

**Illinois Environmental Protection Agency  
Bureau of Air, Permit Section  
1021 North Grand Avenue East  
P.O. Box 19506  
Springfield, Illinois 62794-9506  
217/782-2113**

**Project Summary for an  
Application from  
Duke Energy Lee, LLC for a  
Revised Construction Permit/PSD Approval for its  
Existing Electric Generation Facility in  
Dixon, Illinois**

**Site Identification No.: 103817AAH  
Application No.: 99090029**

**Illinois EPA Contacts:**

**Permit Analyst: Manish Patel  
Community Relations Coordinator: Brad Frost**

**Important Dates:**

**Comment Period Begins: May 13, 2006  
Comment Period Closes: June 12, 2006**

## I. INTRODUCTION

Duke Energy Lee, LLC (Duke Energy) has submitted an application requesting that the Construction Permit/PSD Approval for its peaking power plant be revised to address low load operation of the turbines in conjunction with “Black Start Capability.” Black Start capability is the ability of a power plant to start operation during a power blackout, relying solely on its own resources without using electricity from the grid. This ability was not present in the original design and construction of this facility. Illinois EPA is proposing to issue a revised construction permit to Duke Energy which allows them to operate the turbines at low load for this purpose.

## II. BACKGROUND

Duke Energy’s Lee facility includes eight “simple cycle” combustion turbines for generation of electricity. The facility is capable of generating approximately 640 MW of electricity. This facility functions as a peaking station, to generate electricity in the peak demand periods and at other times when other power plants are not available due to scheduled or unexpected outages. Operation of the facility may occur throughout the year, although the facility runs primarily in the summer months. The facility was built pursuant to a Construction Permit/Prevention of Significant Deterioration (PSD) Approval issued in March 2000. The permit allowed use of natural gas and fuel oil to fire the turbines. However, Duke Energy did not install fuel oil firing capability on the turbines when it built the facility.

The turbines are sources of emissions of carbon monoxide (CO), nitrogen oxide (NO<sub>x</sub>), particulate matter (PM), sulfur dioxide (SO<sub>2</sub>) and volatile organic material (VOM), which result from the combustion of fuel. The principal air contaminants emitted from the turbines are NO<sub>x</sub> and CO.

NO<sub>x</sub> can be formed thermally by combination of oxygen and nitrogen in the air at the temperatures at which fuel is burned. Thermal NO<sub>x</sub> is formed during the operation of all common high temperature combustion processes. NO<sub>x</sub> can also be formed from the combination of any nitrogen in the fuel with ambient air oxygen component. This is not significant for burning of natural gas, which contains trace amounts of nitrogen. Factors affecting NO<sub>x</sub> formation from a turbine include design, ambient conditions, turbine load and fuel types. The NO<sub>x</sub> emissions from the turbines are controlled with low-NO<sub>x</sub> combustors. Low-NO<sub>x</sub> combustors lower NO<sub>x</sub> formation by lowering the combustion flame temperature.

CO is formed by the incomplete combustion of fuel. CO is associated with most combustion processes and is found in measurable amounts in turbine exhaust. VOM and PM are also emitted as a result of incomplete combustion of fuel. SO<sub>2</sub> is found only in trace amounts from combustion of natural gas. CO and VOM are controlled by providing adequate fuel residence time and high temperature in combustion zone to

ensure complete combustion. PM is controlled by proper combustion control and firing natural gas fuel, which has negligible ash content.

### III. DISCUSSION ON CHANGES TO THE PERMIT

Duke Energy has requested that the Construction Permit/PSD Approval for the facility be revised to address low load operation of the turbines in conjunction with Black Start Capability. Black Start capability was added to the facility when three distillate oil-fired reciprocating engines were installed pursuant to Construction Permit 04050068 issued on June 29, 2004. These engines are small enough to be started on their own and to then supply enough power to start a turbine. With Black Start capability, the turbines at the facility need to operate at load less than normal operating load for extended periods of time for operational testing to ensure reliable operation of the turbines under the low-load conditions that would accompany actual Black Start Operation. In particular, during an actual Black Out, operation of the turbines would be restricted by the internal power needs of the facility and other power plants that would rely on this facility to resume operation. Under the revised permit, this low load operation of the turbines would be limited to a total of 200 turbine operating hours per year excluding turbine operation to actually restore the electric grid following a black out.

Permitted emission of NO<sub>x</sub> and CO from the turbines, to address the low load operation, would increase by 16.8 ton/year and 52.5 ton/year, respectively. The NO<sub>x</sub> increase of 16.8 ton/year is higher than the 9.3 ton/year limited in the Construction Permit 04050068 because it accounts for routine operation of turbines under low load, providing more flexibility in the revised Construction Permit/PSD Approval. NO<sub>x</sub> and CO emissions from the three engines themselves are limited to 22.7 and 4.9 ton/year, respectively by Construction Permit 04050068. Overall, combining the turbines and the engines, the annual emissions of the "Black Start" project is below the PSD significant emission rates, i.e., 39.5 tons compared to 40 tons for NO<sub>x</sub> and 57.4 tons compared to 100 tons for CO.

