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

B403264852

FACILITY: General Motors LLC - Pontiac North Campus		**SRN / ID:** B4032
LOCATION: 850 Glenwood, PONTIAC		**DISTRICT:** Warren
CITY: PONTIAC		**COUNTY:** OAKLAND
CONTACT: Rachel Gribas , Environmental Engineer		**ACTIVITY DATE:** 08/12/2022
STAFF: Iranna Konanahalli	**COMPLIANCE STATUS:** Compliance	**SOURCE CLASS:** MAJOR
SUBJECT: ROP CMS scheduled FY 2022 inspection of General Motors Pontiac North Campus ("GM") located at 850 North Glenwood, Mail Code: 483-710-106, Pontiac, Michigan 48340.		
RESOLVED COMPLAINTS:		

General Motors Pontiac North Campus (B4032)
GM Pontiac Engineering Center (GM PEC)
850 North Glenwood
Mail Code: 483-710-106
Pontiac, Michigan 48340-2920

NAICS Code: 541380 Testing Laboratories.

Recently issued ROP: MI-ROP-B4032-2020; Effective Date: April 30, 2020, and Expiration Date: April 30,2025. MI-ROP-B4032-2020 removed GM Pontiac Metal Center (MI-ROP-B4032-2014e Section 1: Stamping SIC 3714 MOTOR VEHICLE PARTS & ACCESSORIES) from the ROP of GM Pontiac Engineering Center (ROP Section 2: Engine Testing SIC 8734 SERVICES-TESTING LABORATORIES) based upon "major source" definition. First two digits of Standard Industrial Classification (SIC) Codes (SIC 3714 & 8734) are different. In addition, as GM PEC had already obtained MACT Synthetic Minor HAPs emissions restrictions (PTI No.122-13), two major MACT conditions were removed from the ROP upon the repeal of Once-in-Always-in [OIAI] Policy: National Emission Standard for Hazardous Air Pollutants for Engine Test Cells/Stands promulgated in 40 CFR Part 63, Subpart PPPPP (NESHAP / Engine Test Cells MACT 5P) and National Emission Standard for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters promulgated in 40 CFR, Part 63, Subpart DDDDD (NESHAP / Boiler MACT 5D). The Engine Test Cells MACT 5P and Boiler MACT 5D removals are based upon PTI No. 198-18 FG-TESTCELLS & FG-RACINGTCS). As a matter of fact, when Wing 3 was permitted (PTI No.122-13), facility-wide HAP/HAPs opt-out limits were added and yet GM had to comply with Test Cells MACT 5P and Major Source Boiler MACT 5D due to OIAI Policy. Also, as GM PEC is not subject to NESHAP / MACT 5P, 110 engine dynamometer test cells (FG-TESTCELLS) have become subject to Compliance Assurance Monitoring (CAM) rule pursuant to 40 CFR Part 64 for four (4) communal Regenerative Thermal Oxidizers (4 RTOs). Exhaust is captured from the engine test cells by the Central Engine Exhaust System (CEES) and transferred to four (4) communal regenerative thermal oxidizers (RTOs) for carbon Monoxide (CO) destruction. Continuous compliance is assured in two ways: (1) by maintaining the average temperature of the RTO above the minimum temperature identified in the most recent stack test, and (2) maintaining the pressure drop of the CEES below -2 inches of water. Maintaining a minimum RTO temperature ensures that the unit meets the required destruction efficiency. A pressure drop in the CEES below -2 inches of water ensures the capture efficiency of the RTO. Each RTO has two thermocouples where temperature is monitored and recorded at least once every 15

minutes. There are 19 pressure transducers within the CEES system that monitor and record the pressure drop at least once every 15 minutes. Number of RTOs running at any given time, depends upon demand (number of the test cell running at that time).

Hydrogen (H2) plant: Per the ROP, an adjacent hydrogen plant shall not supply, GM PEC, greater than 49% of its total hydrogen production based on a 12-month rolling period. This requirement was added to MI-ROP-B4032-2020 under EU-FUELCELLS. Hence, the hydrogen plant is not a part of the ROP. The proposed MI-ROP-B4032-2020a will modify this condition such that the hydrogen plant can supply all hydrogen produced at this site to GM PEC as OneH_2- Pontiac, MI, is not able to find other customers for its hydrogen (H_2). The proposed hydrogen plant will include sixteen (16) hydrogen reformers. The plant is expected to produce approximately 800 kilograms (kg) of hydrogen (H_2) per day. In addition, OneH_2 will be installing a natural gas-fired emergency engine. OneH_2- Pontiac will be installing the plant pursuant to Rule 336.1291.

Table 3 – OneH2 Pontiac Hydrogen Plant Rule 291 Analysis

Rule 702 BACT / PSD (top-down): BACT (Best Available Control Technology) determination for Carbon Monoxide (CO) is equal to the Test Cell NESHAP / MACT 5P. Nitrogen Oxides (NOx) BACT is no control with US EPA emission factor limit in pounds of NOx per MM BTU (MI-ROP-B4032-2014e, FG-TESTCELLS, I.2: 1.38 for SI RICE such as gasoline and 2.2 for CI RICE such as Diesel). CO & VOC (PSD CO BACT = MACT 5P control: 4 RTOs OCE> 96% or DE > 96% with 100% CE) are used as a surrogate for HAPs associated with engine testing, which are all VOCs.

PSD: GM Powertrain (now known as GM PEC) consolidated all its engine testing facilities by moving equipment from other facilities. Net out for PM10 is made enforceable by the requirement to permanently decommission coal fired Boiler No. 5 before installation of test cells. This project (PTI No. 33-04) is a major PSD modification that resulted in significant increases of NOx, CO, and PM10. There was a coal-fired boiler (Boiler No. 5) at the facility that was removed from service in 1995, the emissions of which were used to net out of PSD for PM10. The maximum potential heat input for these test cells is 303.33 MM BTU per hour, and the yearly maximum heat input is 520,000 MM BTU per year with a maximum heat input of 114,400 MM BTU per year from diesel fuel (PTI No. 33-04 and MI-ROP-B4032 -2014e, FG-TESTCELLS, II.1&2).

ROP sections1 & 2: Section 1: General Motors Pontiac Metal Center and Section 2: General Motors Pontiac Powertrain. Metal Center was subject to ROP because it is adjacent to Powertrain. The definition of “major stationary source” requires a tripartite test for determining the geographic extent of a single source. Specifically, a major stationary source is defined as all of the pollutant emitting activities that are (1) located on one or more contiguous or adjacent properties; (2) are under common control of the same person (or persons under common control); and (3) belong to a single major industrial grouping or are supporting the major industrial group (as determined by the Major Group SIC codes (first two digits) in the Standard Industrial Classification Manual). As stated above, based upon SIC code first two digits being different, Metal Center has been removed from the MI-ROP-B4032-2020.

PTI rolled into ROP: PTI Nos. 198-18, 124-16, 122-13, 309-06A, 218-04A, 33-04C, 33-04B, 252-95, 124-84, 62-82A, 671-77.

PTI Applications voided: AQD voided 57 applications.

Once-in-Always-in [OIAI] Policy: According to May 16, 1995, EPA memorandum entitled “Potential to Emit for MACT Standards – Guidance on Timing Issues” from John Seitz,

Director of OAQPS, Major Sources of HAPs on the “first compliance date” are required to comply permanently with the applicable MACT standard to ensure that maximum achievable reductions in toxic emissions are achieved and maintained. In other words, in order not to be a major source, the company should have obtained federally enforceable permit limiting its potential-to-emit (PTE) below major source threshold for HAPs before the first compliance date (timeliness). In addition, Clean Air Act (CAA), as amended, requires all major sources to obtain a Title V (RO) permit

OIAI policy repeal: Effective on February 8, 2018, US EPA Issuance (‘‘Reclassification of Major Sources as Area Sources Under Section 112 of the Clean Air Act’)’ and withdrawal (‘‘Potential to Emit for MACT Standards—Guidance on Timing Issues.’’) of guidance memorandums, Page 5543, Federal Register /Vol. 83, No. 27 /Thursday, February 8, 2018 / Rules and Regulations.

As is explained in the memorandum, the plain language of the definitions of ‘‘major source’’ in CAA section 112(a)(1) and of ‘‘area source’’ in CAA section 112(a)(2) compels the conclusion that a major source becomes an area source at such time that the source takes an enforceable limit on its potential to emit (PTE) hazardous air pollutants (HAP) below the major source thresholds (i.e., 10 tons per year (tpy) of any single HAP or 25 tpy of any combination of HAP). In such circumstances, a source that was previously classified as major, and which so limits its PTE, will no longer be subject either to the major source MACT or other major source requirements that were applicable to it as a major source under CAA section 112. The guidance signed on January 25, 2018, supersedes that which was contained in the May 1995 Seitz Memorandum.

Not subject to: NESHAP/ MACT 5P, 40 CFR Part 63, Subpart PPPPP - National Emission Standards for Hazardous Air Pollutants for Engine Test Cells/Stands, Page 28774, Federal Register / Vol. 68, No. 101 / Tuesday, May 27, 2003 / Rules and Regulations / Final rule. MI-ROP-B4032-2024 also contains MACT Synthetic Minor limits for HAPs. OIAI Policy repeal is under litigation. However, GM has decided to remove major MACT (especially Test Cells MACT 5P & Boiler MACT 5D) conditions from ROP based upon OIAI policy repeal. US EPA has not promulgated Area Source MACT for Engine Test Cells / Stands.

Not Subject to (cold-cleaners): NESHAP/ MACT T, area source National Emission Standards for Hazardous Air Pollutants: Halogenated Solvent Cleaning (40 CFR, Part 63, Subpart T; NESHAP/ MACT T). GM does NOT use the MACT T listed halogenated HAP solvents (>5%w: methylene chloride (CAS No. 75-09-2), perchloroethylene (CAS No. 127-18-4), trichloroethylene (CAS No. 79-01-6), 1,1,1-trichloroethane (CAS No. 71-55-6), carbon tetrachloride (CAS No. 56-23-5), and chloroform (CAS No. 67-66-3)) in the cold-cleaners.

RTOs: PTI No. 33-04B allowed GM to reduce number of regenerative thermal oxidizers (RTOs) from 6 to 4; no other change. The PTI modification (PTI No. 33-04B ➔ PTI No. 33-04C) allowed hydrogen fuel cells (not internal combustion engines) testing (EU-FUELCELLS operate at less than temperature of 1,000°C) to be conducted without RTO control. PTI No.122-13 allowed installation of 19 new research and development (R&D) engine dynamometers, 3 relocated (from an engine testing facility in Wixom, Michigan) racing engine dynamometers and using, except racing engines, existing 4 RTOs. Per 122-13, the three relocated racing engine dynamometers operate uncontrolled; i.e. racing dynos are not using RTOs oxidize CO and VOC. The 19 new R&D engine dynamometers are routed to a manifold where the exhaust joins the exhaust from the existing 88 (per PSD PTI No. 33-04, originally permitted for 128 engine dynamometers) engine dynamometers before

utilizing the four existing RTOs. The custom building management TLC controllers and software determine how many RTOs (2-4: one RTO may be under repairs and maintenance) are running at any given time depending upon demand (VOC / CO laded exhaust air flow rate or number cells operating at that time). The permit (PTI No. 122-13) was approved for only three (3) racing engines and not four (4).

NSPS Dc boilers: Three (3) natural gas fired steam boilers are subject to: NSPS Dc, New Source Performance Standards (NSPS) for Small Industrial-Commercial-Institutional Steam Generating Units (40 CFR, Part 60, Subpart Dc). All boilers have design heat input capacity of 36.8 (>> 10) MM BTU per hour producing maximum 31,050 pounds of steam per hour. All boilers were installed after June 9, 1989: while Boiler Nos. 1 & 2 were installed about May 04, 2010, Boiler No. 3 was installed about July 01, 2014. Only NSPS Dc requirement for pipeline quality natural gas fired boilers (no fuel oil backup) is fuel usage recordkeeping. GM complies with this requirement via annual MAERS submittal.

