BEFORE THE POLLUTION CONTROL BOARD
OF THE STATE OF ILLINOIS

IN THE MATTER OF:	)	
	)	
NATURAL GAS-FIRED, PEAK-LOAD	)	R01-10
ELECTRICAL POWER GENERATING	)	
FACILITIES (PEAKER PLANTS)	)	

TESTIMONY OF CHRISTOPHER ROMAINE

My name is Christopher Romaine. I am here today for the Illinois Environmental Protection Agency, where I am employed as the Manager of the Utility Unit in the Permit Section of the Division of Air Pollution Control.

I have a Bachelor of Science degree in engineering from Brown University and have completed coursework towards a Masters Degree in Environmental Engineering from Southern Illinois University. I am a Registered Professional Engineer in the State of Illinois.

I joined the Illinois Environmental Protection Agency (Illinois EPA) in June 1976 at a junior level in the Permit Section in the Division of Air Pollution Control. I became Manager of the Utility Unit in 1999, after about a year and a half as the Acting Manager. I also previously served as Manager of the New Source Review Unit in the Permit Section. In addition to my duties related to permitting, I have assisted in developing a number of regulatory programs for stationary sources. These programs include Reasonable Available Control Technology (RACT) for certain types of volatile organic material units, the Clean Air Act Permit Program (CAAPP), and the Emission Reduction Market System (ERMS).

As Manager of the Utility Unit, I oversee a staff of engineers who review air pollution control permit applications for electric power facilities. This includes the review of construction permit applications submitted for proposed new power plants. My tenure in the Utility Unit has coincided with the influx of proposals for new natural gas-fired power plants in Illinois, which has accompanied economic deregulation of the generation of electricity in the State.

The purpose of my testimony is to assist the Board in its inquiries by providing information on the air pollution control aspects of peaker plants and emissions permitting. As Manager of the Utility Unit, I have assisted in the review of many of these applications and have participated in most of the public hearing held by the Bureau of Air on these projects. Through my work with the applications for new peaker plants, I have also acquired a general familiarity with aspects of these plants unrelated to their emissions.

Peaker Plants

Peaker power plants are not a new phenomenon. There are a small number of existing peaker power plants in Illinois that have only operated on a very limited basis as needed to meet peak electric power demand or provide emergency power. In this regard, electric power is supplied by a mix of power plants. This mix of generating capacity is necessary because the use of and demand for electricity varies greatly depending upon the time of year and the time of day, and the power system must have the capability to respond to this variation.

This mix includes so-called base load power plants, cyclic plants and peaker plants. Base load plants run around the clock, day in, day out, at relatively stable levels to meet the base electrical demand. These are the least expensive and most efficient plants to operate and include newer coal fired boiler and nuclear power plants. Cyclic power plants operate on a daily cycle, tracking the daily cycle of power demand as it rises and falls during the day. These plants include gas and oil fired boilers specifically built for this purpose and older coal and oil fired boilers that are more expensive to operate. Some of these plants do not operate for long periods during the spring and fall when sufficient power can be provided by other less costly units. The peaker power plants have had a critical place in the power supply system as they have operated to meet the demand for electricity when the demand is at its highest. In Illinois, this peak demand occurs on hot summer days, during daylight hours, due to the use of electricity for air conditioning. The engines that are used in peaker plants are the most expensive to operate because they but can be turned on and off very quickly compared to steam power plants. Accordingly, peaker plants can also be used to meet an emergency demand for power, when another power plant has an unexpected outage or there is a breakdown of a substation or power lines (assuming power can still be carried to the area where it is needed). In this role, peaker plants in Illinois have historically operated at most several hundred hours per year. However, they are the final source of supply and defense against power outages.

What is new in Illinois, is the large number of peaker plants proposed since mid-1998, really almost "simultaneously," in conjunction with the economic deregulation of electric power generation. These plants are being proposed throughout the state, not only in rural areas where new power plants were historically sited, but also in developed and developing areas in the greater Chicago metropolitan area. In the Chicago area, some plants are being sited for existing industrial locations, but many have selected sites that are not in industrial areas and might be best characterized as open, often close to residential areas. Moreover, unlike existing peaker plants, which were developed by local electric utilities like Illinois Power or Commonwealth Edison, most of the new plants are being developed by companies that are new to Illinois, who, as we understand it, intend to sell power on the wholesale power market. Thus it is not clear whether all this additional generating capacity is needed to meet local needs or that proposed plants are being developed at the most appropriate locations. At the same time, it is important to note that there are certainly new peaker projects that are proposed by our historic utilities. Like the existing peaker plants, some of these projects are occurring at or adjacent to existing coal-fired power plants.

Gas Turbines

The peaker power plants in Illinois, which are being addressed by this proceeding, use gas turbines to produce electricity. Gas turbines are also known as combustion turbines and are more commonly referred to as jet engines.

A gas turbine is a rotary internal combustion engine with three major parts: an air compressor, burner(s), and a power turbine (See IEPA Exhibit 1). In the air compressor, a series of bladed rotors compresses the incoming air from the atmosphere. A portion of this compressed air is then diverted through the combustors or burners, where fuel is burned, raising the temperature of the compressed air. This very hot gas is mixed with the rest of the compressed air and passes through the power turbine. In the power turbine, the force of the hot compressed gas as it expands pushes another series of blades, rotating a shaft. Much of the mechanical energy produced by the power turbine is consumed to drive the air compressor. The remainder is available to perform useful work. In the case of a gas turbine power plant, the power turbine turns a generator and makes electricity.

In their basic form, gas turbines are compact powerful machines. Unlike steam electric power plants, where a boiler is used to make steam and drive a steam turbine generator, in a gas turbine, the combustion of fuel occurs in the gas turbine itself. There is no separate boiler. All the moving components in the gas turbine are on one or more rotating shafts located along a single axis. A separate cooling system is not required to condense steam for reuse. The waste heat from the gas turbine is directly discharged to the atmosphere with the exhaust gases out a short stack, which is usually only between 50 and 100 feet tall.

Gas turbines rely on modern metallurgy and material science to make the blades for the power turbine, which must withstand the high temperatures accompanying direct exposure to combustion gases. Gas turbines also rely on the availability of a supply of clean fuel such as natural gas, kerosene, or light oil. Note that gas turbines are called "gas" turbines because the working fluid is a hot gas, not because they burn natural gas. The derivation is similar to that of steam turbine, water turbine and wind turbine, where the fluid driving the turbine is identified.

Due to their characteristics, gas turbines, like any engine, are useful in particular applications. Certainly, they are the basis of modern commercial and military aircraft.

The characteristics that make gas turbines suitable for use as airplane engines also make them suitable for use for peak electric power production. These include simplicity of operation, which facilitates intermittent use in response to varying demand for electric power. Use of gas turbines for the purpose of satisfying peak power demand, when the price of electricity is high, also allows reliance on clean natural gas. The higher cost of this fuel compared to coal is balanced by the lower capital cost of a gas turbine power plant compared to that of the more complicated steam power plant. In other respects, the thermal efficiency of modern simple cycle power plants is about the same as that of a coal-fired power plant, that is, between 30 and 35 percent.

