



**TransCanada**  
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April 24, 2019

Kristen Hart  
Wisconsin Dept. of Natural Resources – GEF2  
PO Box 7921  
Madison, WI 53707-7921

RE: Comments on Proposed Revisions to Wisconsin Administrative Code NR 406

Dear Ms. Hart:

TransCanada Pipeline Corporation (TransCanada) respectfully submits the following comments regarding proposed changes to Wisconsin Administrative Code Chapter NR 406. The comments we are submitting do not relate directly to the changes that Wisconsin Department of Natural Resources (DNR) has proposed for the rule but are instead related to adding an exemption that is not currently in NR 406.

TransCanada Pipelines owns and operates pipelines across much of the United States, including ANR Pipeline, ANR Storage, Great Lakes Gas Transmission and Northern Border Pipeline in the upper Midwest. To maintain pipeline pressure throughout the systems, natural gas compressor stations are located at approximately 75-mile intervals along each pipeline. In the upper Midwest, TransCanada operates combustion turbines which power centrifugal compressors for the transmission of natural gas through our pipelines in the following states: Michigan, Wisconsin, Illinois, Minnesota, North Dakota and South Dakota.

Most of the compressor facilities along our pipelines are required to obtain Title V operating permits. Individual states in this region have taken responsibility to implement and enforce the Title V air permitting program. While there are differences among these states in some aspects of the Title V program implementation and enforcement related to the natural gas transmission industry, Wisconsin differs significantly in that a construction permit is required prior to replacing a gas generator in small aero-derivative combustion turbines.

TransCanada considers gas generator changeouts to be Routine Maintenance, Repair and Replacement (RMRR) and are not be subject to PSD permitting requirements provided that the gas generator being replaced is an identical unit to the one being installed. Actual-projected-actual emission calculations show that even if the work is not considered RMRR, the gas generator replacement projects would not trigger PSD. Attachment 1 provides further detail regarding the EPA Multi-Factor Analysis and provides additional detail regarding the gas generator function and replacement process.

As with all machines, combustion turbines experience mechanical and thermal wear due to normal operation of the unit over time. To maintain units properly, all combustion turbine manufacturers recommend regularly scheduled maintenance, including a complete overhaul at set service intervals. Furthermore, the Federal Energy Regulatory Commission (FERC) requires

pipeline operators to conduct routine maintenance and service (including periodic overhaul) at all compressor facilities.

TransCanada relies on third-party contractors to perform gas generator overhauls, as the overhaul process can take up to six weeks to complete. Instead, spare gas generators are stored at several TransCanada facilities, and are available to be shipped where they are needed. The work to replace the gas generator takes only a few days to complete, reducing the unit downtime significantly compared to removing the gas generator, shipping it to a third party contractor, and waiting up to six weeks for it to be returned. As mentioned above, spare gas generators are identical to the unit being replaced.

TransCanada adheres to the manufacturer-recommended maintenance schedules for all units within the fleet. Attachment 2 is a white paper was written by Interstate Natural Gas Association of America (INGAA) in 2004 and describes the “current standard industrial practices – consistent with manufacturer recommended maintenance procedures – associated with turbine overhaul in the interstate natural gas transmission industry”. This white paper provides additional background on TransCanada’s position that gas generator changeouts are considered normal maintenance and should not require a construction permit.

Although Wisconsin does not have a specific exemption for gas generator changeouts, most other states in the Upper Midwest do provide either exemptions or permit language allowing this activity to occur without need for a construction permit. Examples of exemptions and permit language from other states in the Upper Midwest are included in Attachments 3 and 4.

Currently, a gas generator replacement at a facility in Wisconsin requires a construction permit for the following reasons:

- There are no specific exemptions under NR 406.04(1) that apply to these changeouts;
- The maximum theoretical emissions of the turbines exceed the general exemption thresholds under NR 406.04(2); and
- The gas generators constitute a basic emissions unit and therefore would not qualify as an exempt replacement under NR 406.04(6).

Because gas generator replacement is a common industry practice and that emissions from the unit following a gas generator replacement are not expected to exceed permitted emission limits, TransCanada believes that this activity should be exempt from requiring a construction permit. TransCanada proposes the following language to be inserted at NR 406.04:

NR 406.04(1)(zj): Replacement of the gas generator or power turbine on a simple cycle combustion turbine, provided that the following conditions are met:

1. The gas generator or power turbine are the same model as the gas generator or power turbine being replaced;
2. The replacement gas generator or power turbine does not increase the heat input capacity of the combustion turbine;
3. The replacement gas generator does not cause emissions to exceed current permit limits.

Please review the enclosed information let me know if you have any questions or require any further information. I can be reached at (715) 758-3341 or at [Chris\\_Waltman@TransCanada.com](mailto:Chris_Waltman@TransCanada.com).

Sincerely,



Chris Waltman  
Senior Air Quality Specialist  
TransCanada – US Pipelines

Cc: Houston Environment File

Enc.

# **ATTACHMENT 1**

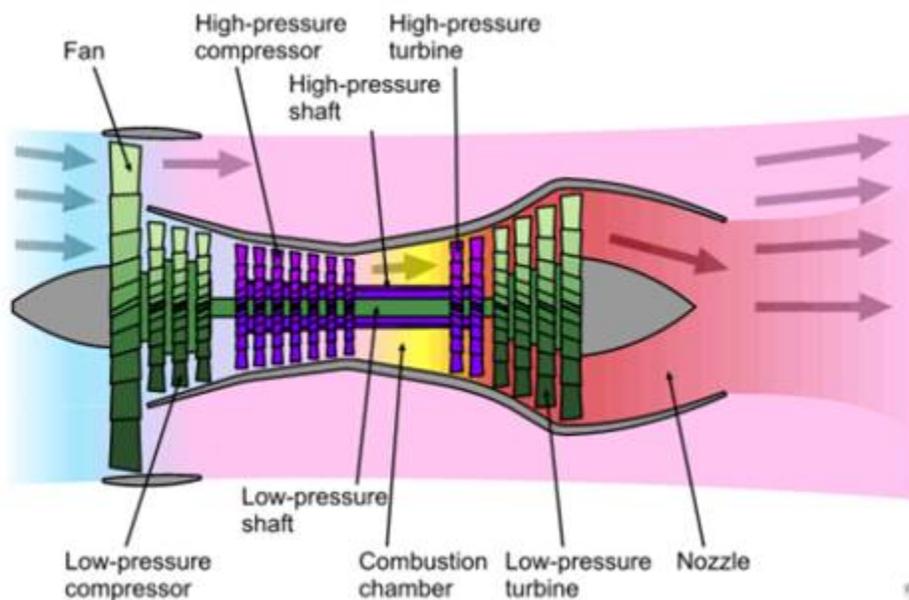
## **EPA MULTI-FACTOR TEST FOR ROUTINE MAINTENANCE, REPAIR AND REPLACEMENT DETERMINATIONS**

## Nature and Extent of the Project:

Small aero-derivative combustion turbines are commonly used in the natural gas transmission industry as the prime mover for centrifugal compressors. As with any machine, combustion turbines require ongoing maintenance. However, maintenance alone cannot prevent parts from wearing out over extended periods of time. Combustion turbine manufacturers have recommended major overhaul schedules, which are approximately 30,000 operating hours (depending on manufacturer).

The components of the gas generator are:

- a. Axial compressor
- b. Combustor
- c. High pressure turbine
- d. Power turbine (not pictured below)



The gas generator is composed of the axial compressor, the combustor and the high-pressure turbine. The axial compressor is the cold air section of the gas generator, and is used to compress air into the combustor. The combustor is where the cold air charge is mixed with fuel and where the fuel is combusted to create the exhaust gasses that drive the high-pressure turbine. The high-pressure turbine is connected to the axial compressor by a shaft, and this rotation causes more air to be forced into the combustor, thus generating more power.

Exhaust gasses from the gas generator are then used to drive the power turbine (not pictured above). The power turbine receives hot exhaust gas from the gas generator and converts the energy from the exhaust gas flow into mechanical energy, which is used to turn the centrifugal natural gas compressor. The centrifugal compressor provides flow through the pipeline.

Additional components associated with a combustion turbine are the intake and filtration structure, exhaust stack, unit operation controls, centrifugal compressor and the compressor building.

The gas generator and power turbine components that may be rebuilt or replaced during an overhaul include:

- Front bearing housing
- Inlet guide vanes
- Compressor cases
- Stator vanes
- Bleed valves
- Compressor wheels and shaft
- Compressor outlet casing
- Compressor rotor blades
- Internal wheelcase
- Air intake snouts
- External wheelcase
- Nozzle box and rear bearing housing
- Turbine rotor assembly
- Flame tubes and air casing

Many of the items noted above also have subcomponents which may also be replaced during an overhaul.

A major overhaul of the gas generator involves disassembly of the unit and evaluating all parts for wear, corrosion, erosion deposits and damage. Any parts deemed out of specification are replaced with parts meeting original manufacturer's specifications. GLGT is not equipped to perform this type of work. The combustion turbine manufacturer or third-party contractors perform combustion turbines for GLGT facilities.

The gas generator overhauls utilize turbine manufacturer replacement components. Using like-for-like components during the overhaul ensures that the gas generator changeout is also like-for-like, as all components and the complete gas generator assembly are the exact same make and model as the one that is being replaced. Unit output (horsepower), heat input (mmBtu/hr), throughput (mmscf/day) and emissions (lb/mmBtu and lb/hr) for the replacement gas generator are the same as the original unit.

The turbines located on the GLGT and ANR systems (Solar, GE and Rolls Royce) have designed the gas generators to be easily removed and replaced with the same model. A spare gas generator is installed on the unit instead of overhauling the existing gas generator because a major overhaul on a gas generator is time-consuming process, often taking six weeks or more to complete. The process of changing out a gas generator takes only a few days.

An overhauled gas generator is kept at a company storage facility until it is used to replace an existing gas generator that has reached the number of operating hours to trigger an overhaul. The

gas generator that was removed is then sent off-site to be overhauled and returned to the company stock when the work is completed.

### **Purpose of Gas Generator Changeouts:**

A combustion turbine can operate indefinitely, assuming the manufacturer-recommended services (including overhaul) are performed at specified intervals. Many of the combustion turbines operating on the GLGT and ANR systems were installed in the 1960s and are still in operation today. The range of installation dates for combustion turbines on the GLGT and ANR systems in Wisconsin range from 1965 to 2012.

The gas generator portion of a combustion turbine has a limited service life. As with all machines, parts wear out or become fatigued. Turbine manufacturers have developed maintenance practices to ensure that turbine units are able to operate in a safe and reliable manner. Maintenance practices include overhaul, which occurs at approximately 30,000 hours (depending on manufacturer). A unit is typically inspected about half-way through this period to ensure that excessive wear is not taking place and that the gas generator is suitable for continued operation.

The operating capacity of a gas compressor unit is not expected to change from the original design capacity at the time that the unit is overhauled. The purpose of the major overhaul is to ensure the safe and reliable operation of the unit, and to avoid potentially costly and dangerous damage to a unit that is worn beyond manufacturer's specifications. Further, all TransCanada compressor facilities are regulated by Federal Energy Regulatory Commission (FERC), which has prescriptive requirements for ongoing maintenance (including overhaul) to ensure safe, reliable operation of the compressor.

Similarly, unit efficiency is not significantly degraded during the period between installation of a new gas generator and the time it is ready to be overhauled. Combustion turbine efficiency is affected primarily by ambient conditions (air temperature, air pressure and elevation) and pipeline conditions (suction pressure and discharge pressure). Gas generator overhauls do not typically improve the efficiency.

### **Frequency of Gas Generator Overhauls:**

The frequency at which gas generators are overhauled is dictated by manufacturer recommendations. Manufacturers typically recommend a major overhaul at 30,000 to 35,000 operating hours. While some units operating on active pipelines may reach 30,000 hours in a matter of four or five years, other units may take 10 years or longer as the pipeline they serve is not as active.

### **Cost of Gas Generator Replacement:**

A gas generator replacement costs approximately \$1.5 million. This cost varies depending on the size of the gas generator. Gas generator replacement cost also varies by manufacturer. These costs are included in TransCanada's operation and maintenance budget and are rarely capitalized. Any capitalized projects are reviewed for any air permitting compliance requirements and all necessary air permits are obtained prior to the start of construction. For the purposes of this document, TransCanada is limiting the discussion to only gas generator changeouts that are included in the O&M budget.

TransCanada has analyzed the cost to replace a gas generator versus the cost to replace the combustion turbine unit numerous times. It has been determined that the gas generator replacement cost is significantly less than 50% of the replacement cost, and that the cost trigger for NSPS is not reached as a result of the work. The "average" cost of replacing a complete combustion turbine, including the ancillary systems, is approximately \$20 million. These evaluations are completed on a case-by-case basis each time a gas generator is replaced to verify whether or not the work will trigger NSPS for the unit.

