TECHNICAL FACT SHEET

November 6, 2024

Purpose and Summary

The Michigan Department of Environment, Great Lakes, and Energy (EGLE), Air Quality Division (AQD), is proposing to act on Permit to Install (PTI) application No. APP-2024-0096 from Consumers Energy Company - Zeeland Generating Station (CEC). The permit application is a proposal to install advanced gas path (AGP) and axial fuel staging (AFS) upgrades to two existing simple cycle combustion turbines. The proposed project is subject to the permitting requirements of the Department's Rules for Air Pollution Control and state and federal Prevention of Significant Deterioration (PSD) regulations. Before acting on this application, the AQD is holding a public comment period and a virtual public hearing, if requested in writing, to allow all interested parties the opportunity to comment on the proposed PTI. All relevant information received during the comment period and the virtual hearing, if held, will be considered by the decision maker prior to taking final action on the application.

Background Information

CEC is an existing electric generating facility located at 425 North Fairview Road in Zeeland, Ottawa County, Michigan (Figure 1). The facility currently consists of:

- two natural gas-fired simple cycle combustion turbines (installed in 2001),
- two natural gas-fired combined cycle combustion turbines (installed in 2002),
- two natural gas-fired duct burners (installed in 2002),
- a steam generator collectively operating in combined cycle mode,
- a 17.82 MMBTU*/hr natural gas-fired auxiliary boiler (installed in 2018),
- a cooling tower,
- a diesel fire pump, and
- a cold cleaner

*MMBTU = million British Thermal Units

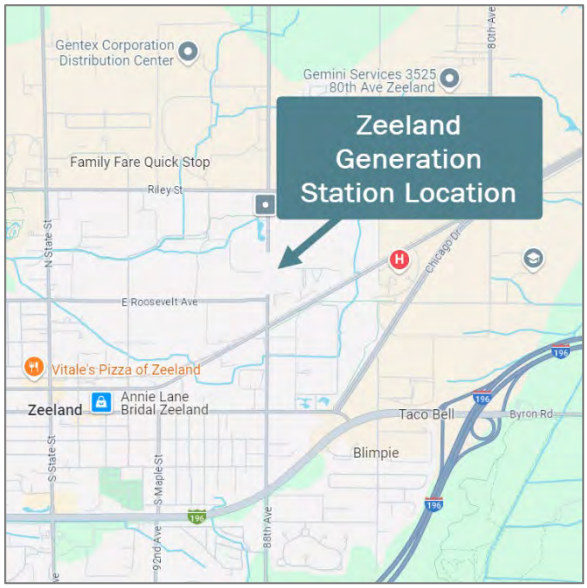

Figure 1 Location of Zeeland Generating Station

Each of the four turbines are General Electric model number 7FA and are equipped with dry low-NO_x combustor systems. Nitrogen oxide (NO_x) emissions from the combined cycle turbines and duct burners are controlled by selective catalytic reduction (SCR) using aqueous ammonia as the reactant. NO_x and carbon monoxide (CO) emissions from each turbine are monitored via continuous emissions monitoring systems (CEMS). The total output for the facility is approximately 800 megawatts (MW).

CEC currently operates under Renewable Operating Permit (ROP) No. MI-ROP-N6521-2020a. The facility is classified as an existing major source under both the State of Michigan and the federal PSD rules and regulations but is a minor source of Hazardous Air Pollutants (HAPs).

Proposed Facility and Present Air Quality

The AGP is to increase electricity output and improve fuel efficiency, and the AFS will control how the fuel is mixed for better efficiency. The proposed changes will result in increased electrical output capability and maximum hourly heat input rate of the turbines, as well as greater operating flexibility. The upgrade will increase the maximum hourly emissions but not result in an increase to the existing allowed annual emission limits.

The facility is located on the northeast side of the city of Zeeland in Ottawa County, Michigan. Ottawa county is currently in attainment with all of the National Ambient Air Quality Standards (NAAQS) set by the United States Environmental Protection Agency (USEPA). The air quality standards are for particulate matter less than or equal to 10 microns in diameter (PM10), particulate matter less than or equal to 2.5 microns in diameter (PM2.5), CO, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone, and lead. The NAAQS are set at levels designed to protect public health, including sensitive populations.

The AQD operates an air monitoring station in Ottawa County which measures PM10, PM2.5, and ozone. The purpose of the air monitoring stations is to assess the regional or area-wide air quality and is not used to determine if a specific source is in compliance with their air permit.

Pollutant Emissions

CEC is requesting to install upgrades to two existing simple cycle combustion turbines at a facility currently classified as an existing major source under the PSD regulations. Any modification at a PSD major source where the emissions of a regulated pollutant increase by more than the Significant Emission Rate (SER) results in the modification being subject to the PSD regulations for that pollutant.

As the following table shows, emissions from the proposed modifications will be above the SER for several regulated pollutants; therefore, the project is subject to the PSD regulations in Part 18 of the Michigan Air Pollution Control Rules and 40 CFR 52.21 for those pollutants.

Table 1: Project Potential Emissions Summary

Pollutant	Baseline Actual Emissions (tpy*)	Projected Actual Emissions (tpy)	Estimated Emissions Increase (tpy)	PSD Significant Emission Rate (tpy)	Subject to PSD?
NO_x	217.5	342.3	124.8	40	Yes
CO	46.9	53.4	6.5	100	No
Particulate Matter (PM)	6.3	12.0	5.7	25	No
PM10	20.8	40.8	20.0	15	Yes
PM2.5	20.8	40.8	20.0	10	Yes
SO_2	4.1	6.5	5.7	40	No
Volatile Organic Compounds (VOCs)	3.1	5.6	2.5	40	No

Pollutant	Baseline Actual Emissions (tpy*)	Projected Actual Emissions (tpy)	Estimated Emissions Increase (tpy)	PSD Significant Emission Rate (tpy)	Subject to PSD?
Greenhouse Gases (GHGs) Measured as Carbon Dioxide Equivalents (CO_2e)	815,570	1,280,616	465,046	75,000	Yes

*tpy = tons per year

A good way to understand this table is to see if the column labeled "Estimated Emissions Increase" is larger than the column labeled "Significant Emission Rate." If it is, then the project is subject to the PSD regulations for the pollutant.

The baseline actual emissions values were based upon CEMS or stack testing data from the facility. The monthly actual NO_x, CO, and CO_2e emissions and heat input are directly measured using CEMS and/or 40 CFR Part 75 Appendix D and G methodologies. Monthly actual PM (filterable), PM10, and VOCs are derived from stack test results and measured input. To be conservative, PM2.5 emissions were assumed to be equal to PM10. SO_2 emissions were based on the emission limits in the current ROP.

For projected actual emissions, CEC used active dispatch models, which examine scenarios with the turbines operating at different loads and temperatures. The models projected monthly heat input for each of the simple cycle combustion turbines through 2034, based on expected unit characteristics following the AGP/AFS upgrades. Such dispatch modeling is regional in scope and accounts for existing generating resources, fuel processes, transmission interconnections, electric demand, and new builds and retirements.

The projected 12-month rolling heat input (MMBtu) was multiplied by an emission factor (lb/MMBtu) representative of expected future operation by selecting the maximum historic emission factor for each simple cycle combustion turbine, considering data within 25% of the projected heat input with the AGP/AFS upgrade. These historic emission factors capture heat input and NO_x and CO emissions during all periods of operation including periods of startup, shutdown, and malfunction. PM/PM10/PM2.5 and SO_2 emissions are driven by fuel consumption, and because fuel consumption during startup and shutdown is less than full load steady-state operation, startup and shutdown emissions for these pollutants are self-correcting for all types of startups. Self-correcting means the emissions for each startup and shutdown sequence, incorporating the minimum downtime required to define that type of startup, are less than the corresponding full load steady-state emission rate.

Key Permit Review Issues

Staff evaluated the proposed project to identify all state rules and federal regulations which are, or may be, applicable. The tables in Appendix 1 summarize these rules and regulations.

- **Minor/Major Modification Determination for Attainment Pollutants**
  The facility is an existing PSD major stationary source. A modification at the facility where the emissions of any regulated pollutant will increase by more than the SER for that pollutant results in the modification being subject to PSD requirements for that pollutant. CEC is located in Ottawa County which is currently in attainment for all regulated pollutants.

The proposed project is subject to PSD for NO_x, PM10, PM2.5, and CO_2e because the emission increase for each regulated pollutant is more than the SER for that pollutant. See Table 1 above for a summary of the proposed emissions changes of each regulated pollutant. Review under the PSD regulations requires Best Available Control Technology (BACT), a source impact analysis, an air quality impact analysis, and an additional impact analysis for each regulated air pollutant for which the project will result in significant emissions. A detailed description of the BACT analysis completed for the proposed turbine modifications is contained below in Appendix 2 of this document.