Gas turbines are also used to generate electricity in hybrid systems known as combined cycle turbines. These systems are not normally used in peaking plants and are instead designed to operate year round to supply electric power. The difference between simple cycle turbines used for peaking and combined cycle turbines is that in a combined cycle turbine, the hot exhaust gases discharged from the turbine do not go directly to the atmosphere. Instead, the hot exhaust gases from the turbine, which are typically at about 1000° F, are ducted through a waste heat boiler and are used to generate steam. This steam is then used to drive a steam turbine generator, as in more traditional power plants. The recovery of the heat energy in the exhaust of a gas turbine in this manner can increase the energy efficiency of a combined cycle plant by about 50 percent as compared to a simple cycle turbine which does not recover any heat energy from its exhaust. The additional electricity that can be produced by a combined cycle turbine is accompanied by additional capital costs for a waste heat boiler, steam turbine, and cooling system. However, the additional output from the plant makes the natural gas-fired combined cycle plant more cost-competitive with coal-fueled plants for electric power generation. Combined cycle power plants generally pose more issues than simple cycle plants. For example they do have steam turbines and associated cooling towers to condense and reuse steam. They are also subject to regulatory requirements that are more stringent than those for peaker plants in certain aspects.

When considering actual gas turbines, there are two basic types of turbines, so called heavy-duty or frame turbines and aero-derivative turbines. Frame turbines are specifically designed for land-based utility or industrial applications. Aero-derivative turbines, while adapted for land-based applications, are derived from aircraft engines and generally have counterpart models of engines that are used on jet aircraft. Depending on the manufacturer and engine model, the extent of these adaptations varies. Aero-derivative turbines generally operate at higher air compression levels than frame turbines and are not available in as large sizes.

There are a handful of manufacturers of each type of turbine. The major manufacturers of frame turbines are General Electric (GE), Westinghouse, Siemens Westinghouse, and Asea Brown Boveri (ABB). Major producers of aircraft engines include Pratt & Whitney, Rolls Royce and again GE (formerly Stewart & Stevenson). In addition, a number of firms make smaller industrial turbines that are not used in utility applications. The peaker power plants being developed in Illinois include projects with turbines from each of the major manufacturers of turbines (See IEPA Exhibit 9).

Each manufacturer makes a number of different models of gas turbines in a range of sizes. Gas turbines are rated by their power output, *i.e.*, the amount of electricity in megawatts (MW) that they can nominally produce. The new peaking plants being developed in Illinois have turbines that range in size from a nominal output of about 20 MW to 190 MW. Except for two small plants, the new peaker power plants being developed in Illinois have two or more turbines, which are usually the same model. The largest number of identical units proposed at a single site is 16 units. Of course, the presence of identical units at a plant simplifies design, construction and operation of a plant. In addition, it is our understanding that this duplicative design increases the reliability of a plant, since the plant can continue to provide some power even if one unit is out of service. The amount of power produced by a plant can be managed by turning gas turbines on or off, so that the gas turbines normally operate in their upper load range, which is where they are most efficient.

A key factor in the design of a peaker plant is the capability to maximize the power output of the plant to be able to meet peak electric power demand. This leads to a number of variations on the basic simple cycle turbine, all due to the scientific fact that the power output of a gas turbine varies based on the density of the air being used in the turbine. The denser the air, the more air that can be pushed through the turbine and the higher the power output. This means that in the absence of any adjustments, the output of a given gas turbine will be significantly less on a 90°F day in July, when peak power is most likely to be needed, than on a 20°F day in January. To correct for this phenomenon, the modern simple cycle turbines used in peaking plants are routinely equipped with devices to cool the air going into the turbine. While it may appear counterproductive to cool the air in a turbine before heating it, cooling the air allows more air to be handled by the air compressor, thereby allowing more fuel to be burned and increasing the power output of the turbine.

Gas turbines can be equipped with several different types of air cooling systems that vary in the effectiveness with which they can cool the inlet air to boost a gas turbine's power output. In the simplest system, water is injected directly into the incoming air to cool the air by evaporative cooling. Clean demineralized water must be used to prevent excess build up of scale or erosion of the blades in the air compressor or power turbine. In more advanced systems, water may also be injected at a point in the air compressor itself. The inlet air may also be cooled by indirect systems in which the air passes through cooling coils. In this case, water may still be used in an open cooling tower where evaporation of water is used to dissipate the heat generated by a mechanical refrigeration unit. Alternatively, a dry cooling system may be used in which the heat generated by a refrigeration unit is dissipated to the atmosphere by dry cooling towers or radiators. The more complex the cooling system, the greater the amount of energy that is consumed in its pumps and compressors, which accounts for some of the increase in power output.

Another approach to boost power output of a gas turbine is to inject clean water or steam into the burners or to inject steam after the burners. All these measures increase the gas flow through the power turbine and thus increase its power output. Because fuel must be burned to evaporate the water (either in the turbine itself or in a separate boiler to make steam), these measures to increase power output are accompanied by a loss of fuel efficiency by a gas turbine.

In summary, while simple cycle gas turbines are similar in concept, the new peaker power plants proposed in Illinois can vary greatly due to the type and number of turbines and the associated systems that have been selected by the developer.

Emissions

Gas turbines emit the pollutants that are associated with burning natural gas for any purpose. The amount of pollutants becomes "large" because of the amount of fuel being burned. For example, even a relatively small 44 MW gas turbine consumes about 400,000 cubic feet of natural gas per hour at full load (400 million Btu fuel heat input).

The pollutant generally emitted in the greatest amounts from a gas turbine is nitrogen oxides (NOx).[1] NOx is formed thermally by combination of oxygen and nitrogen in the air at the temperatures and conditions experienced in the burners of the gas turbine. Thermal NOx is formed during the operation of all common high temperature combustion processes. NOx can also be formed from the combination of nitrogen contained in a fuel with oxygen when the fuel is burned. This is not significant for burning of natural gas, which contains negligible amounts of nitrogen. Factors affecting NOx formation from a gas turbine include ambient conditions, burner design, and firing rate.

Gas turbines emit carbon monoxide (CO) formed as a result of incomplete combustion of fuel. CO is associated with most combustion processes and is found in low but measurable amounts in turbine exhaust. Volatile organic material (VOM), which is also a product of incomplete combustion, is also present in smaller amounts. This VOM includes trace amounts of compounds like formaldehyde and toluene, which are classified as hazardous air pollutants. Factors affecting CO and VOM formation from a

[1] In fact, while gas turbines are routinely described as emitting NOx, most of the NOx is emitted in the form of NO. This NO subsequently oxidizes in the atmosphere, to form NO_2. However, emissions are quantified as if all NO were actually emitted as NO_2.

gas turbine again include burner design, and firing rate, which directly influence the time, temperature and turbulence of the combustion conditions experienced in the burners and the efficiency of combustion.

In the absence of other measures, emissions of NOx and CO/VOM are generally considered to be related inversely. That is, everything else being equal, increasing flame temperatures and turbulence in a burner, which improves combustion efficiency and lowers emissions of CO/VOM, results in conditions that are more conducive to formation of NOx. Likewise, lowering peak flame temperatures and turbulence, which reduce NOx formation, tends to lower combustion efficiency and increase emissions of CO/VOM. Thus one objective in combustion modifications to reduce NOx formation is to also take compensatory steps to also maintain or even improve combustion efficiency.

