2013 and 2018). Both indicate compliance with 0.5% by weight maximum sulfur content (see attached).

### Process/Operational Restrictions

The boilers are required to be operated according to manufacturer's recommendations for safe and proper operation in order to minimize emissions during periods of startup, shutdown, and malfunction.

R. Nardi said that the American Society of Mechanical Engineers (ASME) governs the codes on boiler pressure vessels. CSD-1 is a code that dictates device safety. The boilers are annually inspected using CSD1 testing, which tests the combustion outputs for air, oxygen, CO, NO, and NOx. This test is conducted for 4+ hours at 90% load. The data generated from these tests provide them with indicators as to whether or not the boilers are properly functioning. If an output parameter were to deviate from this consistency, steps would be taken to ensure that the problem causing the deviation is corrected. In addition to conducting annual CSD-1 testing, ASME also recommends daily logs and daily visual inspections (such as ensuring no water is leaking, conduct water blow downs, make sure the water chemistry is good, etc.), which R. Nardi said UM Flint adheres to.

### Design/Equipment Parameters

The devices used to monitor and record the boiler's fuel use on a monthly basis are required to be installed, calibrated, maintained and operated in a satisfactory manner. As previously stated, the fuel oil monitoring device is a float that sits within the 1000-gallon day tank that indicates how full the tank is. Natural gas meters are present on each of the boilers to monitor natural gas flow.

The natural gas flow meters for both boilers were last calibrated in 2017 (see attached calibration reports). Similar to ensuring that the boilers are operating properly, they also use the steam output to verify that the fuel input (and thus the devices monitoring the fuel flow) is accurate. Their target operating efficiency is 82-88%. If the efficiency were to change, but the fuel flow rate measured consistently, they would determine the cause, paying particular attention to the fuel flow meter malfunction as one of the possible causes. R. Nardi said that the boiler's efficiency at 90% load for 4 hours is 86.6% (see attached ASME efficiency test) and that the efficiency increases slightly with lower loads (for example, 87% efficiency at 10% load). Thus ensuring that the steam output vs fuel input is maintained within the efficiency range is how UM Flint determines whether the natural gas fuel flow meter needs to be calibrated.

### Exempt Equipment

UM Flint has exempt boilers, emergency engines, and paintbooths campus-wide. Tables 2 and 3 provide a listing of all exempt emergency engines and boilers. Since the 2017 inspection UM Flint installed 2 new boilers, 1 new emergency generator, and 2 new paint booths. The asterisked equipment within each table indicates the most recent boiler and emergency generator installations.

#### *Emergency Engines (Exemption Rule 285(2)(g))*

The largest emergency engine located on campus is a 500 kW, 770 hp unit. Converting these units to Btu/hr, the unit is rated at ~ 1 MMBtu/hr. It appears that all emergency engines, including the largest one mentioned here are exempt because they are all rated at less than 10 MMBtu/hr.

The asterisked generators are the installations that occurred after the 2017 inspection.

**Table 2. Emergency Generators through UM-Flint's Campus**

Engine	Engine Serial #	kW	hp	Fuel	Location	Installation Date	Manufacture Date
<b>**Generator 15</b> Generac Model SG201	G9195002295	200	304	Natural Gas	Murchie Science Building	October 2019	May 2019
<b>Generator 2</b> Cummins Diesel Model GSL9-G2 NR3	73958431	280	375	Diesel	Central Energy Plant	February 2020	2/17/2016
<b>Generator 5</b> Ford Power Products Model LGR-423I-6007-Z	11780 C-21-RH	20	NA	Diesel	Mill Street Parking Deck	1996	1996
<b>Generator 11</b> Ford Natural Gas Model WSG1068	NA	100	153	Natural Gas	First Street Residence Hall	2008	February 2008
<b>Generator 12</b> John Deere Diesel Model 6135HFG75	RG6135G004974	500	NA	Diesel	Murchie Science Building	2014	June 2014
<b>Generator 14</b> CAT Natural Gas Model G3412C	G9195001295	500	NA	Natural Gas	University Tower	2016	November 2016
<b>Generator 4</b>	46873737	280	375	Diesel	French Hall	2009	3/11/2008

Cummins Diesel Model GSL9-G2 NR3							
<b>Generator 8</b> Cummins Model NTA855G3	30341386	350	535	Diesel	Thompson Library generator room	1994	6/14/1993
<b>Generator 13</b> Generac Natural Gas Model F4HE96858J	NA	150	NA	Natural Gas	University Pavilion	2014	8/5/2014
<b>Generator 7</b> Cummins Model GTA28	25269023	500	770	Natural gas	Northbank Center Parking lot	2001	April 2001
<b>Generator 10</b> Cummins Model GTA19	25249138	325	495	Natural gas	William White Building Generator Room	2002	June 2000
<b>Generator 1</b> General Motors Diesel Model 80837305	8VF056821	310	NA	Diesel	Riverfront Building	1981	NA
<b>Generator 6</b> CAT Diesel Model CAT 3306 PC	66D47746	211	755	Diesel	University Center/Rec Center	1979	NA

### **Boilers**

The unpermitted boilers throughout campus are natural gas-fired and much smaller than the 2 permitted boilers, all rated under 7 MMBtu/hr. These boilers would qualify for exemption under Rule 282(2)(b)(i) because they are rated at less than 50 MMBtu/hr. Table 3 contains a listing of all boilers located throughout campus.