## **ATTACHMENT 2**

# **THE ROUTINE OVERHAUL OF NATURAL GAS-FIRED COMBUSTION TURBINES IN INTERSTATE NATURAL GAS TRANSMISSION SERVICE**

The following white paper was written by Interstate Natural Gas Association of America (INGAA) in 2004 and describes the “current standard industrial practices – consistent with manufacturer recommended maintenance procedures – associated with turbine overhaul in the interstate natural gas transmission industry”. This white paper provides additional background on TransCanada’s position that gas generator changeouts are considered normal maintenance, and should not require a construction permit.

FINAL  
4/7/05

**The Routine Overhaul of  
Natural Gas-Fired Combustion Turbines  
in Interstate Natural Gas Transmission Service**

December 2004



**Interstate Natural Gas Association of America**

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## EXECUTIVE SUMMARY

Natural gas transmission compressor stations utilize gas turbines to drive gas compressors. These compressor stations ensure that pipeline pressures are maintained to transport natural gas along pipeline routes throughout the United States. The industrial-scale or aero-derivative turbines used in pipeline applications range in size from approximately 1000 horsepower (hp) to 40,000 hp (0.75 to 30 megawatt (MW)). Over 75% of the turbines in interstate natural gas transmission service are rated at less than 10,000 hp (7.5 MW), with an average size of 6900 hp and a median size of 4800 hp. These turbines are much smaller than units typical for other applications such as power generation. For example, the EPA AP-42 document indicates that the *average* size gas turbine in the United States is 40,200 hp – which is larger than nearly all of the units used in interstate natural gas transmission. The smaller turbines in gas transmission provide options for overhaul that are not possible for larger turbines.

For the smaller industrial turbines, maintenance includes an approach to overhaul of turbine components that was developed by the turbine manufacturers and has been an industry standard for over 30 years. This maintenance practice involves completing an overhaul by like-kind replacement of major turbine components and is conducted by the turbine manufacturer or a third party service provider after approximately 30,000 hours of operation. Overhaul is routinely required to ensure that the turbine can operate in a safe and reliable manner.

In recent years, turbine maintenance practices have been reviewed by a number of federal, state, and local regulatory agencies. The overhaul procedures used in gas transmission have been routinely implemented for over 30 years – and predate the advent of NSR/PSD and NSPS.

This White Paper discusses the current standard industrial practices – consistent with manufacturer recommended maintenance procedures – associated with turbine overhaul in the interstate natural gas transmission industry. The objective is to provide technical background that better defines the standard practice of component replacement or

exchange that is integral to overhaul as part of routine maintenance for small industrial turbines. The following key points are relevant to understanding turbine overhaul practices for units in interstate natural gas transmission service:

1. Routine maintenance to ensure safe and reliable operation of a combustion turbine includes periodic overhaul of the gas generator and power turbine components. Manufacturer recommendations for overhaul vary somewhat, but overhauls are typically recommended approximately every 30,000 hours of operation.
2. During the overhaul process, major turbine components may be replaced or repaired, as noted in the EPA support document for the gas turbine NSPS and recommended by the manufacturer.
3. As described by Solar Turbines, Incorporated, the major supplier of industrial-scale turbines for gas transmission service, turbines are designed with fundamental assumptions regarding certain maintenance and repair activities – including overhaul of the gas generator and power turbine at regular intervals. For the past 30 years, Solar has conducted routine overhaul in centralized locations through an exchange program, and estimates that about 80% of these overhauls have been completed using component exchange.
4. The overhaul process does not change the basic design parameters of the turbine process unit or increase horsepower output, heat input, or brake-specific emissions compared to the original unit. While horsepower uprates can be included as an option at the time of major overhauls, such uprates are subject to distinct contractual arrangements and are not part of normal routine maintenance contract provisions. The industry recognizes that horsepower uprates would not be routine maintenance under PSD, NSR, minor NSR, and NSPS, and would obtain the appropriate permits for these uprates as required. For the interstate natural gas transmission industry, power uprates that change pipeline capacity may also require approval by the Federal Energy Regulatory Commission (FERC).
5. Many combustion turbines in natural gas transmission service were designed by the manufacturer with modular gas generator and power turbine components. When overhaul or other routine maintenance is required, the module can be removed from the turbine process unit structure and transported offsite for maintenance or repair.

This offsite maintenance procedure available to components from industrial-scale turbines – but not larger turbines – provides the ability to utilize specialized tooling and enhance quality assurance and control. In fact, some industrial-scale turbines include a solid or limited access case for the gas producer component, which limits access for on-site overhaul and is indicative of a design intended for central facility overhaul.

6. For over 30 years, industry practice has included the installation of functionally equivalent gas generator and power turbine components to replace the components in need of overhaul. An entire industry has been developed to provide this very service for industrial-scale units. Gas generator and/or power turbine replacements do not increase horsepower output, heat input, or brake-specific emissions compared to the original combustion turbine. Major overhaul of turbine gas generator or power turbine modules is the same – resulting in an overhauled component that meets original design specifications – whether or not the original module is returned to the facility or is added to a replacement component inventory.

Overhaul practices meet the definition of routine maintenance and therefore should not be considered a modification under NSR. As the cost of such maintenance is well below 50 percent compared to the cost to build a new turbine process unit, such practices do not represent “reconstruction” under NSPS. The component replacement approach for small industrial scale turbines is a routine and long-standing practice – consistent with manufacturer recommendations to utilize centralized overhaul facilities. The position that this process is routine maintenance is appropriate regardless of whether the original component is reinstalled after overhaul or a functionally equivalent replacement component is installed.

Finally, there are no apparent environmental objectives at stake in the present discussion of routine maintenance for turbines, since the maintenance practices do not result in a change in the basic design parameters (e.g., rated load or heat input), increased capacity, increased emissions, or artificial extension of turbine life. To the contrary, the current maintenance practices that include overhaul ensure emissions performance, as well as safe and reliable operations.

## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>i</b>
<b>I. INTRODUCTION.....</b>	<b>1</b>
<b>II. NATURAL GAS-FIRED COMBUSTION TURBINES IN INTERSTATE NATURAL GAS TRANSMISSION SERVICE .....</b>	<b>4</b>
<b>A. Background and Turbine Description .....</b>	<b>4</b>
<b>B. EPA Description of Turbines.....</b>	<b>8</b>
<b>III. OVERHAUL OF THE GAS PRODUCER AND/OR POWER TURBINE COMPONENTS.....</b>	<b>9</b>
<b>A. Overhaul Process .....</b>	<b>10</b>
<b>B. Turbine Components Subject to Inspection, Maintenance, and Overhaul .....</b>	<b>11</b>
<b>C. Overhaul Interval.....</b>	<b>13</b>
<b>D. Power Uprates and Material Upgrades During Overhaul.....</b>	<b>14</b>
<b>E. Industry Practices for Turbine Overhaul and Component Replacement .....</b>	<b>15</b>
<b>Gas Generator and/or Power Turbine Replacement .....</b>	<b>15</b>
<b>Turbine Manufacturer Description of Replacement Program ....</b>	<b>18</b>
<b>Overhaul Shop .....</b>	<b>19</b>
<b>On-site Repair.....</b>	<b>20</b>
<b>IV. REGULATORY CONTEXT FOR OVERHAUL .....</b>	<b>20</b>
<b>A. "Modification" Under NSR or NSPS .....</b>	<b>20</b>
<b>B. "Reconstruction" Under NSPS.....</b>	<b>22</b>
<b>V. CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>23</b>

## I. INTRODUCTION

This paper describes the routine overhaul of the gas generator<sup>1</sup> and/or power turbine<sup>2</sup> components of industrial-scale natural gas-fired combustion turbines used in interstate natural gas transmission service. In particular, the paper focuses on the use of replacement gas producer and/or power turbine components as part of routine maintenance procedures. The component replacement approach to overhaul is recommended and supported by turbine manufacturers and has been employed for gas turbines in the interstate natural gas transmission industry for over 30 years. This paper has been developed to provide EPA and state and local agencies with background information regarding routine overhaul of the gas generator and/or power turbine components, which is conducted as a part of routine maintenance for natural gas-fired turbines.

The technical support document for the Turbine NSPS (EPA-450/2-77-017a) indicated unambiguously in 1977 that overhaul represented routine maintenance for natural gas-fired turbines. Under EPA's General Provisions for NSPS, 40 CFR 60.14(e)(1), and under the PSD regulations at 40 CFR 51.166(b)(2)(iii)(a), this maintenance is exempt from the regulatory definition of "modification." As described further in this paper, the use of replacement gas producer and/or power turbine components has been an integral part of routine overhaul for over 30 years. Indeed, for most aero-derivative<sup>3</sup> and lightweight industrial turbine models, manufacturers designed the turbines so that overhaul can be efficiently completed by removing and replacing the modular gas producer and/or power turbine components as a part of the overhaul procedure. Therefore, the use of replacement gas producer and/or power turbine components as a part of routine overhaul procedures should be exempt from the regulatory definition of "modification."

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<sup>1</sup> "Gas generator" is used in this paper to refer to the component of a natural gas-fired combustion turbine that creates high pressure, high temperature gas for expansion through the power turbine. Some manufacturers refer to this component as a "gas producer" or "HP wheel."

<sup>2</sup> "Power turbine" is used in this paper to refer to the component of a natural gas-fired combustion turbine that converts high energy gases from the gas producer into shaft power. Some manufacturers refer to this component as an "axial compressor."

<sup>3</sup> The term "aero-derivative" is used to describe natural gas-fired combustion turbines that are designed using the same principles employed in the design of turbines used for aviation. These turbines typically are designed to be compact, lightweight, and portable.

In recent years, INGAA communications with EPA have noted that there have been inconsistent interpretations regarding the status of component replacement as an established part of the overhaul process, and thus routine maintenance for natural gas-fired turbines. For example, INGAA submitted a letter to EPA on July 27, 2001<sup>4</sup>. While many permitting agencies accept the use of replacement gas generator and/or power turbine components as routine maintenance, some agencies have considered this practice a modification, potentially subject to NSPS and NSR review.

To clarify this issue and ensure that this routine maintenance procedure is universally recognized, it is necessary to understand what practices constitute maintenance for natural gas-fired combustion turbines used in the interstate natural gas transmission industry. In the July 27, 2001 letter to EPA, INGAA requested that EPA clarify that overhaul is routine maintenance, and therefore exempt from consideration as a modification under NSR or NSPS. Such clarification was not issued in response to INGAA requests, as EPA awaited release of the revised Routine Maintenance, Repair, and Replacement (RMRR) regulations. Implementation of the revised RMRR regulations<sup>5</sup> is still pending, and, while some material in the new NSR regulations provide additional insight into EPA's view of turbine overhaul, definitive clarification is still needed. Thus, this document provides background on the standard overhaul practices that have been employed for decades for industrial-scale turbines in gas transmission service to further clarify that current the practice is routine maintenance.

Since the primary components of a small industrial-scale combustion turbine are much smaller than "typical" turbines in the U.S., an efficient overhaul approach is available that is not feasible for larger units. The size of turbine components for units in gas transmission are designed for easy removal from the overall turbine unit so that the components can be transported to a centralized, controlled facility for overhaul. This is not the case for larger turbines – such as those used in utility applications. Due to the logistics of the overhaul process for industrial-scale turbines, replacement gas generators and related assemblies have been used as a part of routine turbine maintenance procedures for over 30 years. This practice

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<sup>4</sup> INGAA Comments on New Source Review 90-Day Review and Report to the President, Letter to Office of Air and Radiation Docket Information Center, July 27, 2001.

<sup>5</sup> 68 FR 61248, October 27, 2003.

allows the overhaul to be conducted in a centralized facility, limits downtime, reduces the cost of overhaul, and enhances the quality of the overhaul. The centralized facility has a more highly trained and specialized staff, and allows the overhaul to be completed in a controlled environment using specialized tooling and advanced quality control procedures that are not achievable in a field environment. Also, the centralized overhaul facility provides the ability to complete post-overhaul tests at these maintenance sites to assure that overhauled components achieve rigorous performance specifications

This paper provides EPA and state/local agencies with information regarding the routine overhaul practices for natural gas-fired turbines used in the interstate natural gas transmission industry, including the overhaul practice for the past 30 years that uses replacement of gas generator and/or power turbine components as a part of routine maintenance procedures. The paper focuses on natural gas-fired combustion turbines in interstate natural gas transmission service. The paper does not address specifics of the overhaul practices that are employed by other industries that use natural gas-fired combustion turbines – including larger turbines such as utility-scale applications where component replacement is not feasible due to size limitations.