Gas turbines also emit particulate matter (PM) and sulfur dioxide (SO_2). PM is attributable to any dust in the ambient air that is not removed by the filters on the front of the turbine, noncombustible trace constituents in fuel, and any incomplete combustion products that exist as particulate. SO_2 is formed from burning sulfur compounds contained in the fuel. Emissions of these pollutants are generally considered negligible if natural gas is being burned. Emissions of these pollutants are greater when oil is fired, due to the higher ash and sulfur content of oil, but these are again relatively low with distillate oil. Emissions of PM and SO_2 from a gas turbine are determined by the selection of fuel(s). Control devices are not used for these pollutants. Most of the peaker plants being developed in Illinois are being built with the capability to only burn natural gas. However, the capability to burn oil as a secondary fuel is being included in some plants. This would allow these plants to continue to function if there were an interruption in their natural gas supply, as would most likely occur in winter months when natural gas is used for space heating.

A more detailed discussion of the emissions of pollutants from gas turbines, as well as gas turbines generally, is available in Chapter 3 of Supplement F to USEPA's *Compilation of Air Pollutant Emission Factors*, AP-42 (IEPA Exhibit 2). Due to the particular features of different gas turbines and continuing developments in burner design, the preferred source of information on the expected emissions of a particular model of turbine is the manufacturer of the turbine. Manufacturers routinely provide detailed data sheets providing the maximum expected emissions of a particular model of turbine, along with other performance data, under different conditions of gas turbine load and operating conditions and ambient temperature. Once gas turbines are installed, actual emission rates can be determined by measuring the amount of pollutants in the exhaust of the turbine as it passes through the stack.

There are emission units at peaker power plants other than gas turbines. The other type of unit most commonly found is fuel heaters. These heating systems are used to warm natural gas prior to its use as fuel. The fuel heaters are essential if the pressure of the natural gas pipeline(s) serving a plant is above the pressure required for its gas turbines so that the natural gas cools when it is decompressed for use. (If the pressure of the natural gas supply is below the pressure required for the gas turbines, gas compressors will be present to raise the pressure of the natural gas to the correct pressure.) Ancillary boilers or engines, which may be used for startup, power augmentation or emission control, and emergency firewater engines, if present, will also have emissions due to combustion of fuel in these units. These emissions are similar in character to those of the turbine itself but are emitted in much lower amounts due to the smaller size of these units. Cooling towers, if present, will also be sources of emissions. This is due to the presence of dissolved or suspended solids in water droplets lost from the cooling tower and other substances in the water that may be lost to the atmosphere. Losses of particulate matter from cooling towers can be minimized by using high-efficiency mist eliminators (to reduce loss of water droplets) and managing the solids-content of the water being circulated in the cooling tower.

Applicable Regulations

Modern gas turbines are able to readily comply with the applicable standards that have been adopted for them, which address NOx and SO_2. Accordingly, this testimony focuses on the applicability of the federal rules for Prevention of Significant Deterioration of Air Quality (PSD), 40 CFR 52.21, on the development of peaker plants.[2]

The Illinois EPA administers the PSD permit program for sources in Illinois under a delegation agreement with U.S. EPA. PSD can have an effect on a proposed peaker project because a plant that qualifies as major for a pollutant under PAD is subject to additional requirements for that pollutant under the PSD rules. In particular, a major plant must be operated to comply with control requirements that represent BACT for the pollutant, as determined and approved on a case-by-case basis during issuance of a construction permit for the project. A construction permit that contains such approval is commonly referred to as a PSD permit.[3] Otherwise, with respect to the PSD rules, a

[2] For a discussion of other air pollution control regulations governing peaker plants, as well as additional discussion of the PAD rules, refer to Attachment 1 to this testimony.

"non-major" peaker project need only manage and control its future emissions so as to comply with the terms of its permit so that it does not constitute a major source. Most, but certainly not all, of Illinois' new peakers are not major sources and are not subject to BACT under the PSD program. Given this situation, interest has been expressed by the public as to why such peaker plants are not considered major, so as to be subject to BACT or some other stringent level of emission control set on a case-by-case basis during permitting, especially since peakers will likely operate during a very short period of time conducive to the formation of ozone.

The need for PSD approval or a PSD permit for a proposed project is determined by its potential emissions of pollutants. Because enforceable limits must be considered in determining potential emissions, the permitted emissions of a proposed new source effectively become the source's potential emissions. Permitted emissions generally reflect the hours of operation or throughput requested by a source in its application, with emissions in compliance with applicable standards or at such lower rate as also specified in the application. Accordingly, the need for a PSD permit is triggered for a proposed new peaker plant if the permitted emissions of a pollutant (NOx, SO_2, CO, PM, or VOM) requested by the applicant equal or exceed the major source threshold of the PSD rules.[4]

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[3] If a PSD permit is needed for a proposed project source, the permit applicant must also submit an air quality impact analysis for the proposed new source to demonstrate that the source will not cause or contribute to a violation of the air quality standards for the affected pollutant.

[4] In an area that is designated nonattainment for a pollutant, PSD does not apply to a proposed project for emissions of the nonattainment pollutant or, in the case of ozone nonattainment, the ozone precursors. A separate state permit program addresses emissions of nonattainment pollutants from a proposed source in such an area, Major Stationary Sources Construction and Modification (MSSCAM), 35 Ill.Adm.Code Part 203. A proposed project that qualifies as major under the applicability thresholds of MSSCAM must control emissions of the nonattainment pollutant to the Lowest Achievable Emission Rate (LAER), rather than BACT. The project must also provide "offsets" for its emissions. Offsets are emission reductions that have not been relied upon to demonstrate attainment that have or will occur from existing sources already in the nonattainment area.

The first question about the applicability of PSD to peaker plants arises because there are two applicability thresholds for a major new source under the PSD rules. One threshold, set at annual emissions of 100 tons or more, applies to 28 listed categories of sources. The other threshold is set at 250 tons and applies to all other categories of sources. Simple cycle turbines are not listed as one of the 28 categories of sources. While one of the listed categories is "fossil fuel-fired steam electric plants of more than 250 million British thermal units per hour heat input," simple cycle turbines do not generally use steam to produce electricity. The exception is a turbine that is equipped with steam injection to the power turbine for power augmentation. There is currently only one new peaker plant in Illinois that is proposing to augment power by steam injection. The requested emissions of NOx for this plant are in excess of 250 tons per year, so PSD is triggered irrespective of its source category. The application for this plant is currently pending with the Bureau of Air.[5]

The second question about the applicability of PSD to peaker plants arises because of the seasonal character of peaker plants, where peaking plants will emit most of their emissions on a relatively small number of days during the summer. In contrast, the applicability thresholds of PSD are expressed in terms of annual emissions. People wonder whether a program like PSD should be applied to the new peaker plants as if the peaker plants would operate the rest of the year as they are allowed to in the summer. Certainly, the impacts of a peaker plant on the days that it operates are potentially much

[5] A related point of confusion has been the applicability thresholds under the Clean Air Act Permit Program (CAAPP), Illinois' Title V permit program. In the CAAPP, the basic applicability threshold for a major source is set at annual emissions of 100 tons for all categories of source, without a separate higher threshold at 250 tons. Accordingly, peaker plants with permitted emissions of 100 tons per year or more are required to obtain CAAPP operating permits. However, the CAAPP is a different regulatory program than PSD, and CAAPP permitting does not trigger BACT or other requirements of PSD.

greater than a comparable manufacturing plant permitted for the same annual amount of emissions but operating over the course of an entire year. However, the applicability provisions of the PSD rules do not provide a basis to trigger applicability of PSD on a basis other than annual emissions. Section 169 of the Clean Air Act clearly provides that for purposes of PSD, major sources are to be defined in terms of their annual emissions. In addition, peaker plants are not the only plants that are seasonal in nature. For example, some boilers at heating plants operate primarily in winter.