The asterisked boilers are those that have been installed after the 2017 inspection.

**Table 3. Exempt Boilers Campus-wide**

Boiler	Boiler Serial #	Heat Input capacity	Water Capacity (gallons)	Fuel	Location	Installation Date	Manufacture Date
<b>**Aerco-Benchmark Model BMK2000</b>	G-19-1686	2 MMBtu/hr	40	Natural gas	Murchie Building	2020	June 2019
<b>**Aerco-Benchmark Model BMK2000</b>	G-19-1687	2 MMBtu/hr	40	Natural gas	Murchie building	2020	June 2019
<b>Lochinvar Model KBN400</b>	3815102009167	399,000 Btu/hr	3.4	Natural Gas	Harrison	2016	2015
<b>Peerless Boilers Model 211A-04-W/X</b>	609789-200811	630,000 Btu/hr	31.6	Natural Gas	Northbank	2010	2010
<b>Lochinvar boiler Model EBN 100</b>	CO-14321	100,000 Btu/hr	5.3	Natural gas	Northbank	2001	2001
<b>Lochinvar boiler Model SBN1500</b>	2715101731148	1.5 MMBtu/hr	11.4	Natural Gas	Northbank	2015	2015
<b>Lochinvar boiler Model SBN1500</b>	2715101731149	1.5 MMBtu/hr	11.4	Natural Gas	Northbank	2015	2015
<b>Lochinvar boiler Model SBN1500</b>	2715101731146	1.5 MMBtu/hr	11.4	Natural Gas	Northbank	2015	2015
<b>Lochinvar boiler Model SBN1500</b>	2715101731147	1.5 MMBtu/hr	11.4	Natural Gas	Northbank	2015	2015
<b>LAARS Model RHCH2000NACF2EXN</b>	A 10 221447	1.99 MMBtu/hr	32.5	Natural Gas	Riverfront	2010	2010
<b>LAARS Model PNCH2000NACL2CJN</b>	C 09 211823	1.99 MMBtu/hr	24	Natural Gas	Riverfront	2010	2009
	C 09 211822		24		Riverfront	2010	2009

<b>LAARS Model PNCH2000NAACL2CJN</b>		1.99 MMBtu/hr		Natural Gas			
<b>LAARS Model PNCH2000NAACL2CJN</b>	C 09 211733	1.99 MMBtu/hr	24	Natural gas	Riverfront	2010	2009
<b>LAARS Model PNCV2000NAACL2BJN</b>	C 09 212468	1.99 MMBtu/hr	24	Natural gas	Riverfront	2010	2009
<b>LAARS Model PNCV2000NAACL2BJN</b>	C 09 212358	1.99 MMBtu/hr	24	Natural gas	Riverfront	2010	2009
<b>Lochinvar Model FBN3000</b>	1638103452176	3.0 MMBtu/hr	181	Natural gas	University Tower	2016	2016
<b>Lochinvar Model FBN3000</b>	1639103499152	3.0 MMBtu/hr	181	Natural gas	University Tower	2016	2016
<b>Lochinvar Model FBN3000</b>	1639103499153	3.0 MMBtu/hr	181	Natural gas	University Tower	2016	2016
<b>Universal Boiler Works Model BF 4054 PF</b>	15688-2	1.73 MMBtu/hr	49	Natural gas	William S. White	2000	2000
<b>Universal Boiler Works Model BF 150 W4 PF</b>	156-88-1-1	6.3 MMBtu/hr	152	Natural gas	William S. White	2000	2000

#### *Paint Booths (Exemption Rule 287(2)(c))*

UM-Flint has 7 paint booths throughout campus. See attachment for a list of all booths, their locations, and quantities of paint used. Some booths qualify for exemption under Rule 287(2)(b) (aerosol spray cans or applications from containers less than 8 oz in size, while others appear to qualify for exemption under Rule 287(2)(c)).

#### *Kilns*

UM-Flint has 5 kilns for use in their pottery/ceramic classes located in the University Pavilion Annex. Four are electrically heat, one is natural gas-fired. These are exempt under Rule 282(2)(a)(iii) for electrically heated and natural gas-fired kilns for firing ceramic ware.

*Parts Washer*

UM-Flint has one parts washer located on their campus that measures 6 square feet in air:vapor interface (2'x3'). It uses Safety Kleen solvent and operating instructions were present on the outside of the unit. This unit is used to clean oil filters and is exempt per Rule 281(2)(h).

**MAERS**

M. Malik and I discussed reporting of the various unpermitted boilers and emergency engines to MAERS.

As discussed, we decided that the emergency generator emissions do not have to be reported to MAERS because they are emergency generators used solely for backup power when the local utility service is interrupted (See MAERS User guide, page 27).

The unpermitted boilers' emissions only need to be reported if the total annual natural gas throughput for an individual boiler is equal to or greater than 50 MMT<sup>3</sup>. Based on M. Malik's cursory review of the boilers' throughputs none of the unpermitted boilers' emissions will need to be reported to MAERS.

**Compliance statement:** UM-Flint appears to be in compliance with PTI No.140-13 at this time.

NAME Michelle Luppau

DATE 4/12/21

SUPERVISOR B.M