Section II of the paper provides an overview of natural gas-fired combustion turbines in interstate natural gas transmission service. Section III discusses the overhaul of the gas producer and/or power turbine components of a natural gas-fired combustion turbine, including an overview of the need for overhaul and the overhaul process, the overhaul interval, power uprates, and the use of replacement components. Section IV discusses the regulatory context for overhaul. Section V presents conclusions and industry recommendations to EPA.

## **II. NATURAL GAS-FIRED COMBUSTION TURBINES IN INTERSTATE NATURAL GAS TRANSMISSION SERVICE**

The interstate natural gas transmission industry uses natural gas-fired combustion turbines to provide power to move natural gas within the pipeline system. The industry relies on the turbine operation to provide continuous and uninterrupted service of the natural gas pipeline system, as required by the Federal Energy Regulatory Commission (FERC).

### **A. Background and Turbine Description**

For the interstate natural gas transmission industry, natural gas compression is achieved along the pipeline system using combustion turbines driving centrifugal compressors or two-stroke and four-stroke reciprocating engines driving reciprocating compressors. These units are located at compressor stations placed along a natural gas pipeline at intervals of approximately 70 miles. Combustion turbines used in natural gas transmission compression have been identified as a key technology in reducing air emissions such as NO<sub>x</sub> and greenhouse gases, as compared to other technologies. There are more than 1100 of these units in service in the interstate natural gas transmission industry. The interstate natural gas transmission industry is regulated by the Federal Energy Regulatory Commission (FERC) and Department of Transportation (DOT), and is obligated to maintain operational availability of pipeline equipment to ensure the delivery of natural gas.

The turbines used in gas transmission service are primarily mass-produced aero-derivative models and lightweight industrial turbines. The principal manufacturers of these turbines are Rolls Royce, General Electric, Allison, and Solar Turbines. Based on a database developed by the interstate natural gas transmission industry, Solar is the predominant vendor, with 62% of the units, followed by GE with 20%. In general, these turbines are small, easily transportable simple-cycle or regenerative turbines. The capacity of individual units used in gas transmission ranges from about 1000 to 40,000 hp, with 75% of the units rated at less than 10,000 hp (7.5 MW). This contrasts with the 40,200 hp average size for turbines in the U.S. as noted by EPA in the AP-42 document. A description of the turbine population in gas transmission service includes:

- An average size of 6900 hp;
- A median size of 4800 hp (52% of the units are less than 5000 hp);
- 87% of the units are less than 10 MW (13400 hp);
- Less than 3% of the units exceed 20,000 hp;
- The largest turbine identified in interstate gas transmission (39,700 hp) is smaller than the average size turbine identified by EPA in the AP-42 document (40,200 hp).

Clearly, turbines in natural gas transmission service are much smaller than a “typical” unit in the U.S. population. The size of the units in gas transmission service makes them amenable to an overhaul approach that is not possible for a typical U.S. turbine.

If it is not clarified that overhaul using component replacement is an accepted routine maintenance activity, turbine operators will face unnecessary delays and costs associated with permitting questions that sometimes arise when completing an overhaul. Some questions arise due to confusion regarding description of the hardware that comprises a natural gas-fired combustion turbine.

In describing natural gas-fired combustion turbines, three *primary* components are frequently identified. For example, the EPA AP-42 document states that there are three major components: the compressor, combustor, and power turbine. Similarly, the support document<sup>5</sup> for the Turbine NSPS identifies these three primary components for a simple cycle turbine. However, although these may be primary components, they do not comprise the entire turbine, and an array of additional components and subsystems are integral to a turbine process unit. Such systems include the air delivery system, exhaust system, power drive system, fuel system, lubrication and cooling system, system controls, starting system, and associated support infrastructure. Collectively, a natural gas-fired combustion turbine includes all of this hardware.

The three major components identified above are also the components most subject to wear -- and the need for routine maintenance. In discussing routine overhaul, two components are

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<sup>5</sup> EPA-450/2-77-017a, Standards Support and Environmental Impact Statement Volume 1: Proposed Standards of Performance for Stationary Gas Turbines, Section 3.2.1.1 and Figure 3-5, September 1977.

frequently discussed: the gas generator (or gas producer), which includes the axial compressor and combustor, and the power turbine. As discussed below, for industrial-scale turbines, manufacturers have designed and constructed these components as modular systems to add efficiency, quality control, and simplicity to the overhaul process.

Examples of natural gas-fired combustion turbines are shown in the figures below. In Figure 1, a skid mounted turbine unit is shown. This unit does not include peripheral equipment associated with the unit's installation into an industrial process, such as a compressor-driver at a natural gas compressor station. A schematic of the primary hardware for a turbine used to drive a compressor is shown in Figure 2. This figure also labels the main turbine components. Figure 3 presents a picture of a combustion turbine in compressor service at a gas transmission facility. Figure 4, from the Turbine NSPS support document, shows a cutaway view of a turbine cross section that focuses on the gas generator and power turbine components.

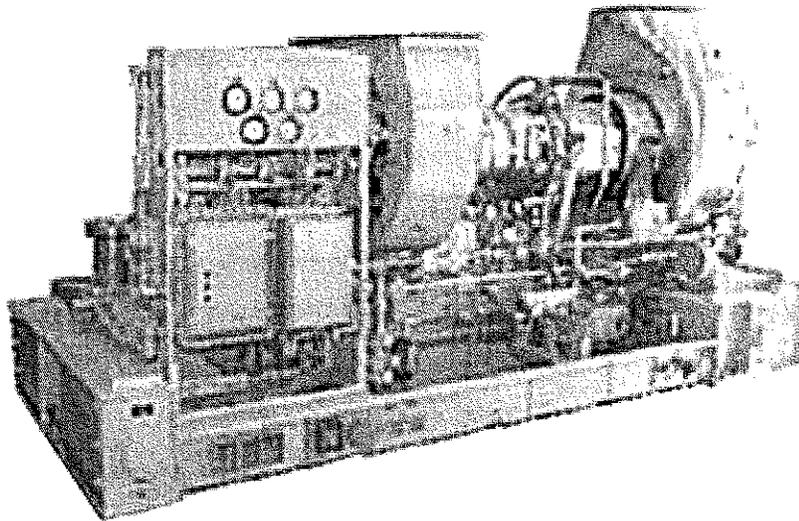


Figure 1: Gas Turbine

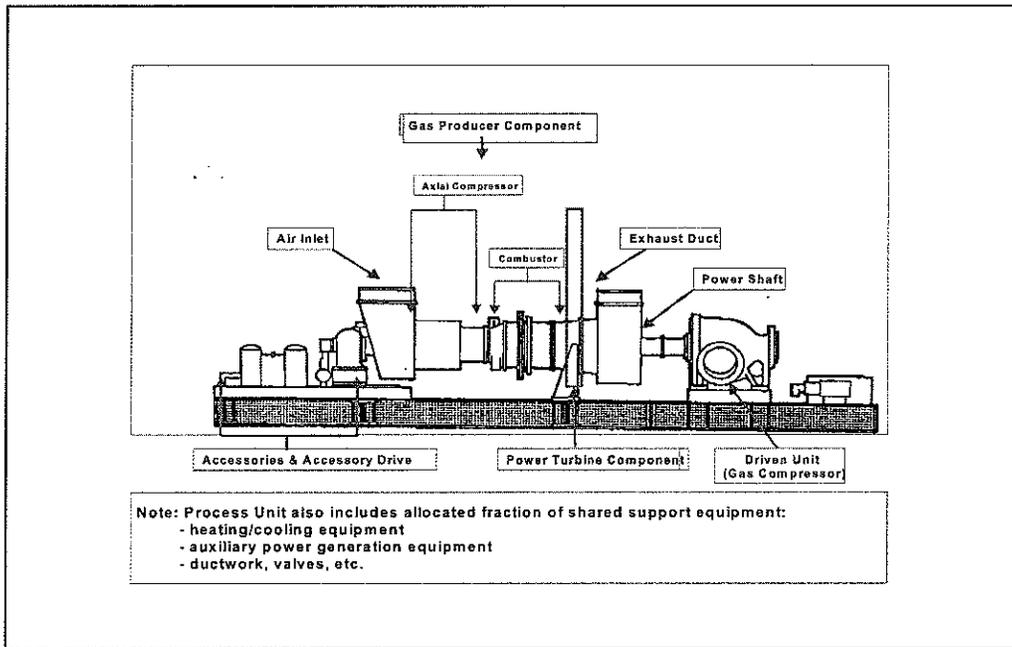


Figure 2. Schematic of Turbine Compressor System

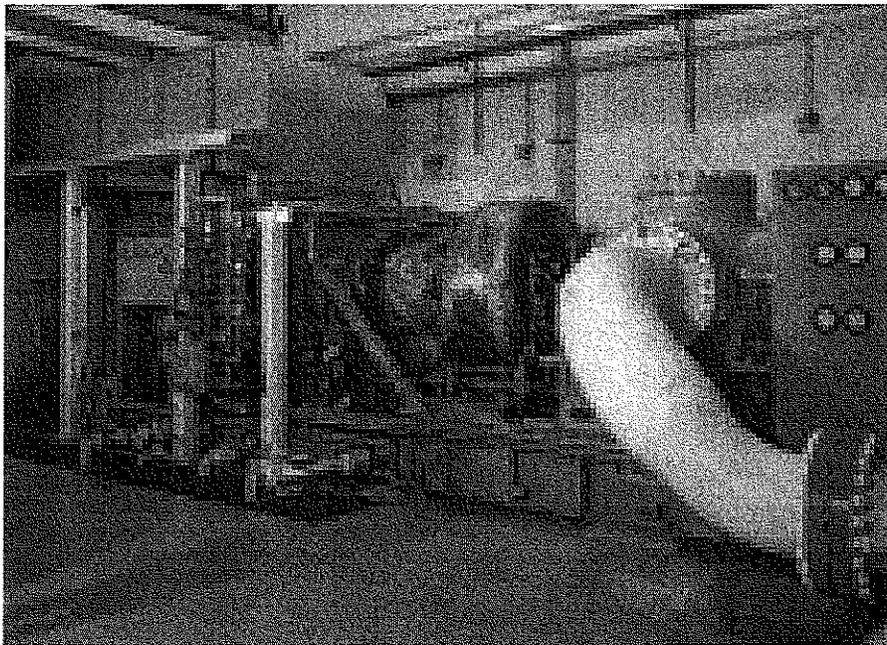


Figure 3. Gas Turbine Installation at a Compressor Station

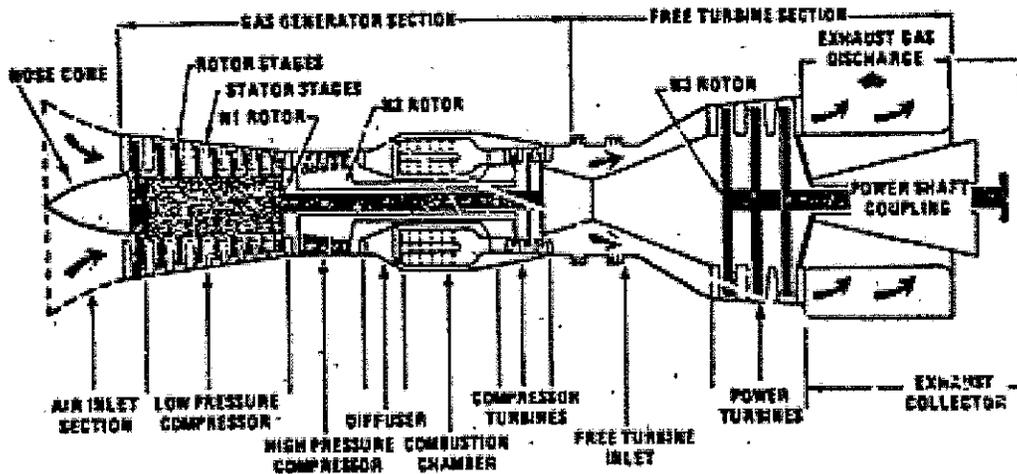


Figure 4. Simple Cycle Turbine Cross-Section showing the Gas Generator and Power Turbine<sup>6</sup>

## B. EPA Description of Turbines

EPA documents include descriptions of the components that make up a turbine. As shown in Figure 4, the Support Document and Environmental Impact Statement for the Turbine NSPS (40 CFR part 60, subpart GG) indicates that a turbine includes an air inlet section, gas generation section, free (or power) turbine section, and exhaust collection. The document also identifies the control system, fuel system, and lubrication system as part of a turbine.

The EPA AP-42 document and Turbine NSPS support document indicate that a simple cycle gas turbine includes three *major* components: compressor, combustor, and power turbine. The descriptions identify the primary components, but in no way imply that other system components are not relevant. The AP-42 document also indicates that the average size turbine is 40,200 hp (30 MW). This national “average” turbine is larger than nearly all of the units used in gas transmission, and considerably larger than the 6900 hp average size turbine in interstate natural gas transmission.