The provisions related to fuel oil firing would also be removed from the permit. This reduces the permitted emissions of turbines for pollutants other than CO. Permitted emissions of CO would not be reduced because firing of oil did not increase permitted CO emissions. (This was a consequence of the higher emission for NO<sub>x</sub> emissions from the turbines from firing fuel oil, which is not as readily controlled as natural gas.) As a result, overall permitted CO emissions would be higher than the previously permitted emissions because of added CO emissions due to low load operation of the turbines.

The revised permit would also include limits on emissions of hazardous air pollutants (HAPs) from the turbines to ensure that the facility is not a major source of HAP emissions.

#### IV. PERMITTED EMISSIONS

The annual emissions from the facility are summarized below. The permitted emissions are based on operation of each turbine for 2,500 hours per year. Actual emissions from the facility are less than the permitted emissions as actual operation of the turbines is much less than 2,500 hours per year each. The facility's annual emissions for the last three years, as reported by Duke, are also provided below, which indicates that actual operation of the turbines is much less than what they are permitted for. This is consistent with the facility's function as a peaking power plant.

Annual facility emissions (ton/year):

Pollutant	Revised Permitted Emissions <sup>1</sup>	Current Permitted Emissions	Reported Annual Emissions		
			2003	2004	2005
NOx	473.1	735.1	0.53	2.40	16.15
CO	607.1	549.4	0.87	2.51	21.93
PM	104.7	122.0	0.16	0.51	3.63
VOM	21.2	38.7	---	0.15	0.20
SO <sub>2</sub>	59.0	166.5	---	0.44	0.38

<sup>1</sup> Revised permitted emissions include emissions from the three reciprocating engines permitted in Construction Permit 04050068.

<sup>2</sup> Current permitted annual emissions do not include the emissions of the reciprocating engines, i.e., 22.7, 4.9, 1.6, 1.8, and 1.5 ton/year emissions of NOx, CO, PM, VOM, and SO<sub>2</sub>, respectively.

#### V. BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

BACT is defined as an emission limitation based on the maximum degree of pollution reduction determined on a case-by-case basis considering technical, economic, energy and environmental factors for a major project subject to federal PSD regulations.

The Construction Permit/PSD approval originally issued for the facility established the BACT for the turbines as use of dry low-NOx combustors and good combustion and operating practices for NOx and CO emissions. One aspect of good operating practices for the turbines was a restriction on the duration of low-load operation, which is inconsistent with operation of the facility with Black Start capability.

Duke Energy evaluated the impact of low load operations of the turbines on the BACT determination made for the turbines. After reviewing the submission, Illinois EPA has determined that the use of dry low-NOx combustors and good practices still represent the BACT for the turbines. This is because the additional low load operation of the turbines would be of relatively short duration and not meaningfully change operation or

nature of the facility. In particular, emission control technology has been developed to focus on full load operation of the turbines, in which turbines normally operate. In addition, blackouts are infrequent and unpredictable. Use of any other emission control measures on the turbines is not appropriate based on consideration of technical feasibility and economic impacts.

## VI. AIR QUALITY ANALYSIS

As a part of PSD review of the original construction permit application, an ambient air quality impact analysis was submitted by Duke Energy to address the impact of the facility on air quality. The analysis was found to be conforming to the guidance and requirements of the USEPA and the Illinois EPA. Illinois EPA concluded that the permitted emissions from the source would not cause or contribute to a violation of the applicable National Ambient Air Quality Standard (NAAQS) or PSD increment.

The revision request addressed the implications of extended low-load operation on the initial air quality analysis. The supplementary analysis shows that the facility will still have an insignificant impact on the ambient air quality. Illinois EPA concur with the analysis submitted by the Duke Energy.

## V. DRAFT REVISED PERMIT

The conditions of the draft revised permit continue to contain limitations and requirements to assure that the facility complies with all applicable State emissions standards, federal New Source Performance Standards (NSPS), and requirements under the federal PSD rules.

The draft revised permit conditions address low load operation of turbines in conjunction with the Black Start capability of the facility and other changes in the development and operation of the facility.

## VI. REQUEST FOR COMMENTS

It is the Illinois EPA's preliminary determination that Duke's request for a revised permit meets all applicable state and federal air pollution control requirements, subject to the conditions proposed in the draft permit. The Illinois EPA is therefore proposing to issue a revised permit for Duke Energy's Lee electric generation facility located in Dixon, Illinois.

Comments are requested on this proposed action by the Illinois EPA and the proposed conditions on the draft permit. If substantial public interest is shown in this matter, the Illinois EPA will consider holding a public hearing in accordance with 35 IAC Part 166.