NSPS Dc Revisions:

1. 72 FR 32759 = Page 32759 Federal Register / Vol. 72, No. 113 / Wednesday, June 13, 2007 / Rules and Regulations / Final Rule – to add compliance alternatives and to revise certain recordkeeping and reporting requirements.
2. 74 FR 5091 = Page 5091 Federal Register / Vol. 74, No. 17 / Wednesday, January 28, 2009 / Rules and Regulations / Final Rule - to correct technical and editorial errors.

The NSPS Dc revisions simplified the natural gas usage recordkeeping. ROP and MAERS natural gas recordkeeping satisfies NSPS Dc.

Not subject to Major Source Boiler MACT 5D (after April 30, 2020 when MACT 5D removed from ROP due to the repeal of OIAI Policy and then Area Source MACT 6J

NCS NESHAP / MACT 6C for GDF: GM PEC is subject to Area NESHAP / MACT 6C, 40 CFR, Part 63, Subpart CCCCCC—National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Dispensing Facilities (GDF). National Emission Standards for Hazardous Air Pollutants for Source Categories: Gasoline Distribution Bulk Terminals, Bulk Plants, and Pipeline Facilities; and Gasoline Dispensing Facilities, Page 1916, Federal Register / Vol. 73, No. 7 / Thursday, January 10, 2008 / Rules and Regulations/ Final rule. Amended at 73 FR 12276, March 7, 2008; 73 FR 35944, June 25, 2008; 76 FR 4181, January 24, 2011. The NESHAP / MACT is for each GDF that is located at an area source. The affected source includes each gasoline cargo tank during the delivery of product to a GDF and also includes each storage tank. AQD has no delegation of these standards and therefore no attempt has been made to evaluate the GDF's compliance with NESHAP / MACT 6C. AQD received **Notification of Compliance Status (NCS)** via letter dated August 15, 2019, for Area Source NESHAP / MACT 6C for GDF. The NCS includes Gasoline Storage Tanks Information, the required test reports. Upon issuance of Synthetic Minor MACT PTI No. 198-18, GM Propulsion has become an Area MACT Source.
Recently (July 7, 2022) performed MACT 6C testing for pressure relief valves for 17 gas tanks. AQD was not involved in in these tests MACT 6C is an Area MACT.
PTI No. 198-18 dated June 20, 2019: This is an administrative permit with a sole purpose of removing Test Cells MACT 5P (Boiler MACT 5D was removed during the ROP renewal (MI-ROP-B4032-2020)) and consolidating two flexible groups. Ninety-one engine dynamometers are currently operated in Wings 1 & 2 of the facility. Prevention of

Significant Deterioration (PSD) review was performed, under PTI No. 33-04, for 128 engine dynamometers, but only, the existing 91 were installed for that project. They are controlled by four regenerative thermal oxidizers (RTOs). In 2014, 19 (R & D) controlled and 3 (racing) uncontrolled test cells were permitted for Wing 3 of the facility. The controlled test cells also route to the same four RTOs as Wings 1 & 2. The Wing 3 controlled test cells (19) are typically for smaller engines because they are for research and development of small components of engines. Once a component of engine works, GM includes it into a full engine, which is tested in Wings 1 & 2. The Wing 3 uncontrolled test cells are for racing engines.
The EU / FG changes are as follows:

4 RTOs

1. Wings 1 and 2: four (4) Communal Regenerative Thermal Oxidizers (4 RTOs) (PTI No. 33-04 & PTI No. 33-04B allowed GM to reduce number of regenerative thermal oxidizers (RTOs) from 6 to 4)
2. Wing 3, R&D: the same 4 RTOs (PTI No.122-13)
3. Wing 3, Racing: uncontrolled (PTI No.122-13)

Of 4, 1 or 2 or 3 (1 of 4 usually on standby) communal RTOs operate based upon the demand (i.e., number of test cells operating).

Contacts:

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2. Ms. Rachel Gribas (Phone: NA; Fax: NA; Cell: 248-828-5929; E-mail: Rachel.Gribas@GM.com; Mail Code: 483-340-141), Environmental Engineer.

3. Charles Kessler (Phone: NA; Fax: NA; Cell: 248-883-2629; E-mail: Charles.Kessler@gm.com; Mail Code: NA), Environmental Engineer. Pontiac Engineering Center | Pontiac Metal Center.

On August 08, 2022, I conducted a level-2 **ROP CMS scheduled FY 2022 inspection** of General Motors Pontiac North Campus / Pontiac Engineering Center (“GM” or “GM PEC”) located at 850 North Glenwood, Pontiac, Michigan 48340-2920. The inspection was conducted to determine compliance with the Federal Clean Air Act; Article II, Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994, PA 451; Michigan Department of Environment, Great Lakes and Energy, Air Quality Division (EGLE-AQD) administrative rules; and ROP.
During the inspection, **Charles Kessler** (Phone: NA; Fax: NA; Cell: 248-883-2629; E-mail: Charles.Kessler@gm.com; Mail Code: NA), Environmental Engineer, Pontiac Engineering Center | Pontiac Metal Center, Global Laboratory Systems, 850 Glenwood Ave., Mail Code: 483-710-106, Pontiac, Michigan 48340, assisted me. **Rachel Gribas** (Phone: NA; Fax: NA; Cell: 248-828-5929; E-mail: Rachel.Gribas@GM.com; Mail Code: 483-340-141), Environmental Engineer, Corporate Support Group, also was present during the tests.

General Motors is a global manufacturer of automobiles (about 10 million vehicles per year) headquartered in Detroit, Michigan. General Motors (GM) Powertrain is (since 2017) known as GM Global Propulsion Systems (8,600 employees). New name reflects that gasoline / diesel reciprocating internal combustion engine (RICE) is not the only propulsion system; alternative and electric systems are tested as well at this facility. Latest name is Pontiac Engineering Center (GM PEC). GM Global Propulsion Systems engine test cell facility was built, in part, to test internal combustion engines for research and development purposes using a wide variety of fuels and test protocols, many mandated by the U.S. EPA. The engines at the facility are fueled by unleaded gasoline, leaded gasoline, diesel, gasohol (E85), ethanol (hardly used in recent past), methanol (almost never used) and other fuels such as compressed natural gas (CNG). GM is deemed to be a “synthetic minor” source concerning HAP emissions because the GM accepted a legally enforceable permit conditions limiting the potential to emit HAPs. GM has removed Major Source MACT conditions of ROP upon its renewal in April 2020.
As of August 2020, Pontiac facility has been renamed: Pontiac Engineering Center.
GM Global Propulsion Systems or Pontiac Engineering Center Global Headquarters consists of two office buildings and an engine and transmission research and development (R&D) facility. The air contaminant emissions are due to the operation of various solvent degreasers (liquid cold-cleaners), maintenance paint /coating booths, natural gas fired boilers, emergency generators, miscellaneous cleaning activities, and numerous engine test cells. Currently, there are nighty-one (91) engine dynamometers on-site in wings 1, 2 and 3. GM installed, in Wing 3, some of 19 new R&D engine dynamometers (not all cells have dynos). The dyno emissions are controlled by four (4) Communal Regenerative Thermal Oxidizers (4 RTOs: not all four RTOs may be running at any given time depending upon demand (number of test cells running)). GM installed three (AQD did not approve fourth engine) racing engine dynamometers. Exhaust from racing engines is NOT connected to 4 RTOs. Auxiliary equipment, such as a natural gas fired boiler, a diesel fired emergency engine, and electric motor coating application, an injector pump spray test, fuel storage tank, electric engine test cells, non-production machining operations and a paint booth, and R&D labs are also present.
Wings 1 & 2 (PTI No. 33-04) were installed during 2005-2008. Wing 3 (PTI No.122-13) was installed during 2013-2015. All Wings (including 19 R&D test cells of Wing 3), except three racing engines, deliver VOC & CO laden exhaust gases to the above mentioned four (4) communal RTOs. Racing engines (3) exhaust gases are not controlled by RTOs. Rupture disk (non-closing differential pressure relief device) is installed at the end each cell’s piping to protect RTOs piping system. Safety rupture disks break open about 2-3 times per year. Pressure builds up if combustion occurs in piping system carrying exhaust gases from test engines; such piping system combustion occurs when engine testing malfunctions for any reason. When broken, rupture disk is replaced promptly. In addition, each cell is equipped with a sprinkler system for fire and safety.
Each of the four RTOs on site has two chambers. When each RTO’s poppet valve changes, the inlet of one RTO chamber closes while its outlet opens, and the inlet of the other chamber opens while its outlet closes. This reverses the airflow. Air travels across the hot ceramic of one chamber, into the RTO combustion chamber, and out across the ceramic of the second chamber, causing that ceramic to heat up. The poppet valve can change at a minimum of every three minutes and a maximum of every five minutes. The timing changes is dynamically depending upon the temperature difference between the inlet and outlet temperatures.
Engine and powertrain testing occurs 24/7/365; all cells may not be running all the time. Four (4) RTOs are connected in parallel. 2, 3 or 4 RTOs can run at any given time depending upon demand (VOC / CO laden exhaust gas flow rate or number of test cells

operating). One of four RTOs may be in maintenance service, repairs, etc. The custom Building Management Control System (PLC and associated software) prevents turning on additional cell if an RTO is not available for that cell.
Wings 1 & 2: 85 test cells. 3 whole room exhaust. 2 pretest rooms. 1 F8 test cell. Total 91 test cells.
Fuel injectors (three benches, one or more fuel injectors per bench) are tested only in Wing 3. In each cell more than one fuel injectors may be tested. Each fuel injector test cell is completely enclosed. Almost all fuel is recycled for testing with insignificant evaporative losses.
Building Management System Software along with PLC controllers manages all test cells and RTOs.

ROP Section 1: Sec1 (pertaining to GM Metal Center) removed from MI-ROP-B4032-2020
NSPS 4I requires:

1. Non-resettable hours-meter. See the readings (Sec 1 & 2).
2. ULSD (15 ppm S) Diesel only. Generally, ULSD is only fuel available in the market for economic reasons.
3. 500 hrs. / yr. for emergency generator: Only testing is performed
4. 100 hrs. / yr. for maintenance and testing: Only testing is performed
5. US EPA certificate: As stated, AQD received US EPA NSPS 4I Certificates for the NSPS 4I engines.
6. Operate in accordance with manufacturer recommendations. A contractor performs semi-annual / annual maintenance, which includes inspection of installation (vibration, structural integrity, etc.), cooling system (radiator / heat exchanger, belts, hoses, antifreeze, etc.) starting system, lubrication system (sample oil and change if necessary, etc.) control panels and generator, fuel system, exhaust system, etc. Replace fuel filters, oil filters, lubricating oil filters, coolant filters, if necessary and dispose of waste oil and filters properly.

PTI Exemption - CI RICE Engines
Fuel usage for Caterpillar Generators is as follows:
1500 kW = 105 gallons per hour diesel (DMC)
1050 kW = 74 gallons per hour diesel
750 kW = 55 gallons per hour diesel
600 kW = 46 gallons per hour diesel
300 kW = 28 gallons per hour diesel

Based upon the above information, assuming 1 MW generator consumes 75 gallons of diesel per hour, knowing 138,000 BTU per gallon of diesel, heat input of 1 MW generator is 10.4 million BTU per hour. Hence, a diesel generator up to 1 MW is exempt from Rule 336.1201 (Permit-to-Install) pursuant to Rule 336.1285(2)(g). It may be noted that some engines convert heat to work more efficiently than others. Recent engine designs have efficiencies up to 40% for heat to shaft work conversion. Converting work to electricity is up to 95% efficient.