<sup>6</sup> EPA-450/2-77-017a, Figure 3-6.

As another example, the PSD/NSR Equipment Replacement Provision of the Routine Maintenance, Repair, and Replacement Exclusion (ERP exclusion), published in the Federal Register on October 27, 2003, includes text on turbine applications in natural gas transmission when discussing what comprises a “process unit”. EPA notes that the process unit definition for a natural gas compression station turbine comports well with the general definition of process unit, stating in the preamble that:

For a *natural gas compressor station*, each compressor system, together with its proportionate share of common support equipment is a separate process unit. This would generally consist of the air inlet system, accessory drive system, gas producer, fuel delivery system, cooling system, lube system, power turbine, power shaft, control system, starting system, exhaust system, and support facilities (e.g., auxiliary power generating equipment, heating/cooling equipment, station and yard pipe, valves, etc.).

The preamble also acknowledges that replacement of equipment components is considered in equipment design, using turbines in natural gas transmission service as an example:

...manufacturing equipment often is built with expendable components. For example, industrial gas turbines, such as those used to drive compressors on natural gas pipelines, regularly need to have components replaced as they wear out due to the high temperature and pressure conditions inside the turbine. In fact, these gas turbines are built with the knowledge and expectation that such replacements will be needed. In recognition of this fact, under the New Source Performance Standard for gas turbines, 40 CFR part 60, subpart GG, we have concluded that “replacement of stator blades, turbine nozzles, turbine buckets, fuel nozzles, combustion chambers, seals, and shaft packings” are not “changes” for regulatory purposes.

### **III. OVERHAUL OF THE GAS GENERATOR AND/OR POWER TURBINE COMPONENTS**

Turbines operate under a variety of stress, temperature, and corrosion conditions. To provide safe and reliable service, turbines, like all mechanical equipment, require the development of a program of planned maintenance that is consistent with the operating environment. Plans generally consist of frequent inspections, routine servicing, and component replacement.

Routine maintenance, sometimes provided through a service agreement with the manufacturer, includes periodic overhaul of the gas generator and power turbine. In addition to scheduled overhaul that occurs after a prescribed interval, gas generator and/or power turbine overhaul may also be performed as the result of routine inspections that reveal operational or mechanical deficiencies such as high equipment vibration levels, abnormal oil temperatures, or visible damage or deterioration of subcomponents. Any one of these inspection results could trigger routine maintenance activities that range from minor repairs to overhaul.

The need for overhaul stems largely from deterioration of the “hot” section of the turbine. The gas generator and power turbine portions of the combustion turbine are exposed to high temperature combustion gases, along with vibration and thermal cycling, which cause thermal stresses, mechanical stresses, and corrosion in these sections of the turbine.

#### **A. Overhaul Process**

Overhaul of the turbine includes disassembly, inspection, repair and/or replacement of subcomponents, assembly, and test of the gas generator and/or power turbine component. Overhaul must be performed by specially trained personnel. When feasible for units that include smaller, transportable components, the complexity of the tooling and overhaul process (including shaft balancing) dictate that it is preferable for the overhaul to take place at a dedicated offsite facility.

When sections of the gas turbine are overhauled, the components are disassembled and thoroughly evaluated. The components are replaced or repaired as necessary. During overhaul, particular attention is given to the presence of deposits, erosion, or corrosion pitting on components prone to wear, such as rotor and stator clearances, inlet guide vanes, and exit guide vanes. The degree to which parts or components are replaced is dependent upon the conditions noted and the number of hours in service.<sup>7</sup> Overhaul restores the mechanical performance in order to ensure durability, and safe and reliable service. Overhaul is a time

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<sup>7</sup> The NSPS proposal EIS notes that, “substantial portions of a turbine may be replaced as a matter of routine maintenance.” (Page 5-6, NSPS proposal support document, EPA-450/2-77-017a, September 1977).

intensive activity that, lacking an alternative such as component replacement, requires several weeks to complete. The overhaul process does not increase horsepower output, heat input, or brake-specific emissions compared to the original combustion turbine. The overhaul process is a necessity to the interstate natural gas transmission industry because of FERC and DOT requirements to ensure safe and reliable operations.

## **B. Turbine Components Subject to Inspection, Maintenance, and Overhaul**

The major components of a gas turbine include:

- Air inlet system
- Gas generator
- Fuel delivery system
- Cooling system
- Lube oil system
- Power turbine
- Power shaft
- Control panel
- Exhaust system
- Associated facility infrastructure

Additional turbine components, some which are subcomponents to the list above, include:

- Front bearing housing
- Inlet guide vanes
- Compressor cases
- Stator vanes
- Bleed valves
- Compressor wheels and shaft
- Compressor outlet casing
- Compressor rotor blades
- Internal wheelcase
- Air intake snouts
- External wheelcase

- Nozzle box and rear bearing housing
- Turbine rotor assembly
- Flame tubes and air casing

As indicated above, the gas generator and power turbine components are subject to routine overhaul. The additional subcomponents listed above are inspected and may be repaired or replaced during overhaul.

To simplify the overhaul process and dramatically decrease the required downtime, as well as increase the quality and efficiency of overhaul, manufacturers developed an approach to overhaul based on the removal of key turbine components for off-site overhaul. To support this overhaul practice, the hardware engineering includes specific design and manufacturing considerations that provide the ability to efficiently replace primary turbine components.

For many turbines in the natural gas industry, the gas generator and power turbine components are designed as modular maintenance components. In fact, many units have been designed with a solid case for the gas generator that limits the ability to perform repairs *in situ* and is indicative of the manufacturer intent for component removal. So that overhaul can be most effectively completed, these modular components are designed for complete removal from the turbine support structure and transport offsite for maintenance and/or repair of the internal subcomponents at a centralized facility. In fact, these modular components are routinely replaced entirely with a like-kind unit at the time of overhaul, rather than completing on-site disassembly and repair of each subcomponent. A diagram of the removal of turbine components from a General Electric LM2500 is shown in Figure 5.

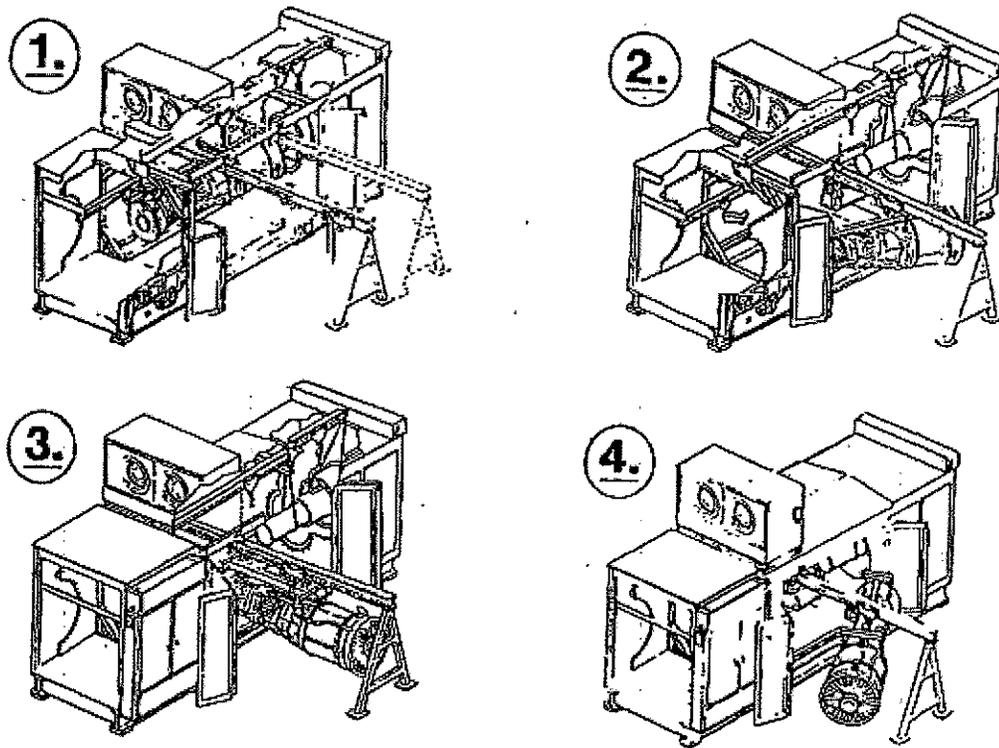


Figure 5: Component Removal for a GE LM 2500 Turbine

### C. Overhaul Interval

Maintenance of turbines requires overhaul, which is an integral part of routine maintenance for mechanical equipment used in industrial applications. Turbine manufacturers and qualified third-party vendors recommend expected intervals between overhauls, but actual intervals vary depending upon operating conditions (e.g., temperature, altitude, and humidity) that can affect the recommended interval for scheduled overhauls. In addition, inspections or operational indicators may trigger the need for “unscheduled” repairs, including replacement of major components such as the gas generator and/or power turbine. Consistent with standard maintenance practices and the discussion provided in this paper, the support document for the Turbine NSPS indicates that:

Most turbines are designed for 20,000 to 40,000 operating hours between overhauls...  
(Page 5-4, NSPS support document)

Solar, General Electric, and Rolls Royce collectively represent about 87% of the turbines in the interstate natural gas transmission industry, and all three manufacturers recommend scheduled turbine overhauls at approximately 30,000 hours of service, but this time interval varies with make and model and may extend to longer service intervals.

Based on the above, most turbines in natural gas transmission service are subject to overhaul about every 3 to 5 years of operation. In many cases, repair or component replacement can take place more often, depending on operational performance and the results of inspections.

#### **D. Power Upgrades and Material Upgrades During Overhaul**

Gas generator and/or power turbine overhaul does not normally include power upgrades. In some cases, power upgrades can be added at the time of overhaul, but this is a separate process and contractual arrangement from routine overhaul. Power upgrades typically require modification to other turbine components, such as the air intake system, fuel delivery system, and the control system, and are not considered routine maintenance. The industry recognizes that horsepower upgrades may be considered a modification under NSR and NSPS.

A separate and distinct activity from power upgrades is the “upgrade” of component parts during routine overhaul. Such an occurrence is part of the natural evolution of the engineering design and quality control program of turbine manufacturers and after market service providers. Gas generator or power turbine overhaul may include the incorporation of material upgrades, due to changes in the material of construction implemented by the manufacturer. For example, new nickel-based alloys and material improvements may be used in fuel injector nozzles, blades, nozzle assembly segments, and bearings. These material upgrades incorporate improvements made in turbine materials as a part of ongoing product improvements that are integral to the design and manufacturing process for equipment manufacturers. In many cases, use of an upgraded part will be the only alternative available,

and such engineering evolution is a standard activity during routine overhaul for industrial equipment.

#### **E. Industry Practices for Gas Generator and/or Power Turbine Overhaul**

For turbine overhaul, three types of practices are used. The outcome in each case is the return of the overhauled component to its original specifications. This ensures safe and reliable operation, and performance consistent with operational and environmental requirements. The overhaul practices include:

- Gas generator and/or power turbine like-kind replacement;
- Repair at an overhaul shop;
- On-site repair.

Component replacement is the typical practice used for the industrial-scale units in gas transmission. On-site repair is the standard approach for large turbines in other industrial sectors, such as those used for utility electricity generation. Each of the approaches to overhaul is discussed further below.

#### **Gas Generator and/or Power Turbine Replacement**

In the most prevalent turbine overhaul practice for units in interstate natural gas transmission service, a turbine component is removed and replaced with a like unit – typically as part of an exchange program contract with the manufacturer or a third party service provider. This option provides the best of both worlds: limited downtime and highly controlled conditions for the overhaul – which results in a high quality product post-overhaul. The removal of a gas generator or power turbine component for overhaul includes replacement with another gas generator or power turbine that has been already overhauled by the manufacturer. General Electric, Solar, and Rolls Royce lease, loan and conduct an exchange program by which they maintain a pool of overhauled gas generators and power turbines for such use. Alternatively, some operators own an inventory of spare gas generators or power turbine modules, which are rotated into service as a like-kind replacement for a component that requires overhaul.

For manufacturer or third party exchange programs, the gas generator or power turbine that is removed from the turbine becomes the property of the service provider, which overhauls that component and places it into the provider's exchange equipment pool. It is notable that this manufacturer-preferred approach to overhaul has created an infrastructure for overhaul of smaller industrial-scale units and has resulted in the creation of service companies specifically to provide this function.