The final question about the applicability of PSD to peaker plants arises only for peaker projects in the Chicago ozone nonattainment area. In particular, why is only PSD being considered for NOx? If NOx were considered an ozone precursor in this area, a proposed new peaker plant would have to address MSSCAM, as well as PSD, for emissions of NOx. This is because the applicability threshold for a new major source under MSSCAM in a severe ozone nonattainment area like Chicago is annual emissions of 25 tons of an ozone precursor. Applicability of MSSCAM would almost certainly require any new peaker plant proposed in the ozone nonattainment area to comply with LAER for NOx. The answer to this question is that U.S. EPA has granted the sates bordering Lake Michigan a NOx waiver under Section 182(f) of the Clean Air Act. This waiver is based on scientific analyses that found that controlling NOx emissions only in the nonattainment are would actually increase ozone levels in the area. Instead, for NOx reductions to improve ozone air quality, they must be provided on a statewide basis and preferably on a multi-state regional basis.

Because of these questions concerning the applicability of PSD to new peaker plants, the Illinois EPA formally sought guidance from U.S. EPA on these issues. U.S.

EPA confirmed that the Illinois EPA is properly implementing the applicability provisions of the PSD rules for these plants. (See IEPA Exhibit 3.)

The applicability provisions of the PSD program for proposed additions of peaker units at existing power plants have not generated these same questions. The applicability provisions of PSD for modifications at existing sources that are already major are significantly different from the provisions for new sources. For an existing major source, applicability of PSD is triggered by a modification to the source that would result in a significant increase in emissions. For this purpose, the significant emission thresholds are an annual increase in permitted emissions of 40 and 100 tons per year for NOx and CO, respectively. For the purpose of determining whether there is a significant emission increase of a pollutant, actual emission decreases that are contemporaneous with the proposed increase in emissions may be considered to show that there is not a significant net emission increase. Nevertheless, PSD may be triggered for an existing source by a much smaller increase than for a new source.

A review of the regulatory programs in other states indicates that there are states that are similar to Illinois that apply BACT to a proposed project only when triggered by the federal PSD program. Wisconsin is an example of such a state. There are other states, like Indiana and Ohio, where there are state-based requirements for BACT that apply to proposed projects that would not trigger BACT under the federal PSD rules. A brief description of the requirements in other states is provided in Attachment 2 to this testimony.

Emissions Control Technology

Emissions from turbines can be reduced by combustion modifications and by add-on control devices. As emissions of pollutants like NOx and CO from gas turbines are related to combustion conditions, combustion modifications are the preferred control technique as it can reduce the formation of pollutants. Combustion modifications involve only the burners of a turbine and other components of the turbine may be unchanged. Over time, a particular design of gas turbine may be produced with several different models of burners, as the turbine manufacturer makes improvements in the design of the burners, which become available for newer units.

One approach to modifying the burners of a gas turbine to reduce NOx emissions is to inject water, either as a liquid spray or as steam, into the burner in the immediate vicinity of the flame. This reduces the peak temperatures in the flame zone, "slowing down" the combustion process to reduce the formation of NOx. This technique can reduce NOx emissions by 60 percent or more. Depending on the particular design, the amount of water injected can range from about 0.5 to 2.0 pounds per pound of fuel. As discussed above, water injection will also tend to increase the emissions of CO and VOM. This effect may limit the amount of water that can be injected, which is also limited by the size and geometry of a particular burner. Water injection in the burner to control NOx decreases the fuel efficiency of a gas turbine system. At the same time, like water sprays for inlet air cooling, water injection for NOx reduction also increases the power output of the turbine.

The other approach to combustion modification is to adjust the way that the air and fuel mix to as to minimize the "hot spots" in the flame where NOx is actually formed. These types of burners are commonly referred to as "dry low NOx" burners. When they are available for a model of turbine, dry low NOx burners can be very effective when burning gaseous fuel, achieving 90 percent or more reduction in NOx emissions compared to earlier models of conventional burners. Dry low NOx burners are not as effective for oil. Accordingly, some dual fuel dry low NOx burners are also equipped for water injection, which is used when oil is burned.

A promising technology for improving burner performance is catalytic combustion. This technology uses high temperature catalyst located in the burners themselves. The catalyst allows combustion to consistently occur at a temperature below that at which thermal NOx formation becomes significant. At this time, proprietary XONON™ catalytic combustion technology has been installed on a demonstration project in California using a 1.5 MW Kawasaki gas turbine. This technology has not yet been demonstrated on any of the larger models of turbines being used in Illinois' new peaker plants. The availability of this technology continues to be evaluated on a case-by-case basis during the review of proposed major plants that must demonstrate BACT.

Even where add-on control techniques are used, some degree of combustion modification will likely be utilized to reduce the amount of control that must be achieved by the control device. This may reduce the capital and operating costs associated with the control device, including the power that is used in or lost to the control device.

Add-on control devices are not commonly used for NOx emissions from simple cycle gas turbines. The traditional add-on device for NOx emissions from a gas turbine relies on a catalyst material. The catalyst facilitates a reaction between ammonia (NH_3) and NOx that reduces the NOx to N_2, forming water (H_2O) as a byproduct. Beds of catalyst are installed at an appropriate location in the exhaust ductwork of the turbine. Ammonia is injected into the hot exhaust gas through a grid system located upstream of the catalyst. Conventional selective catalytic reduction (SCR) catalysts typically have an operating temperature window ranging from 450°F to 850°F, whereas the exhaust gas temperature of a gas turbine is typically above 900°F. While high-temperature SCR catalysts are available, they are not as rugged as conventional catalysts and there is limited experience with their use.

If exhaust gas temperatures are above the upper limit of the SCR catalyst, ammonia does not react in the SCR unit, so that the gas turbine emits ammonia. Improvements in catalysts and catalyst systems in the future may expand the range of SCR units. However, even if the exhaust temperature of a turbine is within the temperature range of the SCR catalyst, some unreacted ammonia is still lost to the atmosphere. This “ammonia slip” becomes larger as the amount of ammonia injected into an SCR is increased to either achieve greater removal of NOx or compensate for deterioration of the catalyst. Although ammonia is not a criteria pollutant, it is of environmental concern. In particular, like NOx itself, emissions of ammonia contribute to fine particulate matter levels in the atmosphere, where ammonia reacts to form compounds such as ammonium sulfate and ammonium nitrate. Surface deposition of these ammonia compounds contributes to acidification of both surface waters and soil. None of Illinois’s new peaker plants is using or proposing to use SCR.

Add-on control devices are also available for CO and VOM emissions from gas turbines. These devices use an oxidation catalyst to complete the combustion of CO and VOM, which are products of incomplete combustion. These devices are installed in an appropriate location in the exhaust ductwork of the turbine and allow combustion to be continued at the temperature of the exhaust without need for supplemental heat. These systems are generally very effective (90+ percent control) when the upstream concentration of CO and VOM is high. However, it is not appropriate to generalize because of the different levels of "uncontrolled" burner emissions of CO and VOM from various models of gas turbines. The new peaking plants proposed in Illinois, which rely on good combustion practices to minimize emissions, are not routinely using oxidation catalyst system. The exception is the peaker plant projects using Pratt & Whitney aero-derivative turbines. Oxidation catalysts are more commonly used in areas of the country where ambient air quality problems with CO have been experienced.