RICE MACT 4Z
Emergency generators may be subject to Area Source NESHAP / MACT ZZZZ or 4 Z, Standards of Performance for Stationary Spark Ignition Internal Combustion Engines and National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal

Combustion Engines; New Source Performance Standards for Stationary Internal Combustion Engines / Final rule (Page 6674 Federal Register / Vol. 78, No. 20 / Wednesday, January 30, 2013 / Rules and Regulations / Final rule.). AQD has no delegation of these standards. Compliance with NSPS 4I is deemed compliance with MACT 4Z.
RICE MACT 4Z requirements may be summarized as:

1. Change oil and filter: every 500 hours of operation or annually whichever occurs first.
2. Inspect air cleaner: every 1,000 hours of operation or annually whichever occurs first.
3. Inspect all hoses: every 500 hours of operation or annually whichever occurs first.
4. Operate / maintain engine and control devices according to manufacturer's recommendation
5. Install non-resettable hours meter and maintain records
6. Keep maintenance records
7. NSPS Notification not required

Emergency engines:

1. 100 hours per year for maintenance checks and readiness testing
2. 50 hours per year for non-emergency (non-income generating)
3. No hours limit for genuine emergency

MI-ROP-B4032-2020 Emission Unit Summary (MI-ROP-B4032-2020 revised this table)

Emission Unit ID	Emission Unit Description (Including Process Equipment & Control Device (s))	Installation Date/ Modification Date	Flexible Group ID
EU-COLDCLEANERS	Small parts degreasers. Each has less than 10 ft^2 interface and is exempted from Rule 201 pursuant to Rule 281(2)(h) or Rule 285 (2)(r)(iv). The units are subject to Rule 707.	07/01/1979	FG-COLDCLEANERS
EU-BLDGA-NGGENERATOR	Existing SI generator < 250 HP.	06/12/2006	FG-EXISTEMERGRICEMACT
EU-BLDGA-GENERATOR: Diesel fired emergency generator (compression ignition, 155 HP). The generator has been removed and scrapped. The letter dated September 30, 2020, to Ms. Zhu from Rachel Gribas stated this emission unit EU-BLDGA-GENERATROR has been removed.			
EU-PLT49FIREPUMP#3	Diesel fired fire pump #3 (compression ignition, 300 HP).	08/01/2008	NA
EU-BLDGA-GENERATOR	Diesel fired emergency generator (existing compression ignition, 155 HP).	06/27/2000 (constructed) and 2006 relocated to the site	FG-EXISTEMERGRICEMACT
EU-BLDGA-GENERATOR: Diesel fired emergency generator (compression ignition, 155 HP). The generator has been removed and scrapped. The letter dated September 30, 2020, to Ms. Zhu from Rachel Gribas stated this emission unit EU-BLDGA-GENERATROR has been removed.			

Emission Unit ID	Emission Unit Description (Including Process Equipment & Control Device (s))	Installation Date/ Modification Date	Flexible Group ID
EU-BLDGB-GENERATOR	Diesel fired emergency generator (existing compression ignition, 536 HP).	01/13/2002	FG-EXISTEMERGRICEMACT
EU-BLDGC-GENERATOR	Diesel fired emergency generator (existing compression ignition, 167.5 HP).	12/07/2005	FG-EXISTEMERGRICEMACT
EU-BLDGC-GENERATOR-COMPUTERRM	Diesel fired emergency generator (compression ignition, 2680 HP) subject to 40 CFR 60 Subpart IIII.	02/01/2006	NA
EU-BLDGD-GENERATOR	Diesel fired emergency generator (existing compression ignition, 800 HP).	09/01/2001 (constructed) and 8/2007 relocated to the site	FG-EXISTEMERGRICEMACT
EU-BLDGBFIREPUMP	Diesel fired fire pump (existing compression ignition, 170.2 HP).	06/01/2002	FG-EXISTEMERGRICEMACT
EU-TANKS(1-25)	Underground fuel storage tanks, consisting of 11 tanks at 15,000-gallon capacity and 14 tank compartments at 6,000-gallon capacity.	04/10/2008	FG-TANKS
EU-EMOTOR-BOOTH	Coating booth is for electric motor development. The coating process emits air contaminants and is exempt from the requirements of Rule 201 pursuant to Rules 278 and Rule 290.	NA	FG-RULE290
EU-EMOTOR-BOOTH: Not installed yet.			
EU-WING3-ERGGEN	Up to 1000 hp Diesel fired emergency generator (compression ignition) subject to 40 CFR 60 Subpart IIII.	Installed May 2020	NA
EU-CEP-BOILER#1	40 MMBTU/HR Johnston boiler with oxygen trim system (Natural gas fired).	01/01/2011	FG-BOILERS
EU-CEP-BOILER#2	40 MMBTU/HR Johnston boiler with oxygen trim system (Natural gas fired).	01/01/2011	FG-BOILERS
EU-CEP-BOILER#3	40 MMBTU/HR Johnston boiler with oxygen trim system (Natural gas fired).	12/18/2014	FG-BOILERS
EU3RDWINGR&DTC (1-18)	Engine dynamometer test cell used for development and testing of internal combustion engines. The engine size will vary, up to 750 horsepower. The engines tested will be fueled by diesel and the following	12/8/2016	FG-TESTCELLS

Emission Unit ID	Emission Unit Description (Including Process Equipment & Control Device (s))	Installation Date/ Modification Date	Flexible Group ID
	spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, ethanol, natural gas, methanol, propane, and hydrogen. The exhaust will be controlled by four communal regenerative thermal oxidizers. These four oxidizers control the other engine dynamometers in FG-3RDWINGR&DTCS and the engine dynamometers in EU-TESTCELLS (1-91).		
EU-FUELCELLCOATER	Coating process which is associated with fuel cell development emits air contaminants and is exempt from the requirements of Rule 201 pursuant to Rules 278 and Rule 287(2)(c).	2015	FG-287(2)(c)
EU-SEALERS	Application of miscellaneous sealers throughout the R&D process.	2008	FG-287(2)(c)
EU-FUELSTORAGE	Multi-compartment fuel storage tank with 2 tank compartments at 2,000-gallon compacity and 2 tank compartments at 1,000-gallon compacity,	05/2015	FG-TANKS
EU-TESTCELLS (1-91)	91 engine test cells with a total heat input capacity of 303.33 MMBtu/hr; using diesel, gasoline, ethanol, methanol, natural gas, propane, liquefied petroleum gas, and hydrogen fuels; internal combustion engines are controlled by four regenerative thermal oxidizers (RTOs) fired by natural gas.	2009, 05/19/16	FG-TESTCELLS
EU-FUELCELLS	Testing of hydrogen fuel cells and not internal combustion engines. No fuel reformer may be used for the hydrogen fuel cells.	05/19/16	NA
EU-INJSPRAYTSTS	Fuel spray tests chambers for injector pump.	12/2015 (modified 5/2016)	FG-RULE290
EU3RDWINGR&DTCRM	Radiometric engine test cell and laboratory for the development and testing of internal combustion	2014	FG-TESTCELLS

Emission Unit ID	Emission Unit Description (Including Process Equipment & Control Device (s))	Installation Date/ Modification Date	Flexible Group ID
	engines. The engine size will vary up to 750 horsepower. The radiometric test cell will utilize special radioactive materials that are added to the engine oil. The exhaust will be controlled by four communal regenerative thermal oxidizers. These four oxidizers control all of the internal combustion engine dynamometers in Wings 1, 2, & 3 of FG-TESTCELLS.		
EU-RACINGTC1	Engine dynamometer test cell used for the testing of internal combustion high performance engines for automotive motor vehicles. The engine size will vary, up to 1,600 horsepower. The engines tested will be fueled by diesel and the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, leaded gasoline, ethanol, natural gas, methanol and propane. Hydrogen will be used as a fuel for fuel cell testing	03/03/2016	FG-RACINGTCS
EU-RACINGTC2	Engine dynamometer test cell used for the testing of internal combustion high performance engines for automotive motor vehicles. The engine size will vary, up to 1,600 horsepower. The engines tested will be fueled by diesel and the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, leaded gasoline, ethanol, natural gas, methanol and propane. Hydrogen will be used as a fuel for fuel cell testing.	03/03/2016	FG-RACINGTCS
EU-RACINGTC3	Engine dynamometer test cell used for the testing of internal combustion high performance engines for automotive motor vehicles. The engine size will vary, up to 1,600 horsepower. The	03/03/2016	FG-RACINGTCS

Emission Unit ID	Emission Unit Description (Including Process Equipment & Control Device (s))	Installation Date/ Modification Date	Flexible Group ID
	engines tested will be fueled by diesel and the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, leaded gasoline, ethanol, natural gas, methanol and propane. Hydrogen will be used as a fuel for fuel cell testing.		

MI-ROP-B4032-2020, Source-wide Synthetic Minor HAP / MACT limits
MI-ROP-B4032-2020, source-wide HAP emissions are: **Grand Total** = **10.56** tpy HAPs in CY 2017, **3.18** tpy HAPs in CY 2019, **2.7497** tpy HAPs in CY 2021 (MI-ROP-B4032-2020, SOURCE-WIDE, I. 2 & 4 limits: 2. < 10 tpy Each Individual HAP and 4. < 25 tpy Aggregate HAPs). GM is keeping the required records and performing necessary calculations based upon emission factors and materials usage (MI-ROP-B4032-2020, SOURCE-WIDE, VI.1-3: the calculations, HAP info).
GM PEC is submitting routinely Semiannual Deviations (Semi1 (Jan-Jun) & Semi2 (Jul-Dec)) and Annual Certification (Jan-Dec) (MI-ROP-B4032-2020, SOURCE-WIDE, VII.1-3: prompt reporting of deviations, semiannual reporting of monitoring and deviations and annual certification of compliance)

Capture Efficiency (CE = 99.78% ≈ 100% CE) for 4 RTOs
The same CE values are okay for MI-ROP-B4032-2020.

In the MI-ROP-B4032-2014 (MI-ROP-B4032-2014e, Appendix 2.2 & FG-TESTCELLMACT, III), Schedule of Compliance concerning 100% capture efficiency Permanent Total Enclosure (PTE) according to 40 CFR 63.9322(a) is present because GM did not meet Permanent Total Enclosure (PTE) requirements per 40 CFR 63.9322(a). MI-ROP-B4032-2020 does not have Schedule of Compliance (MI-ROP-B4032-2020, Appendix 2). GM received an approval from US EPA for the site-specific alternative method for determining capture efficiency per §63.9322(d) of 40 CFR Part 63 Subpart PPPPP – National Emission Standards for Hazardous Air Pollutants for Engine Test Cells/Stands. Air Quality Division (MDEQ-AQD-TPU: Tom Maza) approved the alternative method in a letter dated April 18, 2017. As a response to GM's letter dated December 05, 2016, on January 04, 2017, US EPA (Mr. Steffan M. Johnson, US EAP Measurement Technology Group Leader) approved the modifications to CE testing procedures (CO instead of THC, representative engine under representative operating conditions, 3-hour testing, etc.).
On May 10, 2017, BT Environmental Consulting, Inc. (BTEC, Project No. 17-5011.01, June 21, 2017) conducted carbon monoxide (CO) capture efficiency (CE) test on one representative test cell (D301 test cell exhaust) in Wing 3. US EPA Reference Methods 1-4, 10 and 19 were used.
BTEC reported capture efficiency (CE %) numbers:

1. 99.53% using exhaust only numbers
2. 99.78% (≈ 100% CE) accounting for ambient carbon monoxide (CO)

Stack tests

May 9, 2015, PM10 and NOx stack test

In May 2015, GM conducted stack tests to determine, or verify emission factors for, nitrogen (NOx) and particulate matter less than 10 microns (PM10) under two operating conditions (diesel and gasoline) on two RTOs.

On May 9, 2015, BT Environmental Consulting, Inc. (BTEC, Project No. Project No. 15-4705.00, June 9, 2015) conducted stack tests for nitrogen oxides (NOx) and PM10.

This emissions test program included evaluating NOx concentrations and emission rates from the inlet and outlet of two RTO units simultaneously, and evaluation of PM10 from the outlet of the same RTO units. Emissions from engines running on gasoline were routed through RTO 1, and emissions from engines running on diesel were routed through RTO 3.