The exchange of overhauled turbine components generally involves the gas generator and/or the power turbine. To understand the costs associated with such maintenance, INGAA assembled cost data associated with routine maintenance, repair, and replacement activities at 18 compressor stations on five pipeline systems. The facilities included in the study span the country and reflect geographical variability in material and labor costs. This study compared the costs for different maintenance activities to the cost to replace the entire combustion turbine process unit. Results from this study are summarized in an INGAA letter<sup>8</sup> to EPA commenting on the EPA reconsideration of the NSR Equipment Replacement Provision of RMRR. This analysis compared costs relative to the cost for replacement of the turbine process unit, and indicated that overhaul costs ranged from 3% to 17% of the process unit cost and averaged about 8%.

There are a number of factors that make leasing/loaning, replacement, or fleet replacement the only practical maintenance procedure for turbine owners. Benefits accrue from the centralization of the overhaul process at the manufacturer's or a third party facility. This approach allows the use of a controlled environment for disassembly and repair, the availability of more sophisticated overhaul equipment – including specialized tooling and diagnostic equipment used for disassembly and precision reassembly of the components that are overhauled, immediate access to a spare part inventory, and access to a test cell for testing overhauled units. Reduced downtime for overhaul is also achieved, as the lost time is limited to the time necessary to remove the component and replace it with a like-kind overhauled component from the service provider's inventory. This results in typical downtime of about

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<sup>8</sup> EPA Docket Number OAR-2002-0068-2565, INGAA Comments on EPA Reconsideration of NSR Equipment Replacement Provisions, August 30, 2004

two days, rather than the extended downtime that would result if the operator is required to wait for the removed component to be overhauled and returned to the same turbine.

Some air quality agencies have expressed concern that reliance on gas generator and/or power turbine replacement programs would in some manner extend the operating life of turbines and that such a possibility might delay the introduction of new emissions controls that would be required when the existing population of turbines reaches the end of their useful life. This is simply not true and such a viewpoint discounts the standard and commonsense practice of implementing routine maintenance procedures such as overhaul to ensure that expensive capital equipment achieves its intended life span. Overhauls are necessary every 3 to 5 years. Also, retirement of an existing turbine and replacement with a new unit that would require new permitting occurs on an ongoing basis in the natural gas transmission industry for a variety of reasons, including:

- Change in compressor technology because of changes in operations (such as gas conditions or flow),
- Mechanical failure,
- Improvements in turbine technology, such as fuel efficiency,
- Manufacturer discontinues unit support,<sup>9</sup> and
- Horsepower uprates.

Based on an industry database, Solar turbines represent about 62% of the combustion turbines used in interstate natural gas transmission. According to Solar, about 80% of overhauls are in an exchange program, while others are “customer property-in-shop”. In addition to the quality assurance and performance verification advantages from central facility overhaul, Solar notes that the component replacement approach results in two days of down time versus approximately 6 weeks if the facility waits for the overhaul to be completed on the original component. For component replacement programs, Solar Turbines has stated that there is no difference in the overhaul of a unit that is delivered for overhaul and then returned to its

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<sup>9</sup> Sometimes the OEM will discontinue manufacturing or supporting turbines due to low market demand for the product. For example, new emissions technology or fuel efficiency improvements are needed to maintain market share, and such changes cannot be readily implemented on the existing design. When a manufacturer cannot sell the existing units, manufacturing will discontinue and ultimately the OEM may discontinue support for the existing units.

original installation, and the replacement of the removed component with a unit from the exchange component pool:

Per common industry practice, the replacement gas generator module or gas generator and power turbine module is in the same condition as it would be if it were returned to the same stationary gas turbine. As such, the component replacement does nothing to increase the operating life of the gas turbine beyond that of a properly maintained gas turbine that never utilized replacement components. Therefore, gas generator module or gas generator and power turbine component replacement should be considered routine replacement.

This applies equally to leased/loaned or spare gas generator and/or power turbine modules. Such overhauls are normal maintenance on industrial-scale units used in gas transmission and have been recognized as such for over 30 years.

### **Turbine Manufacturer Description of Replacement Program**

For industrial-scale turbines, the major manufacturers have implemented component replacement as an integral part of routine overhaul service for many years. For example, Solar Turbines Incorporated has explained this program in recent testimony at an EPA hearing on NSR reform, and in an associated White Paper<sup>10</sup>. The Solar testimony and White Paper indicates that the component replacement program has been an integral part of the Solar maintenance program for over 30 years and that overhaul is a fundamental assumption of product design. Solar notes that more than 25,000 units have been overhauled using the centralized overhaul strategy. This standard industrial practice was established well in advance of the advent of NSR or NSPS. Solar notes that,

“...Gas turbines are designed with requirements for certain maintenance and/or repair activities to maintain the life expectancy of the engine. One such maintenance/repair activity is to overhaul the gas producer and power turbine modules at ~30,000 operating hour intervals. Routine overhaul of the modules is a fundamental assumption of our

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<sup>10</sup> EPA Docket Number OAR-2002-0068-0577, Statement of Leslie Witherspoon, Environmental Program Manager, Solar Turbines Incorporated, Before the U.S. EPA, Salt Lake City, Utah, March 31, 2003. Document includes Public Testimony and Solar Turbines White Paper.

product design. The failure to perform the routine maintenance intervals could result in the catastrophic failure of critical components, including risk to property and personnel.

To ensure customers of high reliability and availability, Solar has operated an exchange fleet of turbines since the 1960's. For the past 30 years, Solar has conducted the 30,000 hr routine maintenance overhaul of our turbines in centralized locations through our engine exchange program.”

and,

“The primary reasons for centralized overhaul include lower cost of overhaul, minimal downtime, quality assurance, and the ability to optimize and verify firing temperature, emissions, and other engine parameters in a test cell prior to shipping to a customer.”

### **Overhaul Shop**

Use of an overhaul shop for overhaul/repair involves removal and replacement of the gas generator and/or power turbine component from the field location installation package and transporting the component to a qualified overhaul/repair shop – a controlled work environment where established quality procedures and processes are in place.<sup>11</sup> The quality of the overhaul is verified by testing the gas generator and/or power turbine component in a certified and calibrated test cell.

When using an overhaul shop, standard practice in the interstate natural gas transmission industry requires installation of a spare/replacement component into the turbine while the repair shop completes the overhaul. This approach requires two instances of component removal and installation to complete an overhaul, and is thus less efficient than the component replacement approach to overhaul.

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<sup>11</sup> A certified repair facility provides controlled conditions, proper equipment, and trained personnel, for the repair, overhaul and testing of equipment according to Original Equipment Manufacturer (OEM) specifications.

## **On-site Repair**

Some gas generator and power turbine modules are designed for field overhaul / repair. For example, on-site overhaul may be the only practical option for large gas turbines in other industrial applications. However, this is not cost-effective – or the standard practice – for the units used in gas transmission that include readily transportable modular components. For smaller industrial scale units, field repairs can include replacing some bearings, trim balancing, reworking leaky flanges, and, on some newer turbine models, replacing some compressor blades (e.g., replacing externally accessible bearings or fuel injectors is an example of a repair job that can be handled at the site.) In these instances, the scope of repair is limited and the need for complete thermal and mechanical testing is eliminated. However, the field location is not well suited for disassembly and repair of the gas generator and power turbine modules – and cannot provide the performance verification tests and specialized precision tooling that are available in the centralized repair facility. In addition, some pipeline companies do not have the mechanical expertise, tools, or diagnostic equipment to do some of the required maintenance activities at the compressor station along the pipeline. Such equipment and tools for these installations has not been necessary due to the infrastructure that has been in place for over 30 years to address overhaul of small industrial-scale turbines through like-kind replacement of the gas generator or power turbine component.

## **IV. REGULATORY CONTEXT FOR OVERHAUL**

This section discusses turbine overhaul and the use of replacement components with respect to the regulatory definitions of “modification” and “reconstruction.”

### **A. “Modification” Under NSR or NSPS**

PSD and NSPS regulations include specific definitions of “modification”. Both definitions indicate that a change resulting in an increase in emissions will be considered a modification. The definitions also explicitly state that routine maintenance, repair, and replacement activities shall not, by themselves, be considered modifications. The NSPS regulations also

state that the Administrator will determine which activities are “routine” for a particular source category. In this regard, at the time that EPA issued the NSPS for turbines, EPA declined to include a more specific finding about turbine maintenance, and in fact, argued that the general NSPS definition was sufficient.

When EPA developed the NSPS regulation for gas turbines, issued as subpart GG, the Agency discussed the routine maintenance activities for gas turbines, including turbine overhaul. The support document for the NSPS states that the type of replacements that occur during turbine overhaul will not be considered a modification to existing gas turbines:

The following physical or operational changes will not be considered as modifications to existing gas turbines:

- a. Changes determined to be routine maintenance, repair, or replacement in kind. This will include repair or replacement of stator blades, turbine nozzles, turbine buckets, fuel nozzles, combustion chambers, seals, and shaft packings.  
(Page 5-6, NSPS support document)

The support document also noted that, “substantial portions of a turbine may be replaced as a matter of routine maintenance during the normal overhauls.” (Page 5-6, NSPS support document). The types of repairs discussed in the NSPS support document are indicative of the repairs that occur under the component replacement program, and this support documentation validates that overhaul is considered routine maintenance.

Based on these exemptions, EPA determined that the “impact of the modification provision on existing gas turbines should be very slight” (Page 5-6, NSPS support document). As indicated by Solar Turbines and discussed earlier, the vast majority of overhauls for Solar units are conducted using component replacement. The component replacement overhaul program was in place when the turbine NSPS was adopted. Clearly, a judgment that this practice is not routine maintenance would be in direct conflict with the EPA assertion that the NSPS modification provision would have a “very slight” impact on existing units. In addition, such a judgment would require a definition of overhaul that conflicts with the predominant and standard practice that is well established for this category of gas turbines.

EPA has not finalized any guidance since the NSPS regarding the definition of “modification” for the gas turbine source category. However, EPA has issued guidance to other industries that may illustrate the Agency’s intended use of the modification provisions. For example, in a letter to Union Carbide Corporation dated February 14, 1996, EPA addressed “upgrades” and indicated that the incorporation of an evolutionary design upgrade for distillation column trays would be considered routine maintenance and would not be considered a modification:

You further stated in your letter that the routine re-tray activity will result in a slight (about 2 lbs/hr) increase in the amount of VOCs venting to the unit flare. You also provided as an attachment to your letter a comparison of the existing trays and the trays that will be replaced and the conclusion that the only changes are evolutionary in terms of tray design . . . . We believe that this re-tray activity which Union Carbide plans to undertake is an activity which is routine for distillation columns and not a modification.

As demonstrated above, EPA clearly intended that routine turbine overhaul would be considered routine maintenance, repair, and replacement and, as such, exempt from consideration as a modification under NSR or NSPS. EPA guidance also suggests that evolutionary upgrades that occur as a part of maintenance – such as changes in materials of construction for repair components as discussed in Section III.D – should be exempt from consideration as a modification. Because the exchange components and overhauled original components are functionally equivalent, and changes such as new materials are part of the natural design and engineering evolution for a unit, replacement components are identical in regard to routine maintenance and should be similarly exempt from consideration as a modification.

**B. “Reconstruction” under NSPS**

The definition of reconstruction under NSPS depends on the comparison of the capital costs of replacement components to the fixed capital costs that would be required to construct a comparable new facility:

“Reconstruction” means the replacement of components of an existing facility to such an extent that: (1) the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility, and (2) It is technologically and economically feasible to meet the applicable standards set forth in this part. (40 CFR 60.15(b))

As stated in the NSPS support document, this provision is intended, “. . . to ensure that an owner or operator does not perpetuate an existing facility by replacing all but vestigial components, support structures, frames, housing, etc., rather than totally replacing it in order to avoid subjugation to applicable standards of performance.” (Page 5-3, NSPS support document).

The NSPS support document states that although substantial portions of turbines are replaced during normal overhauls, “Such routine maintenance should be exempted from the regulatory consequences of becoming a reconstructed turbine . . . .” (Page 5-6, NSPS support document). Therefore, EPA did not anticipate that turbine overhaul would be considered “reconstruction” under NSPS.

The costs for turbine overhaul do not exceed 50 percent of the costs to install a new turbine. Thus, overhaul does not meet the definition of reconstruction under NSPS. The industry recognizes that if the cost for replacement components were to exceed 50 percent of the cost to construct a new gas turbine, this would trigger review as reconstruction under NSPS.

## **V. CONCLUSIONS AND RECOMMENDATIONS**

This paper has presented a description of routine overhaul practices for the interstate natural gas transmission industry, and compared these practices with the provisions of stationary source regulations that would trigger the need to re-permit based on the occurrence of a modification or reconstruction. As described in this paper, the practices involved in routine overhaul are extensively documented in operating procedures and specifications established by turbine manufactures and gas transmission companies.