A newer add-on emission control technology for gas turbines is SCONOX™, a proprietary catalytic technology developed by Goal Line Environmental Technologies. SCONOX™ is a catalytic technology that controls NOx, CO and VOM. The first "step" is an oxidation reaction that oxidizes CO to CO_2, VOM to water and CO_2, and nitrogen oxide (NO) to NO_2. This NO_2 is retained in an adsorbent coating of potassium carbonate on the catalyst. The second step in the process is a reduction reaction where the catalyst is regenerated in the absence of oxygen. In this reaction, the NO_2 is reduced back to nitrogen (N_2) with water (steam) and carbon dioxide and is discharged to the atmosphere. To allow the SCONOX™ unit to be regenerated "on-line," the catalyst is installed in a number of separate sections that are equipped with louvers on both front and back. This allows sections be isolated from the rest of the exhaust of the turbine, which is rich in oxygen, as they periodically undergo regeneration. Like SCR, SCONOX™ technology is effective only at temperatures below 700°F. Accordingly, SCONOX™, like SCR, is not suited for simple cycle gas turbines, which are not equipped with a heat recovery steam generator. Unlike SCR, SCONOX™ does not use ammonia but instead requires a supply of steam and a separate combustion system for the production of oxygen-free, CO_2-laden regeneration gas. The only plant in Illinois currently proposing to use SCONOX™ is Standard Energy Ventures, a proposed major source that recently revised its application to request approval to install either simple cycle or combined cycle turbines controlled with SCONOX™ units. It is targeting a NOx emission limit of 3.5 ppm, similar to that achieved by turbines equipped with SCR.

For detailed information on NOx control measures for gas turbines, a good place to begin is the Alternative Control Techniques Document (ACT) prepared by USEPA in the early 1990s to support state development of Reasonable Available Control Technology (RACT) rules for emissions of NOx. This document, *Alternative Control Techniques Document: NOx Emissions from Stationary Gas Turbines,* USEPA, January 1993, EPA-453/R-93-007, provides a comprehensive evaluation of the state of NOx control measures for gas turbines as of that time period. (See IEPA Exhibit 4.) This document is still a useful reference in many respects provided that one remembers the developments that have occurred in advanced burner design since that time. As a result of these developments, certain types of control techniques are no longer feasible for certain models of turbines and others are considerably less cost-effective, even at the hours of operation assumed in the ACT. In particular, water or steam injection is not a feasible control technique for a new model of turbine that achieves a NOx emission rate of 25 ppm or less through advanced burner design. With respect to SCR, the difference between "controlled" and "uncontrolled" NOx emissions of gas turbines may now be 3.5

and 9 ppm. The ACT examined controlled NOx emissions at 9 ppm compared to uncontrolled NOx emissions in the range of 25 to 42 ppm. In addition, the ACT does not address newer control techniques like SCONOX™ or XONON™. Accordingly, as well as being a general reference on gas turbines, the ACT is also a reference point to view the improvements in NOx control technology that have occurred for gas turbines in recent years.

Permitting of Gas Turbines

The volume of applications for new natural gas-fired power plants, including peaker plants, has strained the Bureau of Air's resources and is slowing down other initiatives, notably the issuance of initial CAAPP permits to sources. These applications for new peaker plants consume effort in review of applications, review of modeling, responding to requests for information, holding public comment periods, especially hearings, and other outreach activities, including the preparation for and attendance at these inquiry hearings. While the Bureau of Air's staffing and budget are developed to include these types of activities for a number of major and controversial projects each year, the applications for new peaker plants by themselves go well beyond these plans. In addition, because the Bureau of Air collects fees only from operating plants, peaker plants that are not built will never pay permit fees to cover the effort that has been expended by the Illinois EPA in handling their construction permit applications.

Like other construction permit applications, construction permit applications for peaker plants are reviewed to determine whether the application shows compliance with the applicable air pollution control requirements. If compliance is shown, permits are prepared with detailed conditions that identify applicable rules and requirements and set forth appropriate testing, monitoring and record keeping to verify compliance when and if the proposed facility is built.

Modern gas turbines readily comply with the adopted emission standards that apply to them. The principle technical task in processing an application for a peaker plant is to address the federal PSD rules, as it may establish project-specific emission standards. As previously explained, based on the data for maximum emissions and operation provided in an application, a proposed plant or project may constitute a major source subject to PSD for one or more pollutants. Alternatively, it may constitute a non-major source for many or all pollutants, as is the case for most of the new peaker plants proposed in Illinois.

For a proposed minor source, the task in permitting is to develop a permit that contains appropriate conditions to limit the emissions of the relevant pollutant from the source to below major source thresholds, as described by the applicant in its application. This generally requires establishment of (1) short term limits on emissions, usually expressed in pounds/hour (2) long-term limitations on hours of operation or fuel consumption, (3) annual limits on emissions, expressed in tons/year, and (4) provisions for testing, monitoring, and recordkeeping which the Permittee must implement to verify compliance applicable limitations.

For a proposed major source, conditions delineating permitted emissions must also be developed as described above for a minor source. However, the limits for a major source provide for permitted emissions in excess of major thresholds and are based on the emissions described in the application, which were addressed by the BACT determination, impact analyses, and other requirements for a major project.

In either case, permit analysts rely on the information in the application, including the emission data provided by the manufacturer of the gas turbine. An independent engineering review of this information is not conducted. While analysts can certainly identify information that is unreasonable or anomalous, analysts do not have the technical background or resources to conduct an engineering evaluation of sophisticated emission units like gas turbines. Such a review is also not appropriate. The function of the review of a construction permit application for a proposed project is to determine whether the plans and specifications submitted in the application show compliance. If a permit is issued for the project, significant representations made in the application are made conditions so as to govern, restricting the operation of the project.

In fact, emission testing to date has shown that turbine manufacturers are able to reliably predict maximum emission levels of new turbines as needed for purposes of permitting. Actual emission testing shows compliance with projected emission rates, often with a substantial margin of compliance for pollutants other than NOx, where manufacturers are more conservative in their predictions.

Likewise, while many peaker projects request permitted emission levels just below the PSD applicability threshold of 250 tons per year, it is not apparent that developers are unrealistically constraining the operation of projects. It is quite probable that the operation of some plants is being overstated, so as to maximize their capability to provide peak power. In addition, independently owned peaker plants do enter into advance contracts to provide power upon demand. Accordingly, the requested levels of operation may be related to the ability to establish contractual obligations, even though a plant's anticipated levels of actual operation are much lower. In any event, the developers of peaker projects have generally demonstrated an interest in maximizing the permitted hours of operation of plants and their ability to supply power. For certain plants, this certainly makes it necessary for the developer to select new models of gas turbines that have low NOx emission rates, if the plant is to be permitted as a non-major source.