BTEC reported NOx and PM10 emission results:

1. RTO 1 (gasoline), pounds per MM BTU: Inlet NOx = 0.20, Outlet NOx = 0.27 and Outlet PM10 = 0.008
2. RTO 3 (diesel), pounds per MM BTU: Inlet NOx = 0.13, Outlet NOx = 0.16 and Outlet PM10 = 0.011

UA EPA Reference Methods 1-5, 7E, and 202 were used. GM conducted stack tests for NOx emission factors for gasoline & diesel in May 2015 (MI-ROP-B4032-2014e, FG-TESTCELLS, V.1-3). The NOx and PM10 emissions factors comply with the limits (MI-ROP -B4032-2014e, FG-TESTCELLS, I.2, FG-RACINGTCS, I.3&4, FG-RACINGTCS, 3&4 limit: 1.38 for gasoline and 2.2 for diesel, respectively, pounds of NOx per MM BTU). There is only annual emission limit for PM10 (MI-ROP-B4032-2014e, FGTESTCELLS, I.6 limit: 29.5 tons of PM10 per year).

July 2016 FG-RACINGTCS stack test

In July 2016 GM conducted stack tests to verify nitrogen oxide (NOx) emission factors for gasoline (MI-ROP-B4032-2014b, FG-RACINGTCS, V.1). Ms. Joyce Zhu of AQD observed the stack test. AQD Technical Programs Unit (AQD-TPU) received the Test Protocol on May 30, 2016. AQD-TPU reviewed and approved the test protocol on June 27, 2016, to test the one dynamometer that is used to test gasoline race engines. Nitrogen Oxides stack testing was necessary from a minimum of one representative dynamometer (Chevrolet V8, unleaded gasoline with 20% ethanol, 25 gallons per hour.) per FG-RACINGTCS, V.1. Test Cell B was used for the stack test.

On July 26, 2016, BT Environmental Consulting, Inc. (BTEC, Project No. Project No. 16-4867.00, September 19, 2016) conducted stack tests for nitrogen oxides (NOx) and oxygen (O2) from high performance engines. Testing of the dynamometer consisted of triplicate 60-minute test runs.

BTEC reported NOx emission results for one representative dynamometer (Chevrolet V8):

1. 3.18 pounds of NOx per hour (MI-ROP-B4032-2014e, FG-3RDWINGR&DTCS, I.2 limit: 24.5 pounds per hour combined for dynos of FG-3RDWINGR&DTCS and FG-RACINGTCS, I.2: 73.9 pounds per hour combined for dynos of FG-RACINGTCS)
2. 1.15 pounds of NOx per MM BTU (MI-ROP-B4032-2014e, FG-TESTCELL, I.2 & FG-3RDWINGR&DTCS, I.4 limit: 1.38 pounds of NOx per MM BTU for spark-ignited engine dynos of FG-3RDWINGR&DTCS and FG-RACINGTCS, I.4 limit: 1.38 pounds of NOx per MM BTU for spark-ignited engine dynos of FG-RACINGTCS)
3. 0.13 pounds of NOx per gallon above mentioned gasoline fuel (MI-ROP-B4032-2014e, FG-TESTCELLS, FG-3RDWINGR&DTCS, I and FG-RACINGTCS, I limit: NULL for gallon gasoline).

USEPA Reference Methods 3A and 7E were used.

May 2017 RTO CO DE stack test
In May 2017, GM conducted stack tests to determine destruction efficiency (DE) test for the regenerative thermal oxidizers (4 RTOs). Air Quality Division (AQD-TPU) received the proposed test plan on March 31, 2017. AQD-TPU (Tom Maza) approved the test plan via the letter dated May 11, 2017. RTO Destruction Efficiency (DE) testing was conducted in October of 2015 as well when Wings 1 and 2 were operating but before Wing 3 was operational. Wing 3's initial startup occurred in December of 2016. GM expected the flow rate to regenerative thermal oxidizers (RTOs) to increase 4-10% with Wing 3 in operation, according to Mr. Caltrider. According to §63.9321(a)(2), performance tests must be conducted "at a representative flow rate". GM re-tested because the previous flow rate no longer was representative. May 2017 RTO DE test, therefore, supersedes the previous test (October 2015).
US EPA Reference Methods 1-4 and 10 (CO) were used. A cyclonic flow check was performed at each sampling location.
On May 16 and 17, 2017, BT Environmental Consulting, Inc. (BTEC, Project No. 17-5010.00, June 21, 2017) conducted stack tests for RTO destruction efficiencies for carbon monoxide (CO). BTEC reported carbon monoxide (CO) destruction efficiencies (DE) of **99.0%** for RTO1 (**1.38** pounds of CO per hour, corrected as per USEPA RM 7E), **98.6%** for RTO2 (**1.76** pounds of CO per hour, corrected as per USEPA RM 7E), **98.1%** for RTO3 (**1.23** pounds of CO per hour, corrected as per USEPA RM 7E) and **98.2%** for RTO4 (**1.67** pounds of CO per hour, corrected as per USEPA RM 7E).
The previous destruction efficiency testing (October of 2015) established an RTO operating temperature limit of > 1575 ºF. GM's previous temperature set point was 1591 ºF to ensure the 3-hour average combustion temperature was maintained above the temperature limit of 1575 ºF. For May 2017 test, GM originally began testing at a temperature set point of 1535 ºF. However, because initial destruction efficiency results looked like the RTOs may not achieve 96% overall emissions reductions at this temperature of 1535 ºF, the facility raised the temperature set point back to 1575 ºF for the remainder of testing. Therefore, **RTO operating limit is > 1575 ºF** for these CO destructions (99.0% for RTO1, 98.6% for RTO2, 98.1% for RTO3 and 98.2% for RTO4) to be achieved.

May 2017 RTO DE test efficiencies (RTO1 DE = 99.0%, RTO2 DE = 98.6%, RTO3 DE = 98.1% and for RTO4 DE = 98.2%) meet or exceed NESHAP / MACT 5P, 40 CFR 63.9300 (MI-ROP-B4032-2014e, FG-TESTCELLMACT, I.1 limit: Carbon Monoxide (CO) or Total Hydrocarbons (THC) reduction efficiency (DE * CE), DE * CE > 96% or 20 ppmvd CO, dry gas basis, corrected to 15% O2 content).
It may be noted that the RTO DEs must incorporate Capture Efficiency (CE) of 99.78% (adjusted for ambient CO) for overall control efficiencies (OCE). For example, **RTO3 OCE = 0.981 * 0.9978 = 0.9788 = 97.88% > 96%** (MI-ROP-B4032-2014e, FG-TESTCELLMACT, I.1 limit: Carbon Monoxide (CO) or Total Hydrocarbons (THC) reduction efficiency, CE * DE > 96% or 20 ppmvd CO, dry gas basis, corrected to 15% O2 content). Capture efficiency is 99.78% ≈ 100% CE.

June 12, 2019, NOx (MI-ROP-B4032-2014e EU-RACINGTC2)
About Jul 31, 2019, AQD received the EU-RACINGTC2 (Cell2) NOx test results. The test was conducted, on June 12, 2019, by Montrose Air Quality Services, LLC (248-548-8070) of Royal Oak (Test Plan: 049AS-585630 dated May 2, 2019 and Document Number: M049AS-585630-RT-52RO Document Date: July 26, 2019). The results summary is as follows:

1. Test Date: June 12, 2019
2. Sampling Location: combined exhaust ducts
3. Engine Dynamometer Fuel Flow (gram/second): 19.81
4. Combined Nitrogen Oxides Emissions (lb/hr) (as N02): 4.22
5. Permit Limit - Nitrogen Oxides Emissions (lb/hr) (as NO2): 73.90 (MI-ROP-B4032-2014e EU-RACINGTC, I.2)

Within 180 days after commencement of trial operation of the racing dynamometers, the permittee shall verify NOx emission rates in terms of pph from a minimum of one representative dynamometer of FG-RACINGTCS. (MI-ROP-B4032-2014e EU-RACINGTC, V.1).
US EPA Reference Methods 3A, 7E & 19 were used. Racing engine emissions are uncontrolled. On May 2019, AQD (Ms. Regina Angellotti) approved the test plant for Corvette C7R engine (V8 5.5 L, 525 HP) and running a track lap test pattern.

June 04, 2020, NOx (MI-ROP-B4032-2020, FG-RACINGTCS (Diesel Engine (E104)))
About Jul 31, 2020, AQD received the EU-RACINGTC2 E104 NOx Emission Factor test for one Diesel Engine Dyno via FedEx 8142-4209-8525. The test was conducted, on June 4, 2020, by Montrose Air Quality Services, LLC (248-548-8070) of Royal Oak (Test Plan: NA and Document Number: M049AS-711992-RT-425 Document Date: J July 31, 2020; the report states sampling date as June 6, but the correct sampling date is June 04, 2020). The diesel engine emission factor test plan was submitted via February 26, 2020, letter (FedEx 8064-8103-6830) from Ms. Bethany Gunnels of GM PEC. Due to COVID-19 shutdown EGLE-AQD granted an enforcement discretion for the test deadline. The result reported is 0.64 pounds of NOx per MM BTU diesel fuel (59.1 ppmvd) for Diesel Engine E104 (MI-ROP -B4032-2014e or MI-ROP-B4032-2020, FG-RACINGTCS, I.3 limit: 2.20 pounds of NOx per MM BTU diesel fuel). 5.43 pounds of Diesel during 61.3-minute test were used. US EPA Reference Methods 3A (O2 & CO2) and 7E (NOx) were used. EPA Method 7E is an instrumental test method used to continuously measure emissions of NOx as NO2. EPA Method 19 was used to calculate emissions in pounds per MMBtu.
Ultimate Analysis (Diesel) (Dry):

1. Percent Hydrogen (%H): 13.12
2. Percent Carbon (%C): 86.88
3. Percent Sulfur (%S): **0.00034 (3.4 ppm S < 15 ppm S of ULSD)**
4. Percent Oxygen (%O): 0.05
5. Gross Caloric Value (GCV) (dry) (BTU/lb): 19,632

Within 180 days after burning diesel fuel in the racing dynamometers, the permittee shall verify the NOx emission factor for **diesel** in terms of lb/MMBTU from a minimum of one representative dynamometer of FGRACINGTCS (MI-ROP-B4032-2020, FG-RACINGTCS, VI.2: NOx emission factor for diesel)

Mark Dziadosz of TPU-AQD performed a quality assurance review of the report. The air emissions test report was and received by the Air Quality Division's (AQD) Technical Programs Unit on August 5, 2020. Nitrogen oxide (NOx) emission testing was conducted on Diesel Engine E104. The emission testing was conducted as a requirement of MI-ROP-B4032-2020.

GM Pontiac Engine E104 Data:

Run 1 NOx: 0.63. Run 2 NOx: 0.62. Run 3 NOx: 0.70. Avg. NOx: 0.65. Limit Unit Limit: 2.2. All in pounds per MMBtu.

Testing for NOx was conducted utilizing the United States Environmental Protection Agency (USEPA) Methods 1, 3A, and 7E via three 60-minute runs. No problems were reported for the tests on Engine E104. The sampling and analytical methods in the report (Test Plan: NA and Document Number: M049AS-711992-RT-425 Document Date: July 31, 2020; the report states sampling date as June 6, but the correct sampling date is June 04, 2020) satisfy the requirements of the method.

May 2015 test for FG-TESTCELLS still valid and representative
AQD received the March 25, 2020, letter from Mr. Holly Myers, Operations Director, claiming previous emission factor test report, which was completed in May 2015 for FG-TESTCELLS be considered by EGLE as still valid and representative of the NOx and PM testing that is required by section V.1 of PTI 198-18. The overall engine testing program at PEC has not changed since May 2015; PEC continues to test internal combustion engines for research and development purposes using a wide variety of fuels and test protocols mandated by the US EPA. The variety of fuels include varieties of gasoline and diesel fuels. Subject: Request letter dated March 25, 2020, by Holly Myers, Operations Director, for acceptance of May 2015 FG-TESTCELLS tests remain Valid & Representative Emission Factor to satisfy PTI No.198-18 dated June 20, 2019, FG-TESTCELLS, V.1. testing.