The central purpose of turbine overhaul practices is to inspect wearable components, re-establish design tolerances, and replace worn parts as necessary. As noted, overhauls are scheduled approximately every three to five years, and represent a major cost of turbine operation. For small industrial turbines, the manufacturers, turbine operators, and third part service organizations have practiced an approach for over 30 years that completes overhaul using highly cost effective centralized facilities. Replacement with a like-kind component in conjunction with centralized overhaul increases the quality of the overhaul while minimizing downtime. Replacement components are subject to the same overhaul specifications as components that are returned to their original installation. The cost of replacement components in an overhaul averages about 8% of the total package price for installation of a turbine process unit. These overhaul practices do not result in an inadvertent uprate of turbine capacity or an increase in emissions, but simply complete the overhaul process as efficiently as possible while ensuring that the turbine achieves its practical life expectancy.

The record indicates that overhaul is considered routine maintenance, and this White Paper provides background on component replacement – the predominant overhaul practice for combustion turbines in interstate natural gas transmission service. The turbine overhaul procedures described in this paper represent the routine maintenance conducted by the gas transmission industry, are the maintenance procedures recommended by the manufacturer, and are the same overhaul practices identified in the NSPS document as routine maintenance. As such, these practices do not represent a facility modification. Nor do these practices represent replacement of the entire Subpart GG entity. To construe that overhaul practices are somehow not routine maintenance and are a facility modification would imply that the useful life of a turbine is only three to five years. Further, INGAA has not identified any factual information in the record on which EPA could attempt to make such a finding. To determine that the routine maintenance practice of overhaul, in a regulatory sense, is something different than the routine maintenance practiced for 30 years by the industry would require EPA to take a position contrary to its original decision to rely on the definition of maintenance in the General Provisions. With respect to reconstruction, the cost of component replacement in turbine overhaul falls well below the level required for component replacement to be considered a facility reconstruction.

A final conclusion with respect to EPA's consideration of the routine maintenance practices for turbines in the gas transmission industry is that no environmental objective is at stake. No body of information has been provided to EPA that demonstrates that the industry's maintenance practices changes basic design parameters or results in an increase in capacity, increase in emission levels, or artificial prolongation of turbine life. In fact, under current maintenance practices, turbines are kept at the peer performance necessary to achieve minimum emissions. In addition, the industry has continued to install new turbines in place of existing turbine – with associated new permitting actions – because of factors such as the increased cost of maintenance for older units, technical obsolescence, and the need to retain reliability.

As turbine overhaul and component replacement has been reviewed by regulatory agencies, different interpretations regarding the use of replacement components at the time of turbine overhaul have been considered. INGAA believes that the correct interpretation is that no further NSR or PSD review or notification is needed, as this is the interpretation consistent with current EPA regulations, the documentary record, the facts concerning the industry's routine maintenance practices, and the manufacturer's recommended procedures and intervals for turbine maintenance. This solution is consistent with the regulatory exemption for routine maintenance, repair, and replacement included in the PSD and NSPS regulations. The solution recognizes that industry practice for over 30 years has included the use of replacement components for the gas generator and/or power turbine components and does not impose unnecessary permitting or reporting requirements. This solution is consistent with manufacturer maintenance recommendations, recognizes the historical routine practice that has been in place for over 30 years, and is the proper outcome and the preferred solution to provide certainty regarding the regulatory implications of turbine maintenance.

## **ATTACHMENT 3**

# **GAS GENERATOR REPLACEMENT REQUIREMENTS IN NEIGHBORING STATES**

**List of upper Midwest states where TransCanada operates combustion turbines with no construction permitting requirements for gas generator replacements:**

- a. Illinois
- b. Michigan
- c. Minnesota
- d. North Dakota
- e. South Dakota

**Minnesota Pollution Control Agency requirements for gas generator replacements:**

Minnesota Pollution Control Agency (MPCA) has worked with TransCanada to incorporate language in the Title V operating permits to allow like-kind replacement for gas generators. Language in the permits includes requirements for 40 CFR Part 60 Subpart KKKK should the gas generator replacement not be a like-kind replacement or if it qualifies as modification or reconstruction. MPCA also requires records of the date that the work on the gas generator replacement began and the date that the unit is placed back into service. Facilities with units subject to an emission limit are required to conduct emission testing to ensure compliance with the emission limit. Testing is required to be completed within 180 days following the completion of work, and is required to be completed using the test method specified in the NSPS subpart affecting the unit.

The following are two examples of Title V operating permit language for GLGT facilities in Minnesota. These excerpts from the operating permits contain language allowing replacement of gas generators without a construction permit. The relevant language is highlighted in both documents.



# Minnesota Pollution Control Agency

**Air Individual Permit  
Part 70 Reissuance  
08900012-101**

**Permittee:** Great Lakes Gas Transmission Limited Partnership  
**Facility name:** Great Lakes Gas Transmission - Station 2  
10950 260th St NE  
Newfolden, MN 56738  
Marshall County

**Expiration date:** July 18, 2022

\* All Title I Conditions do not expire

**Part 70 Reissuance:** July 18, 2017

**Permit characteristics:** Federal; Part 70/ Major for NSR

The emission units, control equipment and emission stacks at the stationary source authorized in this permit reissuance are as described in the Permit Applications Table.

This permit reissuance supersedes Air Emission Permit No. 08900012- 003 and authorizes the Permittee to operate the stationary source at the address listed above unless otherwise noted in the permit. The Permittee must comply with all the conditions of the permit. Any changes or modifications to the stationary source must be performed in compliance with Minn. R. 7007.1150 to 7007.1500. Terms used in the permit are as defined in the state air pollution control rules unless the term is explicitly defined in the permit.

Unless otherwise indicated, all the Minnesota rules cited as the origin of the permit terms are incorporated into the SIP under 40 CFR § 52.1220 and as such are enforceable by EPA Administrator or citizens under the Clean Air Act.

*Signature:* **Toni Volkmeier**

*This document has been electronically signed.*

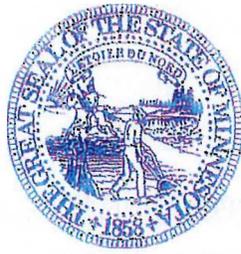
*for* Don Smith, P.E. Manager  
Air Quality Permits Section  
Industrial Division

*for the* Minnesota Pollution Control Agency

Subject Item	Sec.SI.Reqt	SI des:SI desc	Requirement & Citation
			which could endanger human health or the environment. Include the following information in this written description: 1. the cause of the deviation; 2. the exact dates of the period of the deviation, if the deviation has been corrected; 3. whether or not the deviation has been corrected; 4. the anticipated time by which the deviation is expected to be corrected, if not yet corrected; and 5. steps taken or planned to reduce, eliminate, and prevent reoccurrence of the deviation. [Minn. R. 7019.1000, subp. 1]
	5.1.28		Application for Permit Amendment: If a permit amendment is needed, submit an application in accordance with the requirements of Minn. R. 7007.1150 through Minn. R. 7007.1500. Submittal dates vary, depending on the type of amendment needed.  Upon adoption of a new or amended federal applicable requirement, and if there are more than 3 years remaining in the permit term, the Permittee shall file an application for an amendment within nine months of promulgation of the applicable requirement, pursuant to Minn. R. 7007.0400, subp. 3. [Minn. R. 7007.0400, subp. 3, Minn. R. 7007.1150 - 7007.1500]
	5.1.29		Extension Requests: The Permittee may apply for an Administrative Amendment to extend a deadline in a permit by no more than 120 days, provided the proposed deadline extension meets the requirements of Minn. R. 7007.1400, subp. 1(H). Performance testing deadlines from the General Provisions of 40 CFR pt. 60 and pt. 63 are examples of deadlines for which the MPCA does not have authority to grant extensions and therefore do not meet the requirements of Minn. R. 7007.1400, subp. 1(H). [Minn. R. 7007.1400, subp. 1(H)]
	5.1.30		Emission Inventory Report: due on or before April 1 of each calendar year following permit issuance, to be submitted on a form approved by the Commissioner. [Minn. R. 7019.3000-7019.3100]
	5.1.31		Emission Fees: due 30 days after receipt of an MPCA bill. [Minn. R. 7002.0005-7002.0095]
<b>EQUI 1</b>	EU001	Unit 201	
	5.2.1		Opacity <= 20 percent opacity once operating temperatures have been attained. [Minn. R. 7011.2300, subp. 1]
	5.2.2		Sulfur Dioxide <= 0.50 pounds per million Btu heat input. At the time of permit issuance, the potential to emit from the unit is 0.00003 lb/MMBtu due to equipment design and allowable fuels. [Minn. R. 7011.2300, subp. 2(A)]
	5.2.3		Sulfur Dioxide <= 0.0015 pounds per million Btu heat input This limit is effective on January 31, 2018. The potential to emit from the unit is 0.00003 lb/MMBtu due to equipment design and allowable fuels. [Minn. R. 7011.2300, subp. 2(B)]
	5.2.4		Fuel type: Natural gas only, by design. [Minn. R. 7005.0100, subp. 35a]

Subject Item	Sec.SI.Reqt	SI des:SI desc	Requirement & Citation
	5.2.5		The Permittee shall keep records of fuel type and usage on a monthly basis. [Minn. R. 7007.0800, subp. 5]
	5.2.6		<p>Gas Turbine Component Replacement: The gas turbine (EQUI 1) is composed of four main components: an axial compressor, combustor, high pressure turbine (provides mechanical power to drive the axial compressor), and the power turbine (converts thermal to mechanical energy to drive the pipeline compressor). The axial compressor, combustor and high pressure turbine are also known as a gas generator.</p> <p>The Permittee is authorized to replace any or all of the four components for maintenance purposes at manufacturer's specified time intervals as specified later in this permit. The Permittee is NOT authorized to replace components such that the replacement meets the definition of "reconstruction" as defined at 40 CFR Section 60.15 or "modification" as defined in 40 CFR Section 60.14.</p> <p>If 40 CFR pt. 60, subp. KKKK requirements would be triggered by the proposed change due to reconstruction or modification, the Permittee shall apply for and obtain the appropriate permit, as applicable. [Minn. R. 7007.0800, subp. 2]</p>
	5.2.7		<p>Turbine Component Replacement Authorization: The Permittee may make the replacements specified below without the need for a permit amendment if the proposed change is not a modification or reconstruction under 40 CFR pt. 60, there is no increase in the hourly emissions rate, no new applicable requirements are triggered, and the Permittee continues to comply with all existing applicable permit conditions.</p> <p>The Permittee is allowed to replace any of the four main gas turbine components (defined earlier in this permit) with similar components as needed. The Permittee may also replace the entire gas generator (axial compressor, combustor, and high pressure turbine) with a gas generator of the same model and ISO-rated horsepower.</p> <p>The Permittee is not authorized to install an additional gas turbine, is not authorized to completely replace the entire stationary gas turbine as defined at 40 CFR Section 60.4420, is not permitted to operate more than two turbines at the facility, and is not authorized to increase the emission rate (lb/hr, tpy, lb/hp-hr, lb/mmBtu, etc.) of any pollutant with this authorization except as allowed under 40 CFR Section 51.21(b)(2)(iii)(f).</p> <p>The gas turbine will continue to be designated as EQUI 1 regardless if these components have been replaced, and the gas turbine shall continue to be subject to all applicable requirements listed under subject item EQUI 1 in this permit. [Title I Condition: Avoid major modification under 40 CFR 52.21(b)(2) and Minn. R. 7007.3000]</p>
	5.2.8		Turbine Component Replacement Recordkeeping: The Permittee shall record the date and nature of each component replacement

Subject Item	Sec.SI.Reqt	SI des:SI desc	Requirement & Citation
			<p>no later than 5 business days after completion of each replacement.</p> <p>Prior to making such a change, the Permittee shall also record the total cost of the component replacement compared to the cost of an entirely new stationary combustion turbine (as defined at 40 CFR Section 60.4420). [Minn. R. 7007.0800, subp. 2, Minn. R. 7007.0800, subps. 4-5]</p>
EQUI 2	EU003	Standby Electrical Generator	
	5.3.1		Opacity <= 20 percent opacity once operating temperatures have been attained. [Minn. R. 7011.2300, subp. 1]
	5.3.2		Sulfur Dioxide <= 0.50 pounds per million Btu heat input. The potential to emit from the unit is 0.000588 lb/MMBtu due to equipment design and allowable fuels. [Minn. R. 7011.2300, subp. 2(A)]
	5.3.3		Sulfur Dioxide <= 0.0015 pounds per million Btu heat input This limit is effective on January 31, 2018. The potential to emit from the unit is 0.000588 lb/MMBtu due to equipment design and allowable fuels. [Minn. R. 7011.2300, subp. 2(B)]
	5.3.4		Fuel type: Natural gas only, by design. [Minn. R. 7005.0100, subp. 35a]
	5.3.5		The Permittee shall keep records of fuel type and usage on a monthly basis. [Minn. R. 7007.0800, subp. 5]
	5.3.6		The Permittee must change oil and filter every 500 hours of operation or annually, whichever comes first. The Permittee has the option of utilizing an oil analysis program in order to extend the oil change requirement as described below. [40 CFR 63.6603(a), 40 CFR 63.6640, 40 CFR pt. 63, subp. ZZZZ(Table 2d), Minn. R. 7011.8150]
	5.3.7		The Permittee must inspect air cleaner every 1,000 hours of operation or annually, whichever comes first, and replace as necessary. [40 CFR 63.6603(a), 40 CFR 63.6640, 40 CFR pt. 63, subp. ZZZZ(Table 2d), Minn. R. 7011.8150]
	5.3.8		The Permittee must inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary. [40 CFR 63.6603(a), 40 CFR 63.6640(a), 40 CFR pt. 63, subp. ZZZZ(Table 2d), Minn. R. 7011.8150]
	5.3.9		The Permittee must be in compliance with the emission limitations, operating limitations, and other requirements that apply to the Permittee at all times. [40 CFR 63.6605(a), Minn. R. 7011.8150]
	5.3.10		At all times the Permittee must operate and maintain any affected source, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. The general duty to minimize emissions does not require the Permittee to make any further efforts to reduce emissions if levels required by this standard have been achieved. Determination of whether such



**AIR EMISSION PERMIT NO. 02900004- 002**  
**Total Facility Operating Permit - Reissuance**

**IS ISSUED TO**

Great Lakes Gas Transmission Limited Partnership  
for  
**GREAT LAKES GAS TRANSMISSION – SHEVLIN COMPRESSOR**  
**STATION 3**  
County Road 21  
Shevlin, Clearwater County, Minnesota 56676

The emission units, control equipment and emission stacks at the stationary source authorized in this permit reissuance are as described in the Permit Applications Table.

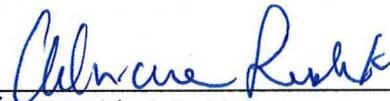
This permit reissuance supersedes Air Emission Permit No.02900004-001, and authorizes the Permittee to operate the stationary source at the address listed above unless otherwise noted in Table A. The Permittee must comply with all the conditions of the permit. Any changes or modifications to the stationary source must be performed in compliance with Minn. R. 7007.1150 to 7007.1500. Terms used in the permit are as defined in the state air pollution control rules unless the term is explicitly defined in the permit.

Unless otherwise indicated, all the Minnesota rules cited as the origin of the permit terms are incorporated into the SIP under 40 CFR § 52.1220 and as such as are enforceable by U.S. Environmental Protection Agency (EPA) Administrator or citizens under the Clean Air Act.

**Permit Type:** Federal; Part 70/Major for NSR

**Operating Permit Issue Date:** August 18, 2015

**Expiration Date:** August 18, 2020 – All Title I Conditions do not expire.

  
for Don Smith, P.E., Manager  
Air Quality Permits Section  
Industrial Division

for John Linc Stine  
Commissioner  
Minnesota Pollution Control Agency

**TABLE A: LIMITS AND OTHER REQUIREMENTS**

Facility Name: Great Lakes Gas Transmission - Station 3

Permit Number: 02900004 - 002

**Subject Item:** EU 001 Unit 301 - Turbine

**Associated Items:** GP 001 Turbines

SV 001

What to do	Why to do it
<p>Gas Turbine Replacement and Reconstruction: The gas turbine is composed of four main components: an axial compressor, combustor, high pressure turbine (provides mechanical power to drive the axial compressor), and the power turbine (converts thermal to mechanical energy to drive the pipeline compressor). The axial compressor, combustor and high pressure turbine are also known as a gas generator. This unit is a Rolls Royce Avon 76G natural gas-fired turbine with a maximum ambient rating of 16,000 HP.</p> <p>The Permittee is authorized to replace any or all of the four components for maintenance purposes, as specified later in this permit, at manufacturer's specified time intervals. Replacement of components meeting the definition of 'reconstruction' as defined at 40 CFR Section 60.15, triggers requirements of 40 CFR pt. 60, subp. KKKK for reconstructed facilities. This permit includes the 40 CFR pt. 60, subp. KKKK requirements for reconstructed affected facilities.</p> <p>(continued below)</p>	<p>Minn. R. 7007.0800, subp. 2</p>
<p>Gas Turbine Replacement and Reconstruction (continued from above): If 40 CFR pt. 60, subp. KKKK (subp. KKKK) requirements are triggered due to reconstruction, the Permittee shall meet the subp. KKKK requirements in this subject item.</p> <p>Requirements specific to subp. KKKK are listed under headings containing the phrase "RECONSTRUCTION".</p> <p>Requirements under headers that are silent regarding reconstruction apply regardless of whether or not reconstruction has occurred.</p>	<p>Minn. R. 7007.0800, subp. 2</p>
<p>EMISSION AND OPERATING LIMITS</p>	<p>hdr</p>
<p>Opacity: less than or equal to 20 percent opacity once operating temperatures have been attained.</p>	<p>Minn. R. 7011.2300, subp. 1</p>
<p>Sulfur Dioxide: less than or equal to 0.50 lbs/million Btu heat input . The potential to emit from this unit is 0.0034 lb/MMBtu due to equipment design and allowable fuels.</p>	<p>Minn. R. 7011.2300, subp. 2</p>
<p>Fuel Type: Limited to pipeline natural gas meeting the definition in 40 CFR Section 60.331(u). The Permittee shall use one of the following sources of information to determine the fuel meets the definition of natural gas: The gas quality characteristics in a current, valid purchase contract, tariff sheet or transportation contract for the gaseous fuel, specifying that the maximum total sulfur content of the fuel is 20.0 grains/100 scf or less. Additionally, natural gas must either be composed of at least 70 percent methane by volume or have a gross calorific value between 950 and 1100 Btu per standard cubic foot.</p>	<p>Minn. R. 7007.0800, subp. 2</p>
<p>MONITORING AND RECORDKEEPING</p>	<p>hdr</p>
<p>The Permittee shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative.</p>	<p>40 CFR Section 60.7(b); Minn. R. 7019.0100, subp. 1</p>
<p>The Permittee shall maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and all other information required by 40 CFR pt. 60 recorded in a permanent form suitable for inspection. The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records, except as specified in 40 CFR Section 60.7(f)(1)-(3).</p>	<p>40 CFR Section 60.7(f); Minn. R. 7019.0100, subp. 1</p>
<p>PERFORMANCE TESTING</p>	<p>hdr</p>
<p>Performance Test (NOx): due no later than 180 days after replacement of any or all of the EU 001 four gas turbine components. Testing shall be performed in accordance with 40 CFR Section 60.8.</p>	<p>Minn. R. 7017.2020, subp. 1</p>
<p>TURBINE COMPONENT REPLACEMENT PROVISIONS</p>	<p>hdr</p>

**TABLE A: LIMITS AND OTHER REQUIREMENTS**

Facility Name: Great Lakes Gas Transmission - Station 3

Permit Number: 02900004 - 002

<p>EU 001 Turbine Component Replacement Authorization: The Permittee may make the replacements specified below without the need for a permit amendment if there is no increase in the hourly emissions rate, no new applicable requirements are triggered, and the Permittee continues to comply with all existing applicable permit conditions.</p> <p>The Permittee is allowed to replace any of the four main gas turbine components (defined earlier in this permit) with similar components as needed. The Permittee may also replace the entire gas generator (axial compressor, combustor, and high pressure turbine) with a gas generator of the same model and ISO-rated horsepower. If replacement of components qualifies EU 001 as a reconstructed facility for purposes of subp. KKKK, the Permittee shall follow the applicable subp. KKKK requirements in this subject item.</p> <p>(continued below)</p>	<p>Title I Condition: To avoid classification as major source and modification under 40 CFR Section 52.21 &amp; Minn. R. 7007.3000</p>
<p>EU 001 Turbine Component Replacement Authorization (continued): If the turbine axial compressor, the combustor, the high pressure turbine, or entire gas generator is replaced, the Permittee shall furnish notifications and reports and conduct a NOx test in the required timeframe according to the performance test requirement for this unit, or according to 40 CFR pt. 60, subp. A, subp. KKKK (whichever is applicable), and Minn. R. ch. 7017.</p> <p>The Permittee is not authorized to install an additional gas turbine, is not authorized to completely replace the entire stationary gas turbine as defined at 40 CFR Section 60.4420, is not permitted to operate more than one turbine at the facility, and is not authorized to increase the emission rate (lb/hr, tpy, lb/hp-hr, lb/mmBtu, etc.) of any pollutant with this authorization.</p> <p>(continued below)</p>	<p>Title I Condition: To avoid classification as major source and modification under 40 CFR Section 52.21 &amp; Minn. R. 7007.3000</p>
<p>EU 001 Turbine Component Replacement Authorization (continued): The gas turbine will continue to be designated as EU 001 regardless if these components have been replaced, and the gas turbine shall continue to be subject to all applicable requirements listed under subject item EU 001.</p>	<p>Title I Condition: To avoid classification as major source and modification under 40 CFR Section 52.21 &amp; Minn. R. 7007.3000</p>
<p>Turbine Component Replacement Recordkeeping: The Permittee shall record the date and nature of each component replacement no later than 5 business days after completion of each replacement.</p> <p>The Permittee shall also record the total cost of the component replacement compared to the cost of an entirely new stationary gas turbine (as defined at 40 CFR Section 60.4420). This record shall be made at least 30 days before a NOx test is conducted on the gas turbine (as a result of the component replacement), but no later than 180 days after each component replacement.</p>	<p>Minn. R. 7007.0800, subps. 2, 4, and 5</p>
<p><b>EMISSION LIMITS -- RECONSTRUCTION</b></p>	<p>hdr</p>
<p>Nitrogen Oxides: less than or equal to 42 parts per million at 15 percent oxygen and on a dry basis or 2.0 lb/MWh.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Section 60.4320(a) and 40 CFR pt. 60, subp. KKKK, Table 1</p>
<p>Sulfur Dioxide: less than or equal 0.90 lb/megawatt-hour gross output or the Permittee shall not burn any fuel in EU 001 which contains total potential sulfur emissions in excess of 26 ng SO<sub>2</sub>/J (0.060 lb SO<sub>2</sub>/MMBtu) heat input.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Section 60.4330(a)</p>
<p><b>COMPLIANCE REQUIREMENTS - RECONSTRUCTION</b></p>	<p>hdr</p>
<p>The Permittee must operate and maintain EU 001, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including startup, shutdown, and malfunction.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR 60.4333(a)</p>

**TABLE A: LIMITS AND OTHER REQUIREMENTS**

Facility Name: Great Lakes Gas Transmission - Station 3

Permit Number: 02900004 - 002

<p>As an alternative to 40 CFR Section 60.4340(a) performance testing requirements, the Permittee may install, calibrate, maintain and operate one of the following continuous monitoring systems:                  (1) Continuous emission monitoring as described in Sections 60.4335(b) and 60.4345, or                  (2) Continuous parameter monitoring as follows:                  (ii) For any lean premix stationary combustion turbine, the Permittee must continuously monitor the appropriate parameters to determine whether the unit is operating in low-NOx mode.                  If any of these options are chosen, the Permittee shall comply with all applicable portions of 40 CFR pt. 60, subp. KKKK, and the Permittee shall apply for a permit amendment as applicable to incorporate such requirements.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Section 60.4340(b)</p>
<p>Fuel Sulfur Content: The Permittee shall maintain a current valid purchase contract, tariff sheet, or transportation contract for the fuel, specifying the maximum total sulfur content for natural gas is 20 grains of sulfur or less per 100 standard cubic feet.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Section 60.4365(a)</p>
<p>PERFORMANCE TESTING - RECONSTRUCTION</p>	<p>hdr</p>
<p>The Permittee shall perform annual performance tests in accordance with 40 CFR Section 60.4400 to demonstrate continuous compliance. If the NOx emission result from the performance test is less than or equal to 75 percent of the NOx emission limit in 40 CFR 60.4320(a) for the turbine, the Permittee may reduce the frequency of subsequent performance tests to once every 2 years (no more than 26 calendar months following the previous performance test). If the results of any subsequent performance test exceed 75 percent of the NOx emission limit for the turbine, the Permittee must resume annual performance tests.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Section 60.4340(a)</p>
<p>Initial Performance Test: due 180 days after Initial Startup and reconstruction of EU 001, for NOx in accordance with 40 CFR Sections 60.8 and 60.4400.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Sections 60.8(a) and 60.4400; Minn. R. 7017.2020, subp. 1</p>
<p>Annual Performance Test: due 425 days after Initial Performance Test (for NOx) or most recent performance test of EU 001, as required in 40 CFR Section 60.8 and in accordance with 40 CFR Section 60.4400. The Permittee shall conduct testing on an annual basis (no more than 14 calendar months following the previous performance test).</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Sections 60.8(a) and 60.4400; Minn. R. 7017.2020, subp. 1</p>
<p>NOx Performance Test Report: In addition to the other notifications and submittals required by Minn. R. ch. 7017, the Permittee shall submit a written report of the results of each NOx performance test before the close of business on the 60th day following completion of the performance test.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Section 60.4375(b)</p>
<p>NOTIFICATIONS - RECONSTRUCTION</p>	<p>hdr</p>
<p>Notification of the Date Construction (or reconstruction) Began: due 30 days after start of construction (or reconstruction). Submit the name and number of each unit and the date construction of each unit began. The Permittee shall submit the notification both to the Commissioner and to the US EPA regional office in Chicago.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Section 60.7(a)(1); Minn. R. 7019.0100, subp. 1</p>
<p>Notification of the Actual Date of Initial Startup: due 15 days after Initial Startup. The Permittee shall submit the notification both to the Commissioner and to the US EPA regional office in Chicago.</p> <p>(RECONSTRUCTION)</p>	<p>40 CFR Section 60.7(a)(3); Minn. R. 7019.0100, subp. 1</p>

**TABLE A: LIMITS AND OTHER REQUIREMENTS**

Facility Name: Great Lakes Gas Transmission - Station 3

Permit Number: 02900004 - 002

<p>Notification of Proposed Replacement of Components: If the Permittee proposes to replace components of EU 001, and the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable unit, the Permittee shall notify the MPCA of the proposed replacements. The notice must be postmarked 60 days (or as soon as practicable) before construction of the replacements is commenced and must include the following information:</p> <ul style="list-style-type: none"><li>(1) name and address of the owner or operator;</li><li>(2) the location of the facility;</li><li>(3) a brief description of the existing facility and the components which are to be replaced;</li><li>(4) a description of the existing air pollution control equipment and the proposed air pollution control equipment;</li></ul> <p>(continued below)</p>	<p>40 CFR Section 60.15(d); Minn. R. 7019.0100, subp. 1</p>
<p>(continued from above)</p> <ul style="list-style-type: none"><li>(5) an estimate of the fixed capital cost of the replacements and of constructing a comparable entirely new facility;</li><li>(6) the estimated life of the existing facility after the replacements; and</li><li>(7) a discussion of any economic or technical limitations the facility may have in complying with the applicable standards of performance after the proposed replacements.</li></ul>	<p>40 CFR Section 60.15(d); Minn. R. 7019.0100, subp. 1</p>

## **North Dakota Division of Air Quality requirements for gas generator replacements:**

The North Dakota Division of Air Quality (NDDoAQ) has incorporated language into TransCanada's Title V operating permits allowing like-kind gas generator replacement. NDDoAQ requirements are similar to MPCA's, but also includes requires notification to the Department within 10 days after the work is completed. Also, NDDoAQ does not incorporate the 40 CFR 60 Subpart KKKK language into the operating permit, as MPCA does. Further, for units that have emission limits, NDDoAQ requires emission testing to verify compliance with emission limits. Testing using a portable emission analyzer in lieu of completing a full emission test required by the NSPS subpart is allowed.

Below is an excerpt from the Northern Border Pipeline Compressor Station #4 (operating permit #T5-O84001) describing the recordkeeping, reporting, notification and testing requirements following a like-kind gas generator replacement.

- B. Like-Kind Engine/Turbine Replacement: This permit allows the permittee to replace the existing engine/turbine with a like-kind engine/turbine. Replacement is subject to the following conditions.
- 1) The Department must be notified within 10 days after change-out of the engine/turbine.
  - 2) The replacement engine/turbine shall operate in the same manner, provide no increase in throughput and have equal or less emissions than the engine/turbine it is replacing.
  - 3) The date of manufacture of the replacement engine/turbine must be included in the notification. The facility must comply with any applicable federal standards (e.g. NSPS, NESHAP, MACT) triggered by the replacement.
  - 4) The replacement engine/turbine is subject to the same state emission limits as the existing engine/turbine in addition to any NSPS or MACT emission limit that is applicable. Testing shall be conducted to confirm compliance with the emission limits within 180 days after start-up of the new engine/turbine.

Applicable Requirement: NDAC 33-15-14-03.6

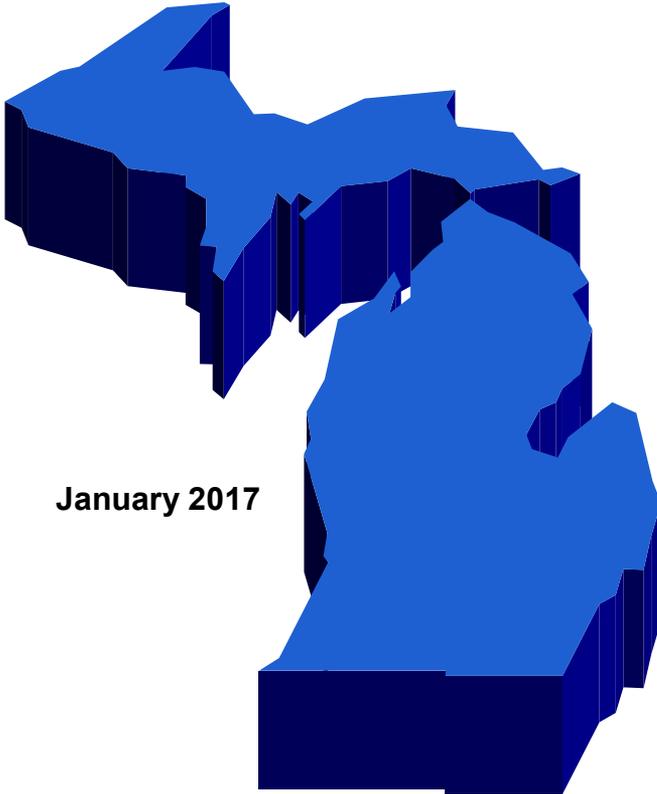
## **ATTACHMENT 4**

# **MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY PERMIT TO INSTALL EXEMPTION HANDBOOK**

The Michigan Department of Environmental Quality (MDEQ) Permit to Install Exemption Handbook (January 2017) is a reference guide for the exemptions found in the Michigan Air Pollution Control Rules R336.1278 through R336.1291. The entire handbook is included in this submittal. However, the relevant exemptions are highlighted on pages 11 and 12.

# Permit to Install EXEMPTION HANDBOOK

Michigan Air Pollution Control Rules  
R336.1278 – R 336.1291 (Rules 278 – 291)



January 2017



Michigan Department of Environmental Quality  
(800) 662-9278 • [www.michigan.gov/deq](http://www.michigan.gov/deq)

### **R 336.1278 Exclusion from exemption.**

Rule 278. (1) The exemptions specified in R 336.1280 to R 336.1291 do not apply to either of the following:

(a) Any activity that is subject to prevention of significant deterioration of air quality regulations or new source review for major sources in nonattainment areas regulations.

(b) Any activity that results in an increase in actual emissions greater than the significance levels defined in R 336.1119. For the purpose of this rule, "activity" means the concurrent and related installation, construction, reconstruction, relocation, or modification of any process or process equipment.

(2) The exemptions specified in R 336.1280 to R 336.1291 do not apply to the construction of a new major source of hazardous air pollutants or reconstruction of a major source of hazardous air pollutants, as defined in 40 C.F.R. §63.2 and subject to §63.5(b)(3), national emission standards for hazardous air pollutants, adopted by reference in R 336.1902.

(3) The exemptions specified in R 336.1280 to R 336.1291 do not apply to a construction or modification as defined in and subject to 40 C.F.R. part 61, national emission standards for hazardous air pollutants, adopted by reference in R 336.1902.

(4) The exemptions in R 336.1280 to R 336.1291 apply to the requirement to obtain a permit to install only and do not exempt any source from complying with any other applicable requirement or existing permit limitation.

History: 1993 AACS; 1994 AACS; 1995 AACS; 1996 AACS; 1997 AACS; 1998 AACS; 2003 AACS; 2008 AACS; 2016 MR 24, Eff. Dec. 20, 2016.

### **R 336.1278a Scope of permit exemptions.**

Rule 278a. (1) To be eligible for a specific exemption listed in R 336.1280 to R 336.1291, any owner or operator of an exempt process or exempt process equipment must be able to provide information demonstrating the applicability of the

exemption. The demonstration may include the following information:

(a) A description of the exempt process or process equipment, including the date of installation.

(b) The specific exemption being used by the process or process equipment.

(c) An analysis demonstrating that R 336.1278 does not apply to the process or process equipment.

(2) The demonstration required by this rule shall be provided within 30 days of a written request from the department. Any other records required within a specific exemption shall be provided within timeframes established within that specific exemption.

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History: 2003 AACCS; 2016 MR 24, Eff. Dec. 20, 2016.

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### **R 336.1279 Rescinded.**

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History: 1993 AACCS; 1995 AACCS; 2003 AACCS.

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### **R 336.1280 Permit to install exemptions; cooling and ventilating equipment.**

Rule 280. (1) This rule does not apply if prohibited by R 336.1278 and unless the requirements of R 336.1278a have been met.

(2) The requirement of R 336.1201(1) to obtain a permit to install does not apply to any of the following:

(a) Cold storage refrigeration equipment and storage of the refrigerant, including cold storage equipment using anhydrous ammonia that has storage capacity of less than 500 gallons.

(b) Comfort air conditioning or comfort ventilating systems not designed or used to remove air contaminants generated by, or released from, specific units of equipment.

anhydrous ammonia in a quantity of more than 500 gallons, that have a boiling point of 0 degrees Celsius or lower.

(k) Storage containers and transfer operations of noncarcinogenic solid material, including silos, that only emit particulate matter and that are controlled with an appropriately designed and operated fabric filter collector system or an equivalent control system.

(l) Filling of noncarcinogenic liquids in shipping or storage containers that have emissions that are released only into the general in-plant environment.

(m) Storage of wood and wood residues.

(n) Storage of methanol in a vessel that has a capacity of not more than 30,000 gallons.

History: 1980 AACS; 1992 AACS; 1993 AACS; 1995 AACS; 1997 AACS; 2003 AACS; 2008 AACS; 2016 MR 24, Eff. Dec. 20, 2016.

**R 336.1285 Permit to install exemptions; miscellaneous.**

Rule 285. (1) This rule does not apply if prohibited by R 336.1278 and unless the requirements of R 336.1278a have been met.

(2) The requirement of R 336.1201(1) to obtain a permit to install does not apply to any of the following:

(a) Routine maintenance, parts replacement, or other repairs that are considered by the department to be minor, or relocation of process equipment within the same geographical site not involving any appreciable change in the quality, nature, quantity, or impact of the emission of an air contaminant therefrom. Examples of parts replacement or repairs considered by the department to be minor include the following:

(i) Replacing bags in a baghouse.

(ii) Replacing wires, plates, rappers, controls, or electric circuitry in an electrostatic precipitator that does not measurably decrease the design efficiency of the unit.

(iii) Replacement of fans, pumps, or motors that does not alter the operation of a source or performance of air pollution control equipment.

(iv) Boiler tubes.

(v) Piping, hoods, and ductwork.

(vi) Replacement of engines, compressors, or turbines as part of a normal maintenance program.

(b) Changes in a process or process equipment which do not involve installing, constructing, or reconstructing an emission unit and which do not involve any meaningful change in the quality and nature or any meaningful increase in the quantity of the emission of an air contaminant therefrom.

(i) Examples of such changes in a process or process equipment include, but are not limited to, the following:

(A) Change in the supplier or formulation of similar raw materials, fuels, or paints and other coatings.

(B) Change in the sequence of the process.

(C) Change in the method of raw material addition.

(D) Change in the method of product packaging.

(E) Change in temperature, pressure, or other similar operating parameters that do not affect air cleaning device performance.

(F) Installation of a floating roof on an open top petroleum storage tank.

(G) Replacement of a fuel burner in a boiler with an equally or more thermally efficient burner.

(H) Lengthening a paint drying oven to provide additional curing time.

(c) Changes in a process or process equipment that do not involve installing, constructing, or reconstructing an emission unit and that involve a meaningful change in the quality and nature or a meaningful increase in the quantity of the emission of an air contaminant resulting from any of the following:

(i) Changes in the supplier or supply of the same type of virgin fuel, such as coal, no. 2 fuel oil, no. 6 fuel oil, or natural gas.

(ii) Changes in the location, within the storage area, or configuration of a material storage pile or material handling equipment.

(iii) Changes in a process or process equipment to the extent that such changes do not alter the quality and nature, or increase