For a major project requiring a PSD permit, the additional technical tasks in permitting are to review the air quality impact analysis and the BACT demonstration submitted as part of the permit application. The air quality impact analyses prepared for peaker plants subject to PSD indicate that these plants do not pose a threat to air quality. These analyses separately address each criteria pollutant that would be permitted to be emitted in a significant amount. These analyses use dispersion modeling to address emissions of criteria pollutants other than ozone. Maximum hourly emission rates are modeled for pollutants for which short-term air quality standards are established. Either hourly rates or annual emission rates are modeled for review against standards that apply on an annual basis. The impacts of specific plants vary depending upon the size of the property, the presence of units other than turbines, the layout of the plant, special features that affect downwash, and so forth. Because ambient ozone is formed from atmospheric reactions of precursor compounds, dispersion modeling cannot be used to address the impact of VOM emissions of a single source on ozone air quality. U.S. EPA has developed screening tables based on generic airshed ozone modeling that may be used to assess the potential impact of the VOM emissions of a project in attainment area on ozone air quality. However, the specific ozone modeling performed by the Illinois EPA and others for Illinois suggests that the VOM emissions of individual peaker plants will not have a significant impact on ozone air quality. Instead, the emissions of precursor compounds, both VOM and especially NOx, from new peaker plants must be addressed as part of ozone attainment planning, just as the emissions of existing peaker plants are addressed in such planning.

Since January of this year, the Illinois EPA has also been requiring applicants for non-major peaker plants to provide air quality impact analyses to support their applications. These analyses show that the proposed peaker plants that are non-major also do not threaten air quality. In most cases, peak impacts are below the numerical significant impact levels set in the PSD rules. This is a consequence of the low concentration of pollutants in the exhaust of modern gas turbines accompanied by good dispersion due to the high temperature of the exhaust.

As already indicated, most peaker plants are being developed as non-major sources. To date, there have been only three BACT determinations for NOx that have been made for simple cycle peaking plants in Illinois. All involved GE frame turbines burning only gaseous fuel. Dry low-NOx burner systems achieving 15 ppm NOx, hourly average, have been determined to constitute BACT. The later two determinations also include BACT limits set at 12 ppm NOx monthly and 9 ppm NOx on an annual average. Add-on control devices have not been required as BACT for either NOx or CO. The BACT demonstrations in these applications have evaluated the use of add-on control devices for NOx and CO. The demonstrations have shown that add-on control devices were not routinely being used on new simple cycle turbines. The cost-effectiveness of add-on devices if they were to be applied was shown to be in excess of the level considered reasonable. This is a consequence of the low emission levels now being achieved by modern gas turbines with burner NOx control and the low hours of operation proposed for turbines as peaking units. Lastly, the air quality impacts of the new peaker plants, as addressed in the modeling analyses, have not necessitated further control of emissions to protect ambient air quality. Applications are currently pending that require determinations of BACT for additional GE frame turbines burning only gaseous fuel and for frame turbines with burners designed for both natural gas and fuel oil as a backup fuel and for aero-derivative turbines.

The further tasks associated with the Illinois EPA's processing of applications for peaker plants are related to public involvement in the permitting process. The Illinois EPA's administrative rules dealing with public comment periods at 35 Ill.Adm.Code Part 252 mandate a public comment period on a draft permit before a construction permit is issued for a major source or modification. This allows for public input before a case-by-case BACT determination is made. These rules also provide for a public comment period on any construction permit application at the discretion of the Illinois EPA. Under this authority, the Illinois EPA routinely holds public comment periods, usually with a public hearing, for proposed projects in which the public has expressed a significant degree of interest or opposition. Because of the interest in proposed peaker plants generally expressed by the public, Illinois EPA Director Thomas Skinner decided that all applications for proposed new peaker plants would be subject to a public comment period before a permit would be issued. As with the comment period for a major project, a public hearing is held as part of the comment period if one is requested by the applicant or in response to requests from the public or local elected officials of if the Illinois EPA expects a significant degree of public interest in a particular project.

Public comment periods on permit applications serve several purposes. First, they inform the public that a peaker plant is being proposed at a particular site. This is important because developers of peaker plants may apply for construction permits before applying for the local approvals that may be needed for a project. Second, public comment periods allow the public to provide comments on the draft permit for the plant. Public comments have resulted in ongoing improvements to the permits being issued to peaker plants, with additional conditions being imposed and existing conditions being clarified. Third, public comment period provide an opportunity for dialogue between the Illinois EPA and the concerned public about an application. This is particularly true when a public hearing is held as part of the public comment period.

At hearings, the public expresses many concerns about the proposed plants. The public is concerned not only with the potential effects of the emissions from these plants, but also with impacts on water quality and noise. Members of the public also routinely express concerns about the impacts of proposed plants on property values, local water wells, and the character of the area in which it is proposed to be located. They are also concerned that proposed plants are not needed to provide local electrical power, believing that that plants would be better developed elsewhere. In response to these latter concerns, the Illinois EPA must explain that its authority under state law is narrowly limited to consideration of environmental issues and, in the case of construction permits for emission sources, matters related to emissions and air quality. The Agency's Office of Community Relations has developed a *Peaker Power Plant Fact Sheet* for public distribution to help explain the narrow nature of the Illinois EPA role in the development of peaker plants (IEPA Exhibit 20).

Following a public comment period, the Illinois EPA prepares a written responsiveness summary compiling all significant public comments made by the public at the hearing or in written comments, accompanied by the Illinois EPA's responses. These summaries are sent to the people who participated in the public comment period, either by attending a hearing or by sending a letter to the Illinois EPA with comments, at the time that final action is taken on an application. These written responsiveness summaries document the Illinois EPA's consideration of public comments and provide a written record of the Illinois EPA's response, which the public can refer to in the future.

Conclusion

Peaker power plants are not a new phenomenon. What is new in Illinois is the large number of new peaker plants that have been proposed in the two-year span since mid-1998 in conjunction with the economic deregulation of the electric power generation industry. These plants pose a range of concerns for the public. The Bureau of Air has enhanced its procedures for processing peaker plant applications to attempt to address concerns expressed by the public to the extent that such concerns are within the existing scope and authority of the Illinois EPA.

This concludes my testimony. I will be happy to entertain questions.

Illinois Environmental Protection Agency

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AIR POLLUTION REQUIREMENTS

Federal Requirements

Construction Permits

The peaker plants being developed in Illinois are required to obtain construction permits prior to commencing construction under 35 Ill. Adm. Code 201.142. Certain sources of emissions are exempt from these permitting requirements under Section 201.146, but natural gas-fired turbines used for power generation do not qualify for a permit exemption. This permitting process is intended to afford the Agency an opportunity to review facilities prior to construction so that construction is conducted in a manner designed to ensure that applicable requirements will be met.

New Source Review

If emissions from a proposed new source of air pollution or from a modification to an existing source are considered major, the source must undergo federal new source review (NSR) analysis as part of the construction permitting process. Different NSR rules govern areas that attain the National Ambient Air Quality Standard (NAAQS) for pollutants and in areas that do not attain the NAAQS. These national standards are established by U.S. EPA under Section 109 of the Clean Air Act (42 U.S.C. §§7401-7671q (CAA)) and are set at a level that protects the public health with an adequate margin of safety and protects the public welfare from any known or anticipated adverse effects. Peaker plants emit the following pollutants for which U.S. EPA has established national standards: nitrogen dioxide (NO_2), particulate matter (PM), sulfur dioxide (SO_2), carbon monoxide (CO). In addition, volatile organic material (VOM) and sometimes nitrogen oxide (NOx) emissions, both of which are emitted by peaker plants, are subject to regulation as precursors to ozone.

Attainment area NSR is addressed under the Prevention of Significant Deterioration (PSD) program found at 40 CFR '52.21. These federal regulations are implemented in Illinois through construction permits pursuant to a delegation agreement entered into by U.S. EPA and Illinois EPA and under the authority Section 9.1 of the Environmental Protection Act (Act). Under PSD, a new source or a modification to an existing minor source is considered major if potential emissions of a pollutant are 250 tons per year or more unless the source is identified in certain listed categories (40 CFR '52.21(b)(1)(i)(a)). If a source is in one of the listed categories, it is considered major if its potential emissions of a pollutant are100 tons or more per year. *Id.* This list includes fossil fuel-fired steam electric plants of more than 250 million British thermal units per hour heat input. Peaker plants that use simple cycle gas-fired turbines are not covered by this category, or any of the other listed categories, as the turbines used in peaker plants do not generate steam. Therefore, the PSD threshold for simple cycle peaker plants is 250 tons per year. If the gas-fired turbine produces electricity by steam through a waste recovery system, often referred to as combined cycle turbines, the plant would be reviewed under the 100 tons per year or more threshold. Once a proposed source qualifies as major for one pollutant, other pollutants only need be emitted in a significant amount, as defined at 40 CFR §52.21(b)(23), to be subject to PSD.

If a source is subject to PSD for a pollutant, it must demonstrate that its emissions will be controlled with the Best Available Control Technology (BACT) (40 CFR §52.21(j)) and that its emissions will not cause or contribute to any violation of any NAAQS or exceed any applicable maximum allowable increase in air pollution over the baseline concentration in the area (40 CFR §52.21(k)). BACT is established during the permitting process based on a case specific analysis. A source applying for a permit for a major source or modification must perform modeling to determine the air quality impact of its proposed project, using dispersion modeling for pollutants other than ozone. To address the air quality impacts from individual sources of ozone precursors, U.S. EPA has developed screening tables based on generic airshed ozone modeling. Dispersion modeling is not relied upon under PSD to address the air quality impact from ozone precursor emissions because ambient ozone is formed by atmospheric reactions of the precursor compounds and the impact of a single source cannot typically be measured through modeling.

If an area does not attain the NAAQS, it is considered a nonattainment area and proposed new or modified major sources are subject to nonattainment NSR (NAA NSR). Illinois= NAA NSR requirements are found at 35 Ill. Adm. Code 203. The applicability threshold for NAA NSR differs based on the pollutant involved and, in some instances, the severity of the pollution problem in the area. A new major source or modification subject to NAA NSR must demonstrate that its emissions will be controlled to the Lowest Achievable Emissions Rate (LAER), and it must obtain offsetting emission reductions from other sources in the nonattainment area in which it plans to locate before it will be permitted to construct and operate. Again, the offsetting emission reductions that will be required of such a source varies based on the pollutant of concern and the severity of the pollution problem in the area.

The Chicago area is a severe nonattainment area for ozone, which means that new or modified sources that emit VOM must be reviewed to determine if NAA NSR applies. In this area, a new or modified source is considered major if it has the potential to emit 25 tons or more per year of VOM. The Metro-East/St. Louis area is a moderate nonattainment area for ozone, which means that nonattainment NSR applies to new or modified sources that have the potential to emit 100 tons per or more of VOM or NOx.

NOx emissions are sometimes regulated as an ozone precursor and thereby subject to NAA NSR, but U.S. EPA approved a waiver of this requirement for the areas surrounding Lake Michigan, including the Chicago area, pursuant to Section 182(f) of the CAA. This waiver was based on modeling that showed that NOx decreases may actually increase ambient ozone pollution concentrations. Currently, NOx emission sources are reviewed under PSD based on the NAAQS for NO_2 .

To determine what emissions need to be considered for NSR applicability, the term *source* must be reviewed, as source-wide emissions are aggregated. *Source*, which is often used interchangeably with the term *stationary source*, is defined essentially the same for NAA NSR and PSD applicability. See 35 Ill. Adm. Code 203.136 and 203.112, and 40 CFR §52.21(b)(5) and (6). Pollutant emitting activities or operations are considered part of the same source if they are under common control, belong to the same major industrial grouping (defined by the major two digit standard industrial classification (SIC) or the facilities are in a support relationship) and are located on contiguous or adjacent properties. Peaker plants, as defined for purposes of these hearings, all belong to the same major industrial grouping as these facilities are classified as SIC 49. Therefore, the elements of the source definition that must be evaluated in permitting new peaker plants is the location of various plants and whether common control exists.

Locations are considered contiguous if they are touching or adjoining. See *Color Communications v. Illinois Environmental Protection Agency*, PCB 96-125 (July 18, 1996). This term is generally limited to properties that share a boundary but may extend to properties located apart if a physical connection joins or touches both locations. Adjacent is a somewhat broader term and includes properties that are nearby or neighboring. *Id.* In some instances, facilities separated by some distance may be considered adjacent if the two separated locations operate in an integrated fashion.

U.S. EPA assumes that facilities that share common ownership will be under common control. January 4, 1995 Letter from Cheryl Newton, U.S. EPA, Region 5, to Richard Martin, Department of Public Works, City of Indianapolis, <www.epa.gov/ARD-R5/permits.htm>. In some instances, separately owned facilities may be considered under common control based on the relationship between the facilities. If one facility locates on the property of another, U.S. EPA finds that a rebuttable presumption exists that the facilities are under common control. November 27, 1996 Letter from Matt Haber, U.S. EPA, Region 9, to Jennifer Schlosstein, Simpson Paper Company. To rebut this presumption, the facilities must establish the independence of the operations. Factors such as contractual relationships and shared workforce or management are evaluated to establish whether common control exists.

Under this analysis, peaker plants will be addressed independently under NSR if the sources are not contiguous or adjacent, or are not under common control. This means that peaker plants that are under common control will be permitted separately under NSR if the facilities are not located on contiguous or adjacent properties. Also, peaker plants that are located nearby will be permitted separately if they are not under common control. If two or more peaker plants are separate sources, emissions will be considered separately to determine if the source is major and thereby subject to NSR. On the other hand, if a peaker plant is proposed by an existing electric company at or next to an existing power plant, the proposed peaker will be reviewed as a modification to the existing facility.

For purposes of NSR applicability, potential annual emissions are considered to determine the applicability of requirements, even when the relevant air pollution problem is seasonal in nature such as ozone pollution that only occurs during warm weather. As peaker plants most frequently operate during peak power demand periods in the summer, much of the emissions from these facilities will occur during the warm weather months that are of concern for ozone pollution. Applicability of the NSR programs, however, is based on annual emissions and does not consider potential seasonal emissions independently. If NSR is triggered, air quality analysis and offsets address the seasonal nature of the emissions from the proposed facility.

Under both PSD and NAA NSR, federally enforceable limitations on emissions must be considered. The concept *potential to emit* includes a recognition of limitations placed on the source=s operation if the limitations are federally enforceable. See, 40 CFR §52.21(b)(17) and 35 Ill. Adm. Code 203.128. Therefore, many new sources are not subject to the substantive the requirements of the PSD and NAA NSR programs by limiting their operations in their construction permit, as these permits are federally enforceable under the Illinois State Implementation Plan (SIP).

If a source accepts federally enforceable limitations on its operations to operate as a minor source and, therefore, is not subject to NSR, the source may apply to modify its operations in the future. If a source modifies operations, it would be considered a major modification under NSR if it meets the applicability threshold and the modified operations would be subject to NSR. The previously permitted minor operations may become subject to NSR requirements under the following provision:

> At such time that a particular source or modification becomes a major stationary source or major modification solely by virtue of a relaxation in any enforceable limitation which was established after August 7, 1980, on the capacity of the source or modification otherwise to emit a pollutant, such as a restriction on hours of operation, then the requirements of paragraphs (j) through (s) of this section [major source PSD requirements] shall apply to the source or modification as though construction had not yet commenced on the source or modification.

40 CFR '52.21(r)(4), *see also*, 35 Ill. Adm. Code 203.210(b). If this provision applies, the operations previously permitted as minor would be required to meet major source NSR requirements.

Once a source receives a PSD permit, construction must generally commence within 18 months of issuance of the permit and may not cease for a period of 18 months. The PSD regulations specifically allow for permits to set schedules for the development of phased projects under which construction is allowed to discontinue for 18 months or more. 40 CFR §52.21(r)(2). The NAA NSR rules do not specifically state that construction must commence within a specified period, but the Illinois EPA routinely conditions the validity of the permit on construction commencing within 12 months.

New Source Performance Standards

U.S. EPA has promulgated New Source Performance Standards (NSPS) for emissions from new turbines under Section 111 of the CAA, found at 40 CFR Part 60, Subpart GG (adopted at 44 Fed.Reg. 52798 (September 10, 1979)). Federal NSPS are implemented in Illinois pursuant to a delegation agreement entered into by U.S. EPA and Illinois EPA and under the authority of Section 9.1 of the Act. These standards apply to stationary gas turbines with a heat input at peak load equal to or greater than 10.7 gigajoules per hour that commence construction, modification, or reconstruction after October 3, 1977. The limit for NOx emissions from large turbines, such as those used in peaking power plants, is approximately 75 parts per million (ppm). The exact limit varies by model of turbine because the limit is adjusted for the efficiency of the turbine. Additionally, such turbines may not use any gas that contains sulfur dioxide in excess of 0.015 percent by volume at 15 percent oxygen on a dry basis and sulfur in excess of 0.8 percent by weight. This NSPS no longer reflects the best available control technology for new equipment. New natural gas-fired turbines are routinely designed to achieve 25 ppm of NOx. Additionally, low-sulfur oil that meets the sulfur content limitations from the standard is readily available with a sulfur content of 0.50 percent by weight.

Hazardous Air Pollutants

If a new or reconstructed peaker plant is considered major for emissions of hazardous air pollutants (HAPs), it must undergo review under Section 112(g) of the CAA. See also, 65 Fed.Reg. 34010 (May 25, 2000). A source is considered major for HAPs if it emits 10 tons per year or more of any individual HAP or 25 tons per year or more of all HAPs aggregated. A new major source of HAP emissions must achieve the maximum degree of reduction that is deemed achievable for new sources in a category or subcategory and may not be less stringent than the emission control achieved in practice by the best controlled similar source, often referred to as the Maximum Achievable Control Technology or MACT. 42 U.S.C. §7412(d)(3). Section 112(g) is implemented in Illinois under Section 39.5(19)(e) of the Act. New source MACT is implemented on a case-by-case basis during construction permitting until a National Emission Standard for Hazardous Air Pollutant (NESHAP) is promulgated for the relevant source category.

Generally, peaker plants are not known to emit more than *de minimis* levels HAPs. Natural gas-fired combustion units emit amounts of formaldehyde, but formaldehyde (listed under Section 112(b)(1) of the CAA) emissions from peaker plants in Illinois have not been enough to trigger new source analysis under Section 112(g) of the CAA.

Title IV Acid Rain Requirements

New peaker plants are considered affected sources for acid rain deposition under 42 U.S.C. §7642(e). While existing units that were operational prior to the 1990 amendments to the CAA may be entitled to an allocation of SO_2 allowances, new sources are required to obtain allowances after January 1, 2000. Some existing peaker plants in Illinois are not considered affected sources for acid rain deposition because they do not serve generators with a nameplate capacity of more than 25 MW (42 U.S.C. §7641(8)) and are, therefore, not subject to requirements under Title IV. New peaker plants, however, will be required to obtain allowances for SO_2 after January 1, 2000. Peaker plants must also obtain an acid rain permit from Illinois EPA prior to commencing operation. These permits are issued in Illinois under the authority of the Clean Air Act Permit Program (CAAPP) at 415 ILCS 5/39.5(17).

Operating Permit Requirements

As peaker plants are affected sources for acid rain deposition under Title IV of the CAA, these sources are required to obtain a Clean Air Act Permit Program (CAAPP) operating permit. (415 ILCS 5/39.5(2)(a)(iii)). These are very detailed operating permits required by the federal Clean Air Act for more significant sources of emissions. New CAAPP sources must apply for their operating permit one year after commencing operation of the facility.[6]

State requirements

Particulate Matter

Generic requirements prohibiting emissions of visible particulate matter emissions into the atmosphere generally apply to peaker plants. (35 Ill. Adm. Code 212.123 and 212.301-310, 312) Natural gas-fired peaker plants, however, do not generally emit significant amounts of particulate matter emissions if proper combustion occurs.

Emission Reduction Market System (ERMS)

If a peaker plant located in the Chicago ozone nonattainment area emits at least 10 tons of VOM during the ozone season (May - September), the plant will be subject to the ERMS requirements under 35 Ill. Adm. Code 205. If the source was operating prior to May 1, 1999, it will be allotted trading units by the Illinois EPA based on past emissions, with certain adjustments, and will be required to hold sufficient trading units to account for its seasonal emissions each year. If the source was not operating prior to May 1, 1999, it will not be issued trading units by the Illinois EPA in most instances but will be required to obtain trading units sufficient to account for its seasonal emissions each year. If a new source was issued a construction permit prior to January 1, 1998, it will be allotted trading units by Illinois EPA based on its first three years of operation.

[6] As explained above, new peaker plants must obtain an acid rain permit prior to commencing operation but may operate for one year before applying for its full CAAPP permit. The applicable requirements from the acid rain permit will be carried over to the CAAPP permit.

Proposed Requirements

NOx Budget

The Pollution Control Board adopted 35 Ill. Adm. Code 217, Subpart W for First Notice as a proposed rule. Proposed Subpart W is intended to reduce NOx emissions in Illinois during the ozone season (May - September) from electrical generating units by determining source allocations and providing for participation in the national NOx trading program. Proposed Subpart W applies to fossil fuel-fired stationary boilers, combustion turbines (such as peaker plants) or combined cycle systems that serve generators with a nameplate capacity greater than 25 MW that have at any time produced electricity for sale. New sources that commenced commercial operation on or after January 1, 1995, may receive allowances based on an emission rate and heat input. Initially, these sources may acquire allowances from a new source set aside but eventually will receive allowances from the main trading budget based on when the source commenced commercial operation. Under this proposed rule, NOx emission reductions will occur beginning in May 2003.

Potential Hazardous Air Pollutant Regulations

U.S. EPA intends to develop a National Emission Standard for Hazardous Air Pollutants (NESHAP) to address hazardous air pollutants emitted by stationary combustion turbines. It is expected that peaker plants will be included in this source category. U.S. EPA is expected to propose this NESHAP before the end of the year and finalize a standard in 2002. 65 Fed. Reg. 21363, April 21, 2000. This NESHAP is likