



ADDITIONAL TECHNICAL INFORMATION FOR GAS TURBINES

The following information will be used for the technical review of a permit to install application for a **gas turbine**. This information is in addition to the general requirements outlined in the AQD document "Information for an Administratively Complete Permit to Install Application", Part 2 - Additional Supporting Information, Items A through F. All of the information may not be needed for each application. Also, this document may not be all inclusive. Additional information beyond that identified may be necessary to complete the technical review of any individual application. In the event a determination is made that new additional information is needed for a technical review, this document will be updated.

All referenced guidance documents are available at <http://www.deq.state.mi.us/aps> or you may contact the Permit Section at 517-373-7023.

A. Process Description

1. Describe each gas turbine by identifying the type (simple, combined, or regenerative cycle), and intended use (base loaded, emergency, or peaking).
2. Provide the maximum heat input based on the lower heating value of the fuel, in million Btu per hour, at ISO conditions (288°K, 60% relative humidity, and 101.3 kilopascals pressure).
3. Describe the proposed fuels to be fired including the lower heating value and maximum percent sulfur content, if other than natural gas.
4. Provide the maximum and expected fuel firing rate for each fuel, on an hourly and annual basis, at various ambient temperatures (-20°F, 0°F, 30°F, 50°F, 60°F, and 100°F).
5. Provide the manufacturer specific thermal efficiency in kilojoules per watt-hour.
6. If the turbine(s) is a combined cycle, describe the waste heat recovery boiler including the following:
 - a) The proposed fuels to be fired including lower heating value and maximum percent sulfur content, if other than natural gas.
 - b) The maximum heat input based on the lower heating value of the fuel, in million Btu per hour.
7. Describe how continuous compliance with the emission limits will be documented (continuous emissions monitor, parametric monitoring).

B. Regulatory Discussion

The following state air pollution control regulations may be applicable. Please review these regulations carefully to determine if they apply to your process and summarize the results in the application. The Air Pollution Control Rules may be viewed and downloaded from the AQD website at: www.michigan.gov/deqair.

1. State of Michigan, Department of Environmental Quality, Act 451 of 1994, Natural Resources and Environmental Protection Act, Part 55 Air Pollution Control and the following promulgated rules:
 - a) Rules 215 and 216 apply to an existing facility which has a current Renewable Operating Permit (ROP). A Permit to Install issued for the installation of new equipment or modifications to existing equipment is incorporated into an ROP pursuant to Rules 215 and 216.
 - b) Rule 220 applies to a major source and/or a major modification at a source which is located in a non-attainment area. A non-attainment area is one where the National Ambient Air Quality Standards (NAAQS) are not being met. Rule 220 requires compliance with the lowest achievable emission rate (LAER) and an emission reduction (offset) for each non-attainment air contaminant emitted in significant quantities as defined by Rule 119(e). However, a source may choose to "net out" of the requirements of Rule 220. Refer to "Guidelines for a Netting Demonstration" for additional detailed information.

- c) If the process or equipment was installed or modified after April 17, 1992, Rules 224 – 230 apply. Rule 224 requires the application of Best Available Control Technology for toxics (T-BACT) for all non VOC toxic air contaminants (TACs). T-BACT does not apply to emissions of VOCs. Rule 225 limits the emission impacts of TACs and requires a demonstration that the proposed emission of each TAC complies with a health-based screening level. Compliance can be demonstrated using any of three methods described in Rule 227(1) including the use of computerized dispersion modeling. Refer to “Guidelines for Conducting a Rule 224 T-BACT Analysis,” “TACs-Demonstrating Compliance with Rule 225,” and “Dispersion Modeling Guidance” for additional detailed information.
- d) Rule 301 specifies a process or process equipment shall not discharge visible emissions of a density greater than the most stringent of a 6-minute average of 20% opacity, or a limit specified by an applicable federal NSPS or as a condition of a Permit to Install.
- e) If the process or equipment was installed or modified after August 1, 1979, Rule 702 applies. This rule requires Best Available Control Technology (BACT) for new sources of volatile organic compounds (VOCs). Refer to “Instructions for Conducting a BACT Analysis” for additional detailed information.
- f) Part 8 Rules specify the emission limitations and prohibitions for oxides of nitrogen (NOx).
- g) Rule 901 prohibits emissions of an air contaminant in quantities that cause either a) injurious effects to human health or safety, animal life, plant life of significant economic value, or property; or b) unreasonable interference with the comfortable enjoyment of life and property. Submit the following to address this rule:

Describe the continuous fugitive dust control program to control dust from the plant, roads and yard during construction and operation of the facility.

- h) Rule 911 allows the Department to request a person to submit preventative maintenance and malfunction abatement program(s) for the process, emission control system(s), and monitoring system(s).
- i) Rule 912 requires the process to operate in a manner consistent with good air pollution control practices for minimizing emissions during start-up and shutdown. Please submit the following to address this rule:

A detailed description of the procedures and the methods used to insure that the necessary temperature in the combustion zone, when burning fuels other than, natural gas, propane, Nos. 1-6 fuel oil, wood or coal, is achieved and maintained during turbine start-up and shutdown and during periods when high moisture/low BTU waste is charged into the turbine. Include the type of auxiliary fuel and the maximum auxiliary fuel firing rate used for start-up. Provide all supporting assumptions, calculations, and other documentation.