Re: Permit Number MI-ROP-B4032-2014e / PTI No.198-18, FG-TESTCELLS, V.1 CO, NOx and PM10 emission rates. BTEC, Inc. Project No. 15-4705.00 dated June 9, 2015, sampled on May 9, 2015.

Emission limits: NOx ≤ 1.38 lb/MMBTU for spark-ignited (gasoline) fuels, and 2.2 lb/MMBTU for diesel (prior to the RTOs of Wings 1, 2, & 3 of FG-TESTCELLS); CO ≤ 0.96 lb/MMBTU (Wings 1 & 2 of FG-TESTCELLS; note: CO EF is not a part of this request but a part of destruction efficiency (DE) tests); PM10 ≤ 29.5 tpy (Wings 1 & 2 of FG-TESTCELLS; note: PM10 EF for gasoline and diesel engines is to be used for annual emission calculations *visa-a-vis* default EF values 0.048 lb PM10/ MMBTU for gasoline & 0.31 lb PM10/ MMBTU for diesel)

Contacts: Ms. Bethany Gunnels (Cell: 248-520-2396; E-mail: Bethany.Gunnels@gm.com), Environmental Engineer, General Motors LLC, Pontiac Global Propulsion Systems, 850 Glenwood, Mail Code: 483-710-106, Pontiac, Michigan 48340; Ms. Jessica Alderton (cell: 586-863-8490; E-mail: jessica.alderton@gm.com), P.E., Sr. Environmental Project Engineer, Sustainable Workplaces - EcoSystems Services: Strategic Environmental Solutions, WTC VEC East, 30400 Van Dyke Ave., Warren, MI, 48093

Mr. Holly Myers, Operations Director, GM Pontiac Engineering Center (PEC), requested in his letter dated March 25, 2020, that the May 2015 stack test (BTEC, Inc. Project No. 15-4705.00 dated June 9, 2015, sampled on May 9, 2015) for FG-TESTCELLS be considered by EGLE as still valid and representative of the NOx and PM testing. It may be noted that carbon monoxide (CO) emission factor testing is not a part of this request but a part of destruction efficiency (DE ≥ 96 percent) testing.

AQD approves this request subject to the following conditions:

1. Your statements in the request letter are true and valid;

2. GM PEC shall promptly test within 180 days of making any changes in operating conditions which necessitate reevaluation of the emission rate tests.

AQD approves the March 25, 2020, letter request. E-mail response to Alderton & Gunnels. Letter response to Myers

October 29 - 30, 2019, FG-TESTCELLS, NOx testing
MI-ROP-B4032-2020, FG-TESTCELLS, V.2: The permittee shall verify NOx emission rates in terms of pph from a minimum of one representative dynamometer of Wing 3 of FG-TESTCELLS, the testing shall be conducted once every three years.
About December 17, 2019, AQD received the MI-ROP-B4032-2020, FG-TESTCELLS, Wing 3 NOx (while using representative gasoline and diesel) test report. The test protocol was received on September 30, 2019, and approved on October 9, 2019. The test was conducted, on October 29 - 30, 2019, by Montrose Air Quality Services, LLC (248-548-8070) of Royal Oak (Test Plan: M049AS-652645-PP-52 and Document Number: M049AS-652645-RT-209R0; Document Date: December 13, 2019; Sampling date: October 29-30, 2019). Wing 3 Engine Dynamometers **D301** (October 29, 2019, Gasoline) and **D302 (**October 30; 2019, Diesel) were used for testing. 1.5-liter (D301) and 6.6-liter (D302) gasoline and diesel (ULSD <15 ppm S) engines, respectively, were used. Sampling was performed the FG-TESTCELL D301 & D302 Exhaust Ducts to determine of nitrogen oxides (NOx as NO2) emissions during representative operations. US EPA Reference Methods 3A, 7E, and 19 were utilized.
Montrose reported the results as follows:

Wing 3	Wing 3 Engine Dynamometer D301 Exhaust duct	Wing 3 Engine Dynamometer D302 Exhaust duct
Test Date	October 29; 2019	October 30; 2019
Fuel	Gasoline	Diesel (ULSD 15 ppm S)
Engine Dynamometer Fuel Flow (grams per sec)	0.608	1.706
Engine Dynamometer Load (MM Btu/hr)	0.092	0.264
Nitrogen Oxides (NOx) Emissions (lb/hr) (as N02) per Dynamometer	0.16	0.20
Nitrogen Oxides Concentration (ppmvd)	1,559	296
Wing 3 FG-TESTCELLS Annual Average Fuel Rate (MMB per hour)	0.15	0.08
Scaled-up Wing 3 FG-TESTCELLS NOx Emissions (lb/hr)(as N02)	0.27	0.06
Combined Wing 3 FG-TESTCELLS NOx Emissions (lb/hr)(as N02)	0.33	
PTI No. 198-18 limit, NOx Emissions (lb/hr)(as N02)	24.5	
Compliance		

Ms. Lindsey Wells of TPU-AQD conducted a quality assurance review of the report via INTEROFFICE COMMUNICATION dated March 30, 2020. Ms. Wells agreed with the above reported results. TPU-AQD confirmed this computation with the consultant – the results in the report are based upon the correct calculation. Ms. Wells (517-282-2345, WellsL8@Michigan.gov) states that the reported results are acceptable to the AQD and can be used to determine compliance with MI-ROP-B4032-2020, FG-TESTCELLS and associated PTI No. 198-18.
MI-ROP-B4032-2020, FG-TESTCELLS, I.1 limit:

Pollutant	Limit	Time Period / Operating Scenario	Equipment	Monitoring / Testing Method	Underlying Applicable Requirements
1. NO_x	24.5 pph^2	Hourly	Combined for all dynamometers in Wing 3 of FG-TESTCELLS	SC V.2	**40 CFR 52.21(c) & (d)**

April 2022 RTO CO DE stack test (April 11, 12, 13, and 28, 2022)
Via the letter dated June 20, 2022, to Joyce Zhu from Charles Kessler of GM PEC, AQD received the April 2022 test results for Destruction Efficiency (DE) Test Results for four communal RTOs. The attached was a certification (06/20/2022) by Responsible Official Carrie Guynn (248-320-4473), Operations Director PPO-GPS.
During April 11, 12, 13, and 28, 2022, the sampling was conducted by Montrose Air Quality Services, LLC of Elk Grove Village, IL 60007 (Document Number: MW023AS-014898-RT-1360 & Submittal Date: June 16, 2022) concerning the RTO Nos. 1, 2, 3, and 4. The April 2022 (91 engine test cells in Wings 1 and 2 and 11 firing test cells in Wing 3) test results of Carbon Monoxide (CO) are listed below:

1. **RTO 1**: 32.6 ppmvd, 3.0 pounds of CO per hour & 97.9 > 96 percent destruction efficiency (% DE)
2. **RTO 2**: 39.3 ppmvd, 3.4 pounds of CO per hour & 97.5 > 96 percent destruction efficiency (% DE) at 1530-1590 °F.
3. **RTO 3**: 39.2 ppmvd, 3.7 pounds of CO per hour & 97.8 > 96 percent destruction efficiency (% DE) at 1530-1590 °F.
4. **RTO 4**: 55.0 ppmvd, 5.0 pounds of CO per hour & 98.2 > 96 percent destruction efficiency (% DE) at 1530-1590 °F.

Each test run was for 60 minutes. Each RTO is rated at 27,500 scfm and is designed to destroy VOC at greater than 96% destruction efficiency as calculated by mass. US EPA Reference Method 10 (Determination of carbon monoxide emissions from stationary sources using an Instrumental Analyzer Procedure) was used. For RTOs 1 and 2, the inlet flow could not be measured. Therefore, according to past testing, the inlet flows were assumed to be 95% of the outlet flows to determine DE of CO.
As stated above, the tested values of DE > 96% satisfy the permit requirements (MI-ROP-B4032-2020, FG-TESTCELLS, IV.1: a minimum carbon monoxide (CO) destruction efficiency of 96 percent (by weight) or a maximum CO outlet concentration of 20 ppmvd corrected to 15 percent O_2 concentration)
Two (2) of four (4) RTOs were set into standby mode during each RTO destruction efficiency test to represent a worst-case condition since the RTO retention time will be lower while running all exhaust.

May 17 & 18, 2022, NO_x FG-TESTCELLS & Wing 3 tests

Via the letter dated April 14, 2022, to Joyce Zhu from Charles Kessler of GM PEC, AQD received the test plan for OXIDES OF NITROGEN TESTING for FG-TESTCELLS (Montrose Air Quality Services, LLC, Document Number: MW023-AS-015629-PP-446 Proposed Test Dates: May 17 and 18, 2022, Submittal Date: April 14, 2022). The emissions test program included NOx emission rates and concentrations of two engine dynamometers, located in Wing 3, operating under a single fuel condition each. One engine will be tested while running on gasoline. It may be noted that Wing 3 no longer burns diesel fuel so that will not be tested at this May 2022 testing. Wing 3 test cell operations consist of nine firing engine test cells that perform various development program testing. Test cell utilization varies with testing demand.

Regina Angellotti of AQD-TPU approved the test plan for May 17-18, testing of NOX for one representative engine test cell in each of FG-RACINGTCS and FG-TESTCELLS using a representative engine type and test pattern. NO_x and oxygen (O_2) testing to be conducted in accordance with US EPA reference methods 3A and 7E via three 60-minute test runs per test cell. NOx emission rates to be determined in accordance with US EPA reference method 19.

AQD received the May 17-18, 2022 test results for Nitrogen Oxides (NOx) for RACING ENGINE AND WING 3 GAS ENGINE. During July 17-18, 2022, the sampling was conducted by Montrose Air Quality Services, LLC of Elk Grove Village, IL 60007 (Document Number: MW023AS-015629-RT-1395 & Submittal Date: July 14, 2022) concerning NO_x emission rate from the Racing (EU-RACINGTC2) and Wing 3 Gas Engines (D301). US EPA Reference Method 7E and 19 were used (Test Protocol Nos. MW023AS-015629-PP-439 dated April 14, 2022 and MW023AS-015629-PP-446 date April 14, 2022). Montrose reported NO_x as NO_2 as follows:

May 17, 2022, RACE ENGINE: **4.23** pounds of NO_x as NO_2 per hour with 19.096 grams per second Engine Dynamometer Fuel Flow. 18,663 BTU per pound fuel. 1,184.4 ppmvd NO_X. 1.49 pounds of NO_X per MM BTU. 4.23 pounds per hour emission rate complies with the permit limit (MI-ROP-B4032-2020, FG-RACINGTCS (EU-RACINGTC1, EU-RACINGTC2, EU-RACINGTC3), I.2 limit: 73.9 pph). However, **1.49** pounds of NO_X per MM BTU is **NOT** in compliance with the permit limit (MI-ROP-B4032-2020, FG-RACINGTCS (EU-RACINGTC1, EU-RACINGTC2, EU-RACINGTC3), I.4 limit: **1.38** pounds per MM BTU for spark ignited fuels). 1.38 pounds per MM BTU is default emission factor for fuels other than diesel. The tests were conducted per MI-ROP-B4032-2020, FG-RACINGTCS (EU-RACINGTC1, EU-RACINGTC2, EU-RACINGTC3), V.1: verify NOx emission rates in terms of pph from a minimum of one representative dynamometer of FG-RACINGTCS).

May 18, 2022, WING 3 GAS ENGINE: **0.15** pounds of NO_x as NO_2 per hour with 0.649grams per second Engine Dynamometer Fuel Flow. Scaled-Up Wing 3 Nitrogen Oxides Emissions (lb/hr) (as NO2) is 0.18. The scaled-up lb/hr NOx (as NO2) emissions for D301 utilizing gasoline is calculated using the facility provided Annual Average Fuel Rate (MMBtu/hr) and the calculated Fd-Based NOx emissions (as NO_2). 19,208 BTU per pound fuel. 1,356.2 ppmvd NO_X. 1.53 pounds of NO_X per MM BTU. The tests were conducted per MI-ROP-B4032-2020, FG-TESTCELLS, V.2: verify NOx emission rates in terms of pph from a minimum of one representative dynamometer of Wing 3 of FG-TESTCELLS. 0.15 pounds of NOx as NO2 per hour 4 emission rate complies with the permit limit (MI-ROP-B4032-2020, Combined for all dynamometers in Wing 3 of FG-TESTCELLS, I.1 limit: 24.5 pph). However, **1.53** pounds of NO_X per MM BTU is **NOT** in compliance with the permit limit (MI-

ROP-B4032-2020, FG-TESTCELLS, I.4 limit: **1.38** pounds per MM BTU for spark ignited fuels). 1.38 pounds per MM BTU is default emission factor for fuels other than diesel. Per MM BTU heat input emissions rate is an approximate representation.

MI-ROP-B4032-2020, EU-BLDGC-GENERATOR-COMPUTERRM
Diesel fired emergency generator (compression ignition, 2680 HP) subject to 40 CFR 60 Subpart IIII.

Per the letter dated May 18, 2021, from Rachel Gribas of GM, EU-BLDGC-GENERATOR-COMPUTERRM, CI (Diesel) RICE Engine has been decommissioned in place as of April 21, 2021. **M-001 Rule 215 change Notification** was sent (RO Holly Myers signed on 05/18/2021)
NSPS 4I Certificate: Manufactured July 2006. Engine Model Number: 4000 MDEC. 2973 HP Diesel Engine. Engine emissions meet the limits in Table 1 and compliance requirements in 40 CFR 60.4211.

Only ULSD (15 ppm Sulfur) is used (MI-ROP-B4032-2020, EU-BLDGC-GENERATOR-COMPUTERRM, II.1-2: only 0.0015 % S Diesel) hinge or spring hinge.

EU-BLDGC-GENERATOR-COMPUTER (LOADING DOCK): Generator Make/Model: MTU/ 2000MDEC. Serial No. 2134471. Engine Model: DETROIT/ 4000MDEC. Engine Serial No. 5272002641. Mfg: July 2006. 2,000 kW = 2.0 MW. Hours meter reading: 275 hrs. on Dec 30, 2016, 290 hrs on July 1, 2019.

MI-ROP-B4032-2020, EU-PLT49FIREPUMP#3
300 horsepower (HP) emergency diesel fired fire pump with an installation date of August 1, 2008. This fire pump is classified as “New” for RICE MACT and NSPS applicability. The internal engine that is exempt from Rule 201 pursuant to Rule 285(g) and subject to the RICE NSPS 40 CFR Part 60, Subpart A and IIII, and the RICE NESHAP 40 CFR Part 63, Subpart A and Subpart ZZZZ.

NSPS 4I Cert: JOHN DEERE POWER SYSTEMS 2008 MODEL YEAR. Engine Family: 8JDXL08.1037. Certificate Number: JDX-NRCI-08-09. Effective Date & Date Issued: 12/10/2007.

Manufactured after April 1, 2006. This engine produces only work for pumping water for fire & safety sprinklers not electric power (kW).
Manufacturer: JOHN DEERE POWER SYSTEMS. Engine Family: 8JDXL08.1037. NSPS 4I Certificate Number: JDX-NRCI-08-09 (Effective Date: 12/10/2007). Installed: August 1, 2008. Model: 6081HF001 John Deere. Serial No.: RG6081H182661.
The John Deere fire pump engine has been certified (Certificate Number: JDX-NRCI-08-09 (Effective Date: 12/10/2007)) by the manufacturer as required by 40 CFR Part 60 Subpart IIII and the permittee maintains the engine as required by 40 CFR 60.4211. Hence no NSPS performance test is required
This John Deere unit does not generate electricity. It provides mechanical power for fire and safety sprinkler systems during emergency fires.
GM PEC burns only ULSD Diesel fuel in EU-PLT49FIREPUMP#3 (MI-ROP-B4032-2020, EU-PLT49FIREPUMP#3, II.1: only 15 ppm S diesel). The pump starts only when there is an emergency fire although the engine is test fired to ensure its reliability during an accidental fire.
Peerless Midwest (Sam Hufnagel) performed maintenance on March 15, 2021, such that the engine can perform according to NSPS 4I)

The fire pump engine (EU-PLT49FIREPUMP#1) was removed in August 2016.

MI-ROP-B4032-2020, EU-WING3-ERGGEN
Up to 1000 hp Diesel fired emergency generator (compression ignition) subject to 40 CFR 60 Subpart IIII.

NSPS 4I Certificate for Cummins Model Year 2014. Engine Family: ECEXL015.AAJ.
US EPA Certificate No. ECEXL015.AAJ-018. Effective and Expiration dates: 05/20/2013 & 12/31/2014. Issue date: 05/20/2013

EU-WING3-ERGGEN (Gate p-08): Generator Make/Model: Cummins DFEJ-1413521. Serial No. I40741122. Engine Model: Cummins QSX15-G9. Engine Serial No. 79772607. Mfg: NA. 450 kW. Hours meter reading: 82 hrs. on Dec 27, 2017, 123 hrs on July 02, 2019, 206.40 hrs on July 7, 2021.
The engine uses only 15 ppm ULSD (MI-ROP-B4032-2020, EU-WING3-ERGGEN, II.1: 155 ppm S Diesel).

The engine operated less than 100 hours based on the above hours meter readings (MI-ROP-B4032-2020, EU-WING3-ERGGEN, III.1: < 100 hours per calendar year for the purpose of necessary maintenance checks and readiness testing)
GM PEC is not contractually obligated to make engine available (MI-ROP-B4032-2020, EU-WING3-ERGGEN, VII.4). The annual report is not necessary for the Compliance and Emissions Data Reporting Interface (CEDRI).

MI-ROP-B4032-2020, EU-FUELCELLS
Testing of hydrogen fuel cells and not internal combustion engines. No fuel reformer may be used for the hydrogen fuel cells.

Fuel Cells are a zero-emission alternative propulsion system for vehicles. There are many different types of fuel cells. GM is only testing Proton Exchange Membrane (also known as Polymer Electrolyte Membrane; PEM) type fuel cells. Fuel cell operating temperatures is in the range of 60 to 100 °C.
No hydrogen fuel cells testing in recent years since 2017.

Only limit for fuel cells testing is operating temperature (MI-ROP-B4032-2020, EU-FUELCELLS, IV.1 limit: shall not operate any hydrogen fuel cell in EU-FUELCELLS if the fuel cell has a designed internal operating temperature of more than 1,000 degrees Celsius.)

While there are multiple generations or variations of fuel cells tested at GM, they are all PEM fuel cells with operating temperatures in the range of 60 to 100 °C. Some hot excursion testing will go above 100 °C, but never higher than 115 °C. The materials used in the PEM fuel cell are designed to operate at peak efficiencies in this temperature range (60 to 100 °C), the PEM materials will degrade rapidly or fail at temperatures significantly above this range. A PEM type fuel cell will not be tested at temperatures approaching 1000 °C. There are currently no plans to test other types of fuel cells or at higher temperatures (above 115 °C) at the GM Propulsion Facility in Pontiac.

MI-ROP-B4032-2020, FLEXIBLE GROUPS (FGs)

Flexible Group ID	Flexible Group Description	Associated Emission Unit IDs
FG-COLDCLEANERS	Any cold cleaner that is grandfathered or exempt from Rule 201 pursuant to Rule 278, Rule 278a and Rule 281(2)(h) or Rule 285(2)(r)(iv). Existing cold cleaners were placed into operation prior to July 1, 1979. New cold cleaners were placed into operation on or after July 1, 1979.	EU-COLDCLEANERS
FG-TESTCELLS	91 engine dynamometer test cells combined in Wings 1 and 2 with a total heat input capacity of 303.33 MMBtu/hr; using diesel, gasoline, ethanol, methanol, natural gas, propane, liquefied petroleum gas, and hydrogen fuels. 19 engine dynamometer test cells in Wing 3 used for development and testing of internal combustion engines. The engine sizes in Wing 3 will vary, up to 750 horsepower, and will be fueled by diesel, and the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, ethanol, natural gas, methanol, and propane. Hydrogen will be used as a fuel for fuel cell testing. All internal combustion engines tested in the engine dynamometer test cells in Wings 1, 2, and 3 are controlled by four regenerative thermal oxidizers (RTOs) fired by natural gas.	EU-TESTCELLS (1-91) EU3RDWINGR&DTC(1-18) EU3RDWINGR&DTCRM
FG-RACINGTCS	Three engine dynamometer test cells used for the testing of internal combustion high performance engines for automotive motor vehicles. The engine sizes will vary, up to 1,600 horsepower. The engines tested will be fueled by diesel and the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, leaded gasoline, ethanol, natural gas, methanol, and propane. Hydrogen will be used as a fuel for fuel cell testing.	EU-RACINGTC1 EU-RACINGTC2 EU-RACINGTC3
FG-BOILERS	Three 40 MMBTU/HR Johnston boiler's with oxygen trim system subject to 40 CFR 60, Subpart Dc.	EU-CEP-BOILER#1 EU-CEP-BOILER#2 EU-CEP-BOILER#3
FG-RULE287(2)(c)	Paint spray booths that emits air contaminants and are exempt from the requirements of Rule 201 pursuant to Rules 278 and Rule 287(2)(c). The booths are located in the Powertrain Division.	EU-FUELCELLCOATER EU-SEALERS
FG-RULE290	Any emission unit that emits air contaminants and is exempt from the requirements of Rule 201 pursuant to Rule 278, Rule 278a and Rule 290. Emission units installed/modified before December 20, 2016, may show compliance with Rule 290 in effect at the time of installation/modification.	EU-EMOTOR-BOOTH EU-INJSPRAYTSTS
FG-TANKS	Underground fuel storage tanks, consisting of 11 tanks at 15,000-gallon capacity and 14 tank compartments at 6,000-gallon capacity, 2 tank compartments at 2,000-gallon capacity, and 2 tank compartments at 1,000-gallon capacity.	EU-TANKS(1-25) EU-FUELSTORAGE
FG-EXISTEMERGRICEMACT	Existing emergency reciprocating internal combustion engines (RICE) - subject to 40 CFR 63 Subpart ZZZZ (the RICE MACT), but not	EU-BLDGA-GENERATOR EU-

Flexible Group ID	Flexible Group Description	Associated Emission Unit IDs
	subject to the RICE NSPS (40 CFR 63, Subpart IIII or 40 CFR 63, Subpart JJJJ)	BLDGA-NGGENERATOR EU-BLDGBFIREPUMP EU-BLDGB-GENERATOR EU-BLDGC-GENERATOR EU-BLDGD-GENERATOR

MI-ROP-B4032-2020, FG-COLDCLEANERS

Any cold cleaner that is grandfathered or exempt from Rule 201 pursuant to Rule 278, Rule 278a and Rule 281(2)(h) or Rule 285(2)(r)(iv). Existing cold cleaners were placed into operation prior to July 1, 1979. New cold cleaners were placed into operation on or after July 1, 1979.

GM PEC maintains a list of cold-cleaners (approximately 17 cold-cleaners) with Type (CC), Model # & Serial #, Location, Machine description, vapor pressure, solvent type, , tank size, Installation date, etc. About ten (10) aqueous cleaners are present as well.
Each cold-cleaner is exempt from Rule 336.1201 pursuant to Rule 281(2)(h). Each cold-cleaner is installed after 1979 and hence NEW. Each uses Safety-Kleen Premium Gold Solvent containing 6.6 pounds of VOC per gallon (solvent density ρ = 6.6 pounds per gallon). Each is equipped with mechanically assisted lid with either standard (generally) hinge or spring hinge.
All **aqueous cleaners** use ARMA-KLEEN MPC 6321 aqueous alkaline solution. The aqueous solution is heated to 170 ºF, with lid closed. The aqueous cleaners are equipped with agitators. All **solvent cold cleaners** use SAFETY-KLEEN PREMIUM SOLVENT (VIRGIN AND RECYCLED). Safety-Kleen Systems, Inc. services all parts cleaners. Mechanically-assisted lids are always kept closed to prevent evaporation of the solvent, and the operating procedures are posted.
Petroleum distillates, hydrotreated light CAS # 64742-47-8 contains 100% VOC
100% VOC solvent. Flash Point (FP) = 148 ºF TCC (Tag Closed Cup). Auto Ignition = 480 ºF. Boiling Point (BP) = 350 ºF @ 760 mm Hg. Vapor Pressure (VP) = 0.2 mm Hg at 68 ºF. Specific Gravity (SG, Water = 1.0) = 0.77-0.82. Density (ρ) @ 68 ºF = 6.4-6.7 lbs / gallon (0.77-0.82 kg /L). Flammability range = 0.7 %v (LEL) – 5%v (UEL).

FG-TESTCELLMACT

It must be noted that FG-TESTCELLMACT has been removed from the ROP upon renewal (MI-ROP-B4032-2020) based upon PTI No. 198-18.

MI-ROP-B4032-2020, FG-TESTCELLS

There are ninety-one engine dynamometer test cells combined in Wings 1 and 2 with a total heat input capacity of 303.33 MMBtu/hr; using diesel, gasoline, ethanol, methanol, natural gas, propane, liquefied petroleum gas, and hydrogen fuels. There are nineteen engine dynamometer test cells in Wing 3 used for development and testing of internal combustion engines. The engine sizes in Wing 3 will vary, up to 750 horsepower, and will be fueled by diesel, or the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, ethanol, natural gas, methanol, and propane. Hydrogen will be used as a fuel for fuel cell testing. Emissions from all internal combustion engines tests in the engine dynamometer test cells in Wings 1, 2, and 3 are controlled by four communal regenerative thermal oxidizers (RTOs) that are fired by natural gas.

EU-TESTCELLS (1-91), EU3RDWINGR&DTC1 thru EU3RD`WINGR&DTC18 and EU3RDWINGR&DTCRM
As stated above, Test Cell Internal Combustion engines are controlled by four communal regenerative thermal oxidizers (RTOs) fired by natural gas to oxidize especially carbon monoxide to carbon dioxide.
Ninety-one (91) engine dynamometer test cells combined in Wings 1 and 2 with a total heat input capacity of 303.33 MMBtu/hr; using diesel, gasoline, ethanol, methanol, natural gas, propane, liquefied petroleum gas, and hydrogen fuels**. Nineteen (19)** engine dynamometer test cells in Wing 3 used for development and testing of internal combustion engines. The engine sizes in Wing 3 will vary, up to 750 horsepower, and will be fueled by diesel, and the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, ethanol, natural gas, methanol, and propane. Hydrogen will be used as a fuel for fuel cell testing (not an internal combustion (IC) engine). All internal combustion engines tested in the engine dynamometer test cells in Wings 1, 2, and 3 (except racing in Wing 3) are controlled by four regenerative thermal oxidizers (RTOs) fired by natural gas.
In addition to test cells, in Wing 3, fuel injectors are tested. In each test cell, more than one fuel injector may be tested. All fuel is recycled for continuous testing except insignificant evaporative losses.

Currently there are 91 (increased from 89) test cells in Wings 1, 2. All test cells emissions are controlled by 4 communal RTOs (May 2017 RTO DE test efficiencies - RTO1 DE = 99.0%, RTO2 DE = 98.6%, RTO3 DE = 98.1% and for RTO4 DE = 98.2%) for carbon monoxide (CO) oxidation. Each RTO DE > 96%. It may be noted that the RTO DEs must incorporate Capture Efficiency (CE) of 99.78% (adjusted for ambient CO) for overall control efficiencies (OCE). For example, **RTO3 OCE = 0.981 * 0.9978 = 0.9788 = 97.88% > 96%**
As stated above under April 2022 RTO CO DE stack test (91 engine test cells in Wings 1 and 2 and 11 firing test cells in Wing 3) test results of Carbon Monoxide (CO) are listed below:

1. **RTO 1**: 32.6 ppmvd, 3.0 pounds of CO per hour & 97.9 > 96 percent destruction efficiency (% DE)
2. **RTO 2**: 39.3 ppmvd, 3.4 pounds of CO per hour & 97.5 > 96 percent destruction efficiency (% DE) at 1530-1590 °F.
3. **RTO 3**: 39.2 ppmvd, 3.7 pounds of CO per hour & 97.8 > 96 percent destruction efficiency (% DE) at 1530-1590 °F.
4. **RTO 4**: 55.0 ppmvd, 5.0 pounds of CO per hour & 98.2 > 96 percent destruction efficiency (% DE) at 1530-1590 °F.

MI-ROP-B4032-2020, FG-TESTCELLS, I, 1-11

Pollutant	Limit	Time Period / Operating Scenario	Equipment	May 18, 2022, WING 3 GAS ENGINE	
1. NO_x	24.5 pph^2	Hourly		0.15 pounds of NOx as NO2 per	

			Combined for all dynamometers in Wing 3 of FG-TESTCELLS	hour for **one representative dynamometer** of Wing 3 of FG-TESTCELLS.	
2. NO_x	425.6 tpy[2]	12-month rolling time period as determined at the end of each calendar month	Wings 1 and 2 of FG-TESTCELLS		
3. NO_x	23.5 tpy[2]	12-month rolling time period as determined at the end of each calendar month	Wing 3 of FG-TESTCELLS		
4. NO_x	1.38 lb/MMBTU for spark-ignited fuels, and 2.2 lb/MMBTU for diesel[2]	Hourly	Prior to the RTOs of Wings 1, 2, and 3 of FG-TESTCELLS	**1.53** pounds of NO_X per MM BTU is **NOT** in compliance with the permit limit	
5. NO_x	1.38 lb/MMBTU for natural gas fuel[2]	Hourly	Prior to the RTOs of Wings 1, 2, and 3 of FG-TESTCELLS	NG not used	
6. CO	299.3 pph[2]	Hourly	Wings 1 & 2 of FG-TESTCELLS		
7. CO	285.1 tpy[2]	12-month rolling time period as determined at the end of each calendar month.	Wings 1 & 2 of FG-TESTCELLS		
8. CO	0.96 lb/MMBTU[2]	Hourly	Wings 1 & 2 of FG-TESTCELLS		
9. CO	14.4 tpy[2]	12-month rolling time period as determined at the end of each calendar month.	Wing 3 of FG-TESTCELLS		
10. PM10	29.5 tpy[A2]	12-month rolling time	Wings 1 & 2 of		

		period as determined at the end of each calendar month.	FG-TESTCELLS		
11. Lead	0.597 tpy[2]	12-month rolling time period as determined at the end of each calendar month.	Wings 1 & 2 of FG-TESTCELLS		

[A] The permittee shall calculate gasoline PM10 emissions from Wings 1 and 2 of FG-TESTCELLS based on the worst-case gasoline emission factor from either testing per SC V.1 or the emission factor of 0.048 lb PM10/MMBtu gasoline. The permittee shall calculate diesel PM10 emissions from Wings 1 and 2 of FG-TESTCELLS based on the worst-case diesel emission factor from either testing per SC V.1 or the emission factor of 0.31 lb PM10/MMBtu diesel.

Emission Factors for internal combustion engines, unless otherwise accepted by the AQD District Supervisor:

Diesel	Spark-ignited fuels
NO_x: 2.20 lb/MMBTU CO with control: 0.96 lb/MMBTU PM10: 0.31 lb/MMBTU	NO_x: **1.38** lb/MMBTU (May 18, 2022, WING 3 GAS ENGINE tested value = **1.53** pounds of NOX per MM BTU) CO with control: 0.96 lb/MMBTU PM10: 0.048 lb/MMBTU Lead: 0.00085 lb/MMBTU from unleaded gasoline variants 0.0577 lb/MMBTU from leaded gasoline OR as determined from lead content in fuel deliveries

August 12, 2022, Temperatures, °F: RTO1 = **1594**, RTO2 = **1598**, RTO3 = **1650** & RTO4 = **1630**
Based upon April 2022 RTO CO DE stack test, **RTO operating limit is > 1530-1590 ºF** for the required CO destructions (97.9% for RTO1, 97.5 % for RTO2, 97.8 % for RTO3 and 98.2% for RTO4) to be achieved. All CO DE > 96% (MI-ROP-B4032-2020, FG-TESTCELLS, IV.1: a minimum carbon monoxide (CO) destruction efficiency of 96 percent (by weight) or a maximum CO outlet concentration of 20 ppmvd corrected to 15 percent O2 concentration).

GM keeps record of fuels (gasoline, diesel, natural gas, etc.) usage, on daily, monthly and 12-month periods, and performs the calculations.
Fuel usage in FG-TESTCELLS - Wings 1 & 2: **84,772** (July 2021, highest for CY 2021) MM BTU gasoline per 12-mo, 29,277 **(**Dec 2021, highest for CY 2021**)** MM BTU **diesel** per year < 114,400 MM BTU per 12-mo (MI-ROP- B4032-2020, FGTESTCELLS, II.2a limit: 114,400 MM BTU diesel per 12-month). **134,701** (Dec 2021, highest for CY 2021) MM BTU **total** fuel per 12-mo (MI-ROP-B4032-2020, FGTESTCELLS, II.2 limit: 520,000 MM BTU total fuel per 12-month).

Fuel usage in FG-TESTCELLS - Wing 3: **377** (June 2021, highest for CY 2021) MM BTU per 12-mo spark ignited fuel < 23,312 (MI-ROP- B4032-2020, Wing 3 of FGTESTCELLS, II.4 limit: 23,312 MM BTU spark ignited fuel per 12-month), **69** (Jan 2021, highest for CY 2021) MM BTU per 12-mo Diesel < 6,732 (MI-ROP- B4032-2020, Wing 3 of FGTESTCELLS, II.3 limit: 6,732 MM BTU Deisel fuel per 12-month)

GM PEC burn only approved fuels (diesel and the following spark-ignited fuels: unleaded gasoline, leaded gasoline, ethanol, natural gas, methanol, and propane) in each dynamometer of Wings 1 and 2 of FG-TESTCELLS (MI-ROP- B4032-2020, Wings 1 & 2 FGTESTCELLS, II.5)
GM PEC burn only approved spark-ignited fuels (unleaded gasoline, unleaded gasoline blends, ethanol, natural gas, methanol, and propane) in each dynamometer of Wing 3 of FGTESTCELLS (MI-ROP- B4032-2020, Wing 3 FGTESTCELLS, II.6)
GM PEC always operates the test cells (Wings 1, 2, and 3 of FG-TESTCELLS) while operating the communal RTOs (number of RTOs running depends on the demand). August 12, 2022, Temperatures are noted above. All CO DE > 96% based upon the recent test report (April 2022 RTO CO DE stack test) (MI-ROP- B4032-2020, Wing 1,2 & 3 FGTESTCELLS, IV.1: RTO operating at minimum CO DE of 96 percent (by weight))
GM PEC provided the temperature data that showed operation of RTOs at > 1590 °F (MI-ROP- B4032-2020, Wing 1,2 & 3 FGTESTCELLS, IV.2: a temperature monitoring device)
GM PEC provided the differential pressure data that showed operation of central engine exhaust system (CEES) operating at -11 inches of water (MI-ROP- B4032-2020, Wing 1,2 & 3 FGTESTCELLS, IV.3: differential pressure monitoring device(s) on the central engine exhaust system (CEES)).

GM PEC conducted stack tests as noted below:

1. Capture Efficiency (CE = 99.78% ≈ 100% CE) for 4 RTOs: On May 10, 2017, BT Environmental Consulting, Inc. (BTEC, Project No. 17-5011.01, June 21, 2017) conducted carbon monoxide (CO) capture efficiency (CE) test on one representative test cell (D301 test cell exhaust) in Wing 3.
2. May 9, 2015 PM10 and NOx stack test: On May 9, 2015, BT Environmental Consulting, Inc. (BTEC, Project No. Project No. 15-4705.00, June 9, 2015) conducted stack tests for nitrogen oxides (NOx) and PM10.
3. July 2016 FG-RACINGTCS stack test: On July 26, 2016, BT Environmental Consulting, Inc. (BTEC, Project No. Project No. 16-4867.00, September 19, 2016) conducted stack tests for nitrogen oxides (NOx) and oxygen (O2) from high performance engines.
4. May 2017 RTO CO DE stack test: On May 16 and 17, 2017, BT Environmental Consulting, Inc. (BTEC, Project No. 17-5010.00, June 21, 2017) conducted stack tests for RTO destruction efficiencies for carbon monoxide (CO).
5. June 12, 2019, NOx (MI-ROP-B4032-2014e EU-RACINGTC2): on June 12, 2019, by Montrose Air Quality Services, LLC (248-548-8070) of Royal Oak (Test Plan: 049AS-585630 dated May 2, 2019 and Document Number: M049AS-585630-RT-52RO Document Date: July 26, 2019)
6. June 04, 2020, NOx (MI-ROP-B4032-2020, FG-RACINGTCS (Diesel Engine (E104))): on June 4, 2020, by Montrose Air Quality Services, LLC (248-548-8070) of Royal Oak (Test Plan: NA and Document Number: M049AS-711992-RT-425 Document Date: J July 31, 2020; the report states sampling date as June 6, but the correct sampling date is June 04, 2020)
7. May 2015 test for FG-TESTCELLS still valid and representative: Request letter dated March 25, 2020, by Holly Myers, Operations Director, for acceptance of May 2015 FG -TESTCELLS tests remain Valid & Representative Emission Factor to satisfy PTI No.198-18, FG-TESTCELLS, V.1. testing. AQD approved this request on April 06, 2020, with an E-mail to Alderton (Jessica Alderton (jessica.alderton@gm.com) & Gunnels (Bethany Gunnels bethany.gunnels@gm.com)). Mon 4/6/2020 2:59 PM.

8. October 29 - 30, 2019, FG-TESTCELLS, NOx testing: by Montrose Air Quality Services, LLC (248-548-8070) of Royal Oak (Test Plan: M049AS-652645-PP-52 and Document Number: M049AS-652645-RT-209R0; Document Date: December 13, 2019; Sampling date: October 29-30, 2019). On Wing 3 Engine Dynamometers D301 (October 29, 2019, Gasoline) and D302 (October 30; 2019, Diesel)
9. April 2022 RTO CO DE stack test (April 11, 12, 13, and 28, 2022): the sampling was conducted by Montrose Air Quality Services, LLC of Elk Grove Village, IL 60007 (Document Number: MW023AS-014898-RT-1360 & Submittal Date: June 16, 2022) concerning the RTO Nos. 1, 2, 3, and 4. The April 2022 (91 engine test cells in Wings 1 and 2 and 11 firing test cells in Wing 3).
10. May 17 & 18, 2022, NO_x FG-TESTCELLS & Wing 3 tests: During July 17-18, 2022, the sampling was conducted by Montrose Air Quality Services, LLC of Elk Grove Village, IL 60007 (Document Number: MW023AS-015629-RT-1395 & Submittal Date: July 14, 2022) concerning NOx emission rate from the Racing (EU-RACINGTC2) and Wing 3 Gas Engines (D301).

(MI-ROP- B4032-2020, Wing 1,2 & 3 FGTESTCELLS, V.1-2: verify CO, NOx, and PM10 emission rates of FG-TESTCELLS, verify NOx emission rates in terms of pph from a minimum of one representative dynamometer of Wing 3 of FG-TESTCELLS)

GM PEC is performing the required calculations, keeping the required monthly records, keeping RTO temperature records, monitoring the differential pressure across the enclosure (central engine exhaust system (CEES)), keeping all performance test reports, etc. (MI-ROP- B4032-2020, Wing 1,2 & 3 FGTESTCELLS, VI.1-15)
GM PEC has been submitting the required reports (MI-ROP- B4032-2020, Wing 1,2 & 3 FGTESTCELLS, VII.1-6:)

MI-ROP- B4032-2020, FG-RACINGTCS (EU-RACINGTC1, EU-RACINGTC2, EU-RACINGTC3)

Three engine dynamometer test cells used for the testing of internal combustion high performance engines for automotive motor vehicles. The engine sizes will vary, up to 1,600 horsepower. The engines tested will be fueled by diesel and the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, leaded gasoline, ethanol, natural gas, methanol, and propane. Hydrogen will be used as a fuel for fuel cell testing.
It must be noted that FG-TESTCELLMACT has been removed from the ROP upon renewal (MI-ROP-B4032-2020) based upon PTI No. 198-18.
Unlike other test cells in Wings 1-3, four (4) racing test cells exhaust is NOT ducted to 4 communal RTOs. Hence, the emissions, especially carbon monoxide, are uncontrolled.
GM PEC burns only diesel and the following spark-ignited fuels: unleaded gasoline, unleaded gasoline blends, leaded gasoline, ethanol, natural gas, methanol, and propane in each dynamometer of FG-RACINGTCS (MI-ROP-B4032-2020, FG-RACINGTCS, II.1)

FG-RACINGTCS (EU-RACINGTC1, EU-RACINGTC2, EU-RACINGTC3) Fuel usage:
21 (diesel used in Oct 2019, only month used in CY 2019), **NULL** (diesel not used in CY 2021) MM BTU **diesel** per year (MI-ROP-B4032-2020, FG-RACINGTCS, II.2 limit: 767 MM BTU diesel per 12-month).
2,655 MM BTU = **20,374** gallons (Dec 2017, highest for CY 2017), **2,658** MM BTU = **20,669** gallons (March 2019, highest for CY 2019), **2,067** MM BTU =**16,160** gallons (CY 2021) **gasoline** fuel per year (MI-ROP-B4032-2020, FG-RACINGTCS, II.3 limit: 3,616 MM BTU = 27,774 gallons ESTIMATED). GM PEC also used **230** MM BTU per year leaded

gasoline in CY 2021(MI-ROP-B4032-2020, FG-RACINGTCS, II.3 limit: Of the 3,616 MMBTU, the permittee shall not burn more than 767 MMBTU of leaded gasoline per 12-month)
2,655 (Dec 2017, highest for CY 2017)**, 2658** (March 2019, highest for CY 2017), **2067** MM BTU **total** fuel per year (MI-ROP-B4032-2020, FG-RACINGTCS, II.3 limit: no limit).
NULL natural gas is used in CY 2017-2021.

MI-ROP- B4032-2020, FG-RACINGTCS, TESTING

GM PEC performed the tests as stated above and listed below:

1. On July 26, 2016, BT Environmental Consulting, Inc. (BTEC, Project No. Project No. 16-4867.00, September 19, 2016) conducted stack tests for nitrogen oxides (NOx) and oxygen (O2) from high performance engines.
2. The test was conducted, on June 12, 2019, by Montrose Air Quality Services, LLC (248-548-8070) of Royal Oak (Test Plan: 049AS-585630 dated May 2, 2019 and Document Number: M049AS-585630-RT-52RO Document Date: July 26, 2019
3. The test was conducted, on June 4, 2020, by Montrose Air Quality Services, LLC (248 -548-8070) of Royal Oak (Test Plan: NA and Document Number: M049AS-711992-RT -425 Document Date: J July 31, 2020; the report states sampling date as June 6, but the correct sampling date is June 04, 2020).
4. During July 17-18, 2022, the NO_X sampling was conducted by Montrose Air Quality Services, LLC of Elk Grove Village, IL 60007 (Document Number: MW023AS-015629-RT-1395 & Submittal Date: July 14, 2022) concerning NO_x emission rate from the Racing (EU-RACINGTC2) and Wing 3 Gas Engines (D301).

(MI-ROP- B4032-2020, FG-RACINGTCS, TESTING, V.1-3)
As stated above, GM PEC is performing the required emissions calculations, keeping fuel usage records (o diesel and 0 NG usage) ((MI-ROP- B4032-2020, FG-RACINGTCS, VI.1-5: Records)
GM PEC is submitting the required reports (MI-ROP- B4032-2020, FG-RACINGTCS, TESTING, VII.1-6: Reports)

MI-ROP- B4032-2020, FG-BOILERS (EU-CEP-BOILER#1, EU-CEP-BOILER#2, EU-CEP-BOILER#3)

Three 40 MMBTU/HR natural gas fired Johnston boiler's with oxygen trim system subject to 40 CFR 60, Subpart Dc

GM PEC burns only NG in its boilers and keeps fuel records. By submitting MAERS every year, it complies with the NSPS Dc recordkeeping. MAERS-2021 Boilers used 142 MM BTU of natural gas per year based upon the attached RG-BOILERS NG usage spreadsheet (MI-ROP- B4032-2020, FG-BOILERS, VI.1: NSPS Dc, 40 CFR 60, Subpart Dc, Section 60.48c(g))
GM PEC is submitting the required reports (MI-ROP- B4032-2020, FG-BOILERS, VII.1-3: Reports)
GM PEC is complying with the NSPS Dc by keeping fuel (NG) usage records (MI-ROP-B4032-2020, FG-BOILERS, IX.1: 40 CFR Part 60, Subpart Dc

MI-ROP- B4032-2020, FG-RULE287(2)(c)

Any emission unit that emits air contaminants and is exempt from the requirements of Rule 201 pursuant to Rule 278, Rule 278a and Rule 287(2)(c). Emission units installed/modified before December 20, 2016, may show compliance with Rule 287 in effect at the time of installation/modification.

GM has numerous (> 20) booths that meet these requirements. GM has one Rule 287(2)(c) form for each unit: EU-MPB-PWTRNBOOTHS = 1.43 < 10 gallons per year, Bild-E MAIN BOOTH = 0.78 < 10 gallons per year. All booths use in oz units. Total usage << 200 gallons (MI-ROP- B4032-2020, FG-RULE287(2)(c), II.1: 200 gallons coating per month usage for each exempt booth)
All usage logs demonstrate << 200 gallons per month per booth usage. The filters are installed properly. I asked Mr. Charles Kessler to install and inspect the filters such that they fit, at all times, snugly without gaps and holes. I also asked him to continue keep records, using the custom Rule 336.287(2)(c) forms of paint, coatings, adhesives, sealants and solvent, etc. usage according to Rule 336.287(2)(c).

MI-ROP- B4032-2020, FG-RULE290 (EU-EMOTOR-BOOTH, EU-INJSPRAYTSTS)
Any emission unit that emits air contaminants and is exempt from the requirements of Rule 201 pursuant to Rule 278, Rule 278a and Rule 290. Emission units installed/modified before December 20, 2016, may show compliance with Rule 290 in effect at the time of installation/modification.

1. EU-EMOTOR-BOOTH Total usage = 0.05 lbs
2. EU-INJSPRAYTSTS Total usage 120.73 lbs

MI-ROP- B4032-2020, FG- TANKS (EU-TANKS (1-25) and EU-FUELSTORAGE)
Underground fuel storage tanks, consisting of 11 tanks at 15,000-gallon capacity, 14 tank compartments at 6,000-gallon capacity, 2 tank compartments at 2,000-gallon capacity, and 2 tank compartments at 1,000-gallon capacity.

All fuel tanks are equipped with permanent submerge fill pipes, vapor balance systems, interlocking systems, etc. I asked Mr. Kessler to ensure proper vapor balance system operation during gasoline loading.
GM PEC conducted NESHAP / MACT 6C performance testing.

FG-BOILERMACT
This flexible group has been removed from ROP

Conclusion

Only BP ULSD (15 ppm S) dyed is used in the generators. GM is in compliance with ROP. GM PEC is now Synthetic Minor for MACT (not subject to Boiler MACT 5D & engine test cells/stands. MACT 5P effective current ROP MI-ROP-B4032-2020) Engine testing moved to GM PEC, Pontiac.

NAME J Shenanahall. DATE November 1, 2022 SUPERVISOR Joyce