- **Federal NSPS Regulations**
  New Source Performance Standards (NSPS) were established under Title 40 of the Code of Federal Regulations (40 CFR) Part 60. The existing simple cycle turbines are currently subject to the NSPS for Stationary Combustion Turbines, 40 CFR Part 60 Subpart GG. NSPS Subpart GG applies to all stationary gas turbines, constructed after October 3, 1977, with a heat input at peak load equal to or greater than 10 MMBTU/hr, based on the lower heating value.

  As the proposed project is considered a modification under the NSPS, if it is approved, the simple cycle turbines will become subject to the NSPS for Stationary Combustion Turbines, 40 CFR Part 60 Subpart KKKK instead of Subpart GG. NSPS Subpart KKKK applies to any stationary gas turbine with a heat input at peak load equal to or greater than 10 MMBTU/hr (based on higher heat value), that commenced construction, reconstruction, or modification after February 18, 2005.

- **Rule 224 TBACT Analysis**
  State of Michigan Rule 224 requires that emissions of toxic air contaminants or TACs do not exceed the maximum allowable emission rate that results from the application of Best Available Control Technology for Toxics (T-BACT). The requirements of Rule 224 do not apply to HAPs emissions from any process subject to a federal National Emission Standards for Hazardous Air Pollutants or for any emission units that emits VOCs which are in compliance with Rule 702 VOC BACT. The AQD determined the proposed project emissions complied with Rule 702 BACT for VOCs, so the TACs that are VOCs are not subject to Rule 224. The remainder of the TACs are particulates of 0.04 tpy in magnitude. Add-on control of those TACs was determined to be economically infeasible and therefore, T-BACT is considered to be no additional control.

- **Rule 225 Toxics Analysis**
  EGLE Rules for Air Pollution Control require the ambient air concentration of TACs to be compared against health-based screening levels. AQD staff evaluated CEC's air quality modeling and evaluation of TAC impacts. A generic TAC analysis was performed to show compliance with Rule 225. Modeling was done with a 1 gram per second (g/s) emission rate being emitted from each turbine's stack. The review found that all TACs show impacts less than 7 percent of their respective established health-based screening levels and will comply with the requirements of Rule 225.

- **Rule 702 VOC Emissions**
  This rule requires an evaluation of the following four items to determine what will result in the lowest maximum allowable emission rate of VOCs:

  a. BACT or a limit listed by the department on its own initiative

  b. New Source Performance Standards (NSPS)

c. VOC emission rate specified in another permit

d. VOC emission rate specified in the Part 6 rules for existing sources

An evaluation of these four items determined that the current VOC BACT limit (702(c)) for the two turbines dictates the lowest maximum allowable emission rate of VOCs. The current permit contains VOC limits that will not change with the addition of the proposed AGP/AFS. Those limits are proposed to be carried forward because they are still applicable, and the addition of add-on VOC control was determined to not be economically feasible.

- **Criteria Pollutants Modeling Analysis**
  CEC conducted, and the AQD verified, computer dispersion modeling to predict the impacts of NO_x, PM10, and PM2.5 from the proposed modified turbines. NO_x refers specifically to nitrogen oxide and NO_2, with the larger portion being NO_2. NO_2 is a highly reactive gas and is the pollutant for which the USEPA established a NAAQS.

  Emissions from the proposed modified turbines were evaluated against both the NAAQS and the PSD increments. The modeling was run for different operating loads and scenarios to determine the worst-case concentrations. The NAAQS are intended to protect public health. The PSD increments are intended to allow industrial growth in an area, while ensuring that the area will continue to meet the NAAQS.

  The first step in this evaluation is to determine the predicted pollutant impacts from the proposed project. After the impacts are determined, they are compared to the applicable Significant Impact Levels (SIL). For pollutants with impacts less than the SIL, the emissions are presumed to comply with both the NAAQS and the PSD Increments, and no further review is required.

  As shown in Table 2, the predicted impacts for all pollutants and all averaging times are under their respective SILs.

Table 2: Preliminary Modeling Impacts from the Modified Turbines

Pollutant	Averaging Time	SIL ($\mu g/m^3$)	Predicted Impact ($\mu g/m^3$)	% of SIL	Additional Modeling Needed?
NO_2	1-Hour	7.5	3.45	46.0%	No
	Annual	1	0.015	1.5%	No
PM10	24-Hour	5	0.210	4.2%	No
	Annual	1	0.0027	0.27	No
PM2.5	24-Hour	1.2	0.180	15%	No
	Annual	0.13	0.002	1.54%	No

Because the modeling passed the SIL for all pollutants at all averaging times, modeling against the NAAQS and PSD Increment was not required or performed.

- **Additional Impact Analysis**
  An additional impact analysis is required for new or modified PSD major sources under 40 CFR Part 52.21(o) and Michigan Rule 336.2815. This analysis is necessary to evaluate the impacts of the proposed project on soils, vegetation, visibility, and growth. CEC's proposed project is not anticipated to have a negative impact on soils, vegetation, wildlife, or visibility. Additionally, the project is anticipated to have a minimal impact on growth.

Soils, Vegetation, and Wildlife
The USEPA developed the secondary NAAQS to represent levels that protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. As a general rule, if ambient concentrations from a PSD project are found to be less than the secondary NAAQS, emissions from that project will not result in harmful effects on either soil or vegetation.

CEC has demonstrated compliance with the secondary NAAQS by complying with the SIL (which are more stringent) for PM10 (24-hr and annual), PM2.5 (24-hr and annual), and NO_2 (1-hr and annual) indicating that the proposed project will not cause or contribute to adverse impacts on soils, vegetation, and wildlife.

Class I Areas Analysis
Class I areas are federally protected areas for which more stringent air quality standards apply to protect unique natural, cultural, recreational, and/or historic values. Two principal air quality impacts are considered for Class I areas: PSD Increments and air quality related values (AQRV). The Federal Land Managers for Class I areas have the authority to protect AQRV and to consider in consultation with the permitting authority whether a proposed major emitting facility will have an adverse impact on such values. AQRV for which PSD modeling is typically conducted includes visibility. The CEC facility is located more than 300 kilometers from all federally protected Class I areas; therefore, a Class I modeling analysis was not necessary for this project.

Visibility
Background visibility in Ottawa County, a primarily suburban and rural area of Michigan, is relatively clear. Considering the type of fuel that will be combusted, source strength, and low model-predicted impacts, negative impacts to visibility downwind of the proposed modification are not expected to occur.

The Zeeland Generating Station is equipped with a cooling tower that provides water cooling capability for the existing combined cycle turbines. However, the proposed modification of the simple cycle combustion turbines will not affect the combined cycle turbines or cooling tower operations. Therefore, there is no potential for adverse fogging or icing conditions due to the proposed modification.

Growth
The purpose of the growth analysis is to quantify industrial, commercial, residential, and other growth associated with the project. That is, to predict how much new growth is likely to occur to support the source or modification under review, and then to estimate the air quality impacts from this growth.

Considering the nature of the proposed modification (physical changes to existing combustion turbines) and the limited number of on-site jobs that will be created, commercial and residential growth in the area due to them is expected to be very small. Further, the proposed modifications are not expected to cause industrial growth in the area as electric capacity allowing for such growth already exists. As a result, no significant industrial, commercial, or residential growth is expected due to the proposed modification.

Key Aspects of Proposed Permit Conditions

- **Emission Limits (By Pollutant)**
  The proposed permit includes the following emission limits for the two simple cycle turbines:

  NO_x limits were added:
  - 0.04 lb/MMBtu but does not include startup/shutdown
  - 9.0 parts per million by volume (ppmv) at 15% O_2 dry from NSPS GG, use of CEMS to demonstrate compliance
  - 67.1 pounds per hour (pph) as a BACT limit to account for all operating times (including startup and shutdown)
  - 15 ppm at 15% O_2 from NSPS Subpart KKKK, use of CEMS to demonstrate compliance
  - 334.6 tpy annual limit

  PM10 limits were added:
  - 10.8 pph as a BACT limit to check with testing
  - 0.007 lb/MMBtu with an average of 3 test runs as BACT
  - 47.3 tpy annual limit

  PM2.5 limits were added:
  - 10.8 pph as a BACT limit to check with testing
  - 0.007 lb/MMBtu with an average of 3 test runs as BACT
  - 47.3 tpy annual limit

  CO limits were added:
  - 0.021 lb/MMBTU, use of CEMS to demonstrate compliance
  - 175.6 tpy annual limit

  VOC limits were added:
  - 5.8 pph as VOC BACT
  - 24.5 tpy annual limit

  SO_2 limit was added:
  - 0.060 lb/MMBtu limit from NSPS (does not take effect until modification is completed)

  Formaldehyde limit added:
  - 9.4 tpy, carried forward from ROP

  Opacity limit was added:
  - 10% carried forward from ROP

  CO_2e limits were added:
  - 120 lb/CO_2e/MMBtu heat input as BACT
  - 1,065,441 tpy added as BACT

- **Usage Limits**
  The proposed permit only allows the combustion of pipeline-quality natural gas in the modified turbines. Pipeline quality natural gas is defined as 0.0006 lb/MMBTU sulfur content, which is equivalent to 0.2 grains total sulfur per 100 standard cubic foot. This equals 6.8 parts per million (ppm) by weight total sulfur or 3.4 ppmv total sulfur.

- **Process/Operational Restrictions**
  The proposed permit requires CEC to implement and maintain a Malfunction Abatement Plan for the simple cycle turbines. The plan includes requirements for proper maintenance and repairs to reduce malfunctions from occurring. It also includes a description of the corrective actions that will be taken in the event of a malfunction or failure in order to

achieve compliance with the associated emission limits. CEC will also be required to implement a plan that describes how they will minimize emissions during startup and shutdown operations.

- **Federal Regulations**
  The existing simple cycle turbines are currently subject to the NSPS for Stationary Combustion Turbines, 40 CFR Part 60 Subpart GG. If the proposed project is approved, the turbines will continue to be subject to NSPS Subpart GG until the AFS and AGS are installed and operating. At that point, they will become subject to the NSPS for Stationary Combustion Turbines, 40 CFR Part 60 Subpart KKKK and no longer subject to NSPS Subpart GG.

- **Testing & Monitoring Requirements**
  The proposed permit includes the following requirements for the modified simple cycle turbines:
  - Verify VOC, PM10, and formaldehyde emission rates through performance testing.
  - Calibrate, maintain and operate the existing CEMS for NO_x and CO.

Conclusion

Based on the analyses conducted, the proposed project would comply with all applicable state and federal air quality requirements. The project, as proposed, would not violate the federal NAAQS or the state and federal PSD Increments.

Based on these analyses, AQD staff have developed proposed permit terms and conditions to ensure that the facility's process design and operation are enforceable. Additionally, CEC would perform sufficient monitoring, recordkeeping, and reporting requirements to determine compliance with these terms and conditions. If the permit application is deemed approvable, the delegated decision maker may determine a need for additional or revised conditions to address issues raised during the public participation process.

If you would like additional information about this proposal, please contact Janelle Trowhill, AQD, at 517-582-5312 or TrowhillJ1@Michigan.gov.

Appendix 1
STATE AIR REGULATIONS

State Rule	Description of State Air Regulations
R 336.1201	Requires an Air Use Permit for new or modified equipment that emits, or could emit, an air pollutant or contaminant. However, there are other rules that allow smaller emission sources to be installed without a permit (see Rules 336.1279 through 336.1290 below). Rule 336.1201 also states that the Department can add conditions to a permit to assure the air laws are met.
R 336.1205	Outlines the permit conditions that are required by the federal Prevention of Significant Deterioration (PSD) Regulations and/or Section 112 of the Clean Air Act. Also, the same types of conditions are added to their permit when a plant is limiting their air emissions to legally avoid these federal requirements. (See the Federal Regulations table for more details on PSD.)
R 336.1224	New or modified equipment that emits toxic air contaminants must use the Best Available Control Technology for Toxics (T-BACT). The T-BACT review determines what control technology must be applied to the equipment. A T-BACT review considers energy needs, environmental and economic impacts, and other costs. T-BACT may include a change in the raw materials used, the design of the process, or add-on air pollution control equipment. This rule also includes a list of instances where other regulations apply and T-BACT is not required.
R 336.1225 to R 336.1232	The ambient air concentration of each toxic air contaminant emitted from the project must not exceed health-based screening levels. Initial Risk Screening Levels (IRSL) apply to cancer-causing effects of air contaminants and Initial Threshold Screening Levels (ITSL) apply to non-cancer effects of air contaminants. These screening levels, designed to protect public health and the environment, are developed by Air Quality Division toxicologists following methods in the rules and U.S. EPA risk assessment guidance.
R 336.1279 to R 336.1291	These rules list equipment to processes that have very low emissions and do not need to get an Air Use permit. However, these sources must meet all requirements identified in the specific rule and other rules that apply.
R 336.1301	Limits how air emissions are allowed to look at the end of a stack. The color and intensity of the color of the emissions is called opacity.
R 336.1331	The particulate emission limits for certain sources are listed. These limits apply to both new and existing equipment.
R 336.1370	Material collected by air pollution control equipment, such as dust, must be disposed of in a manner, which does not cause more air emissions.
R 336.1401 and R 336.1402	Limit the sulfur dioxide emissions from power plants and other fuel burning equipment.
R 336.1601 to R 336.1651	Volatile organic compounds (VOCs) are a group of chemicals found in such things as paint solvents, degreasing materials, and gasoline. VOCs contribute to the formation of smog. The rules set VOC limits or work practice standards for existing equipment. The limits are based upon Reasonably Available Control Technology (RACT). RACT is required for all equipment listed in Rules 336.1601 through 336.1651.
R 336.1702	New equipment that emits VOCs is required to install the Best Available Control Technology (BACT). The technology is reviewed on a case-by-case basis. The VOC limits and/or work practice standards set for a particular piece of new equipment cannot be less restrictive than the Reasonably Available Control Technology limits for existing equipment outlined in Rules 336.1601 through 336.1651.
R 336.1801	Nitrogen oxide emission limits for larger boilers and stationary internal combustion engines are listed.
R 336.1910	Air pollution control equipment must be installed, maintained, and operated properly.
R 336.1911	When requested by the Department, a facility must develop and submit a malfunction abatement plan (MAP). This plan is to prevent, detect, and correct malfunctions and equipment failures.
R 336.1912	A facility is required to notify the Department if a condition arises which causes emissions that exceed the allowable emission rate in a rule and/or permit.
R 336.2001 to R 336.2060	Allow the Department to request that a facility test its emissions and to approve the protocol used for these tests.

State Rule	Description of State Air Regulations
R 336.2801 to R 336.2810 Prevention of Significant Deterioration (PSD) Regulations **Best Available Control Technology (BACT)**	The PSD rules allow the installation and operation of large, new sources and the modification of existing large sources in areas that are meeting the National Ambient Air Quality Standards (NAAQS). The regulations define what is considered a large or significant source, or modification. In order to assure that the area will continue to meet the NAAQS, the permit applicant must demonstrate that it is installing the BACT. By law, BACT must consider the economic, environmental, and energy impacts of each installation on a case-by-case basis. As a result, BACT can be different for similar facilities. In its permit application, the applicant identifies all air pollution control options available, the feasibility of these options, the effectiveness of each option, and why the option proposed represents BACT. As part of its evaluation, the Air Quality Division verifies the applicant's determination and reviews BACT determinations made for similar facilities in Michigan and throughout the nation.
R 336.2815 – Additional Impact Analyses	Applies to "major stationary sources" and "major modifications" as defined in R 336.2801. The applicant must identify any impairment that might occur to visibility, soils, or vegetation as a result of the project.
R 336.2901 to R 336.2903 and R 336.2908	Applies to new "major stationary sources" and "major modifications" as defined in R 336.2901. These rules contain the permitting requirements for sources located in nonattainment areas that have the potential to emit large amounts of air pollutants. To help the area meet the NAAQS, the applicant must install equipment that achieves the Lowest Achievable Emission Rate (LAER). LAER is the lowest emission rate required by a federal rule, state rule, or by a previously issued construction permit. The applicant must also provide emission offsets, which means the applicant must remove more pollutants from the air than the proposed equipment will emit. This can be done by reducing emissions at other existing facilities. As part of its evaluation, the AQD verifies that no other similar equipment throughout the nation is required to meet a lower emission rate and verifies that proposed emission offsets are permanent and enforceable.

FEDERAL AIR REGULATIONS

Citation	Description of Federal Air Regulations or Requirements
Section 109 of the Clean Air Act – National Ambient Air Quality Standards (NAAQS)	The United States Environmental Protection Agency has set maximum permissible levels for seven pollutants. These NAAQS are designed to protect the public health of everyone, including the most susceptible individuals, children, the elderly, and those with chronic respiratory ailments. The seven pollutants, called the criteria pollutants, are carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), and sulfur dioxide (SO_2). Portions of Michigan are currently non-attainment for either ozone or SO_2. Further, in Michigan, State Rules 336.1225 to 336.1232 are used to ensure the public health is protected from other compounds.
40 CFR 52.21 – Prevention of Significant Deterioration (PSD) Regulations **Best Available Control Technology (BACT)**	The PSD regulations allow the installation and operation of large, new sources and the modification of existing large sources in areas that are meeting the NAAQS. The regulations define what is considered a large or significant source, or modification. In order to assure that the area will continue to meet the NAAQS, the permit applicant must demonstrate that it is installing BACT. By law, BACT must consider the economic, environmental, and energy impacts of each installation on a case-by-case basis. As a result, BACT can be different for similar facilities. In its permit application, the applicant identifies all air pollution control options available, the feasibility of these options, the effectiveness of each option, and why the option proposed represents BACT. As part of its evaluation, the Air Quality Division verifies the applicant's determination and reviews BACT determinations made for similar facilities in Michigan and throughout the nation.

Citation	Description of Federal Air Regulations or Requirements
40 CFR 60 – New Source Performance Standards (NSPS)	The United States Environmental Protection Agency has set national standards for specific sources of pollutants. These New Source Performance Standards (NSPS) apply to new or modified equipment in a particular industrial category. These NSPS set emission limits or work practice standards for over 60 categories of sources.
Section 112 of the Clean Air Act **Maximum Achievable Control Technology (MACT)** **Section 112g**	In the Clean Air Act, Congress listed 189 compounds as Hazardous Air Pollutants (HAPS). For facilities which emit, or could emit, HAPS above a certain level, one of the following two requirements must be met: 1) The United States Environmental Protection Agency has established standards for specific types of sources. These Maximum Achievable Control Technology (MACT) standards are based upon the best-demonstrated control technology or practices found in similar sources. 2) For sources where a MACT standard has not been established, the level of control technology required is determined on a case-by-case basis.

Notes: An "Air Use Permit," sometimes called a "Permit to Install," provides permission to emit air contaminants up to certain specified levels. These levels are set by state and federal law, and are set to protect health and welfare. By staying within the levels set by the permit, a facility is operating lawfully, and public health and air quality are protected.

The Air Quality Division does not have the authority to regulate noise, local zoning, property values, off-site truck traffic, or lighting.

These tables list the most frequently applied state and federal regulations. Not all regulations listed may be applicable in each case. Please refer to the draft permit conditions provided to determine which regulations apply.

Appendix 2

Best Available Control Technology Analysis (BACT) (Michigan Rule 336.2810 and 40 CFR 52.21(j))

Prevention of Significant Deterioration (PSD) New Source Review (NSR) requires a Best Available Control Technology (BACT) analysis with emissions limitations based on the maximum degree of control that can be achieved considering energy, environmental, and economic impact. BACT is usually expressed in a permit as an emission limit, and can be based on add-on control equipment, work practices, or modification of the production processes.

BACT must consider all available emission reduction options and proceeds in a "top-down" five-step process, per the USEPA Draft New Source Review Workshop Manual (October 1990) as follows:

1. Identify all control technologies;
2. Eliminate technically infeasible options;
3. Rank the remaining control technologies by control effectiveness;
4. Evaluate the most effective controls and document the results;
5. Select BACT (e.g., the most effective option not rejected is BACT).

As the following table shows, emissions from the proposed modifications to the simple cycle turbines will be above the SER for NO_x, PM10, PM2.5, and GHGs; therefore, the project is subject to the PSD regulations, which includes the requirement to meet BACT for those pollutants.

Table 1: Project Potential Emissions Summary

Pollutant	Baseline Actual Emissions (tpy*)	Project Actual Emissions (tpy)	Estimated Emissions Increase (tpy)	PSD Significant Emission Rate (tpy)	Subject to PSD & BACT?
NO_x	217.5	342.3	124.8	40	Yes
CO	46.9	53.4	6.5	100	No
PM	6.3	12.0	5.7	25	No
PM10	20.8	40.8	20.0	15	Yes
PM2.5	20.8	40.8	20.0	10	Yes
SO_2	4.1	6.5	5.7	40	No
VOCs	3.1	5.6	2.5	40	No
GHGs Measured as CO_2e	815,570	1,280,616	465,046	75,000	Yes

*tpy = tons per year

The remainder of this document outlines the BACT analysis performed by CEC for the subject pollutants.

<u>NO_x BACT Analysis</u>:
NO_x is generated in the turbines when natural gas is burned. Based upon a detailed analysis, including review of USEPA's RACT/BACT/LAER Clearinghouse (RBLC), CEC identified the following potential NO_x control technologies for the modified turbines:

- Clean fuels
- Dry Low-NO_x burner technology (DLN)
- Good combustion practices

- Selective Non-Catalytic Reduction (SNCR)
- Selective Catalytic Reduction (SCR)
- Water or Steam Injection
- XONON
- EM_x (Formerly $SCONO_x$)
- Non-Selective Catalytic Reduction (NSCR)

These control technologies were all reviewed for technical feasibility. It was determined that SNCR is not technically feasible because the exhaust temperature of the turbines is less than the temperature required for the technology to operate. XONON is not technically feasible because it has not been commercially demonstrated on large combustion turbines comparable to this project. The technology is only available for small turbines (1.5-18 MW) and the turbines in this project are much larger at approximately 192 MW. EM_x requires an operating temperature between 300°F and 700°F which is much lower than the exhaust of the turbines (1,105°F) and is therefore not technically feasible. NSCR is not technically feasible because the exhaust oxygen concentration from the turbines is much higher (at approximately 14%) than what the NSCR catalyst requires to operate (< 0.5%).

The remaining technically feasible control technologies were reviewed for control effectiveness, with SCR being found to have a greater NO_x control efficiency than DLN. Both technologies were then evaluated for cost effectiveness. Using USEPA's control cost estimator program, it was determined that NO_x control using SCR would cost $66,800,000 per turbine with annual costs of $9,300,000. This equates to a cost effectiveness of $40,400/ton NO_x. This amount shows that SCR is not economically feasible as control. DLN is an inherent part of the turbines and therefore the company did not estimate the cost effectiveness of the control.

CEC therefore determined BACT for NO_x to be the use of DLN burners, clean fuels (use of natural gas), and good combustion practices. CEC proposed a NO_x BACT emission limit of 9 ppm (dry basis) corrected to 15% O_2 during normal operation averaged over all operating hours within a calendar day. BACT was also determined to be 67.1 pph during normal operation (including startup and shutdown (SU/SD) events) averaged over all the operating hours in a calendar day since it is technically not feasible to stack test during SU/SD time periods. The hours of operation for startups and shutdowns will be limited to 182 hours for startup and 85 hours for shutdown. Compliance with the proposed NO_x limits will be demonstrated by the facility's existing NO_x CEMS. The AQD evaluated and concurred with CEC's NO_x BACT analysis.

<u>PM10 and PM2.5 BACT Analysis</u>:
PM10 and PM2.5 are emitted in small quantities from turbines as a result of incomplete combustion. Based upon a detailed analysis, including review of USEPA's RBLC, CEC identified the following potential PM10 and PM2.5 control technologies for the modified turbines:

- Clean Fuels
- Good Combustion Practices
- Add-on Particulate Control

The control technologies were then reviewed for technical feasibility. The use of add-on control technologies, such as a baghouse, an electrostatic precipitator, or a wet scrubber can provide control for solid and liquid fuel-combustion applications by removing filterable and/or condensable particulates. However, these add-on control technologies are not technically feasible for natural gas post-combustion emissions due to their capture limitations, and the very low particulate concentration levels. A review of the RBLC showed no add-on control technologies have been required as BACT for PM10 and/or PM2.5 emissions from natural gas-fired turbines.

All the projects specified clean fuels and/or good combustion practices as BACT. The use of clean fuels and good combustion practices were therefore selected as BACT by CEC for PM10/PM2.5 from the modified combustion turbines. CEC proposed BACT limits for PM10 and PM2.5 of 10.8 pph and 0.007 MMBtu/hr for each turbine. These values are similar to limits within the RBLC for similar equipment. The AQD evaluated and concurred with CEC's PM10/PM2.5 BACT analysis.

GHGs BACT Analysis:
GHGs are also generated in the turbines when natural gas is burned. Based upon a detailed analysis, including review of USEPA's RBLC, CEC identified the following potential GHG control technologies for the modified turbines:

- Carbon Capture, Utilization and Sequestration or Storage (CCUS)
- Clean fuels
- Good Combustion practices

CCUS is an emerging technology that involves capture of GHGs from the exhaust and transports it to an available sequestration site (like a geological formation). While not yet in wide usage, CCUS is considered a technically feasible control option. The costs associated with CCUS are threefold: the actual capture equipment installed on the process, transportation costs to a location where the gases can be stored, and long-term storage and facility maintenance costs. There are no potential available sequestration sites near the existing CEC Zeeland Generating Station. As such, a lengthy pipeline would need to be constructed and maintained to transport any GHG captured from the modified turbines. CEC estimated the cost of a CCUS system and associated transportation and storage costs on the modified turbines to be greater than the costs of the proposed modification, making such a system not cost effective.

CEC determined BACT for GHGs to be good combustion practices and the use of clean fuels. This is consistent with other entries in the RBLC. CEC also proposed a BACT limit for GHG of 120 lb CO_2e/MMBtu. The AQD evaluated and concurred with CEC's GHG BACT analysis.