2. Federal Prevention of Significant Deterioration (PSD), 40 CFR Part 52.21. The federal PSD regulations apply to a major source and/or a major modification at a source which is located in an attainment area. An attainment area is one where all the NAAQS are being met. However, as with the non-attainment permitting, a source subject to the PSD regulations may choose to “net out” of the requirements. Refer to “Federal PSD Requirements,” “Instructions for Conducting a BACT Analysis,” and “Guidelines for a Netting Demonstration” for additional detailed information.
 - The Clean Unit test is an alternate method for determining PSD applicability. It encourages industries to invest in control equipment by providing greater operational flexibility after the control equipment is installed. Refer to “Federal PSD Requirements” and the “PSD Workbook” which is available on the Internet at <http://www.deq.state.mi.us/aps/downloads/permits/PSD%20Workbook.pdf>.
3. The PSD increments (40 CFR 52.21 (c)) and the NAAQS (40 CFR 52.21(d)) apply to all sources throughout the United States, regardless of size. Compliance with these air quality standards can be demonstrated using computerized dispersion modeling. An applicant for a PSD permit is required to submit PSD increment modeling for PM-10, SO₂ and NO_x, and NAAQS modeling for PM-10, SO₂, NO_x, CO, Ozone, and Lead as part of the application. Modeling for sources not subject to PSD may be done by the AQD. Refer to “Dispersion Modeling Guidance” for additional detailed information.
4. Federal Standards of Performance for New Stationary Sources (NSPS), 40 CFR Part 60;
 - a) Subpart D, Fossil-Fuel Fired Steam Generators with a heat input capacity greater than 250 MMBtu per hour.

- b) Subpart Da, Electric Utility Steam Generating Units with a heat input capacity greater than 250 MMBtu per hour.
 - c) Subpart Db, Industrial-Commercial Institutional Steam Generating Units with a heat input capacity between 100 and 250 MMBtu per hour.
 - d) Subpart Dc, Small Industrial-Commercial Institutional Steam Generating Units with a heat input capacity between 10 and 100 MMBtu per hour.
 - e) Subpart GG, Standards of Performance for Stationary Gas Turbines.
5. National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 63, Subpart YYYY, Stationary Combustion Turbines.
 6. Acid Rain Provisions of Title IV of the federal Clean Air Act, 40 CFR Part 72.

C. Control Technology Analysis

1. Describe the emission control equipment for the turbines including both the expected and guaranteed efficiency (in percent) for each pollutant controlled.
2. For turbine(s) equipped with water or steam injection, provide the water or steam to fuel ratio, by weight, necessary to provide the control efficiencies at various ambient temperatures and relative humidities and describe the proposed monitoring and recording system for fuel consumption and the water/steam to fuel ratio.
3. Rule 702 BACT applies to all sources of VOCs proposed to be installed within the State of Michigan. A Rule 702 BACT analysis is very similar to a PSD top-down BACT analysis. Michigan's air pollution control rules also define BACT as an emission limit. Rule 702 BACT should be applied on a flexible grouping of equipment – subdivisions of emission units and/or groupings of emission units – as long as it is logical to do so. Logical means that the principles on which the groupings (or subdivisions) are made are consistent with federal guidance and sound engineering practices. Refer to "Instructions for Conducting a BACT Analysis" for additional detailed information.
4. Best Available Control Technology for Toxics (T-BACT) means the maximum degree of emission reduction which the Department determines is reasonably achievable for each process that emits toxic air contaminants (TACs) taking into account energy, environmental and economic impacts, and other costs. T-BACT does not apply to VOCs. The analysis must be specific to the process and the TACs subject to a T-BACT review. T-BACT limits can be expressed as an emission limit, control equipment requirements, and/or work practice standards. Refer to "Guidelines for Conducting a Rule 224 T-BACT Analysis" for additional detailed information.
5. Lowest achievable emission rate (LAER) applies to a major source and/or a major modification at a source located in a non-attainment area. Currently the only two pollutants which may be subject to LAER in Michigan are VOCs and NOx. LAER is defined as the lowest emission limitation contained in any State Implementation Plan (SIP) or the lowest emission limitation achieved in practice. Such an emission limit is presumed to be LAER for that source class and category. If an applicant proposes to meet this presumptive LAER, no site-specific control technology determination will be necessary. When an applicant believes the presumptive LAER limit is not achievable, a site-specific determination is required. This determination should include consideration of raw material changes, process changes, and add-on control equipment. The cost of these changes is not considered. Raw material and process changes should be evaluated through technology transfer (i.e., the likelihood that such a change will transfer from one industry to another), based on the manufacture of similar products or use of similar raw materials or fuels. Add-on controls should be evaluated based on the physical and chemical characteristics of the pollutant-bearing exhaust stream.

D. Emissions Summary and Calculations

1. Estimate the maximum and expected uncontrolled and controlled emission rates and estimated emissions during startup and shutdown of each of the following pollutants, in pounds per hour and tons per year, from the firing of each fuel at various ambient temperatures (-20°F, 0°F, 30°F, 50°F, 60°F, and 100°F). Provide all assumptions, calculations, stack tests, and other documentation used to derive these values. These

calculations should be done for both the turbine and duct burners, if the proposal is for a combined cycle unit.

- a) Particulate matter as total suspended particulate
 - b) Particulate matter as PM10 (particulate diameter less than 10 microns)
 - c) Sulfur dioxide
 - d) Nitrogen oxides, expressed as NO₂
 - e) Carbon monoxide
 - f) VOCs, including formaldehyde
 - g) Total Hazardous Air Pollutants (HAPs)
 - h) Mercury
2. For nitrogen oxides and carbon monoxide from the turbines, also provide the emission rates expressed in parts per million (ppm), corrected to 15% oxygen, on a dry gas basis. Include a curve of emission rate versus ambient temperature, and emission rate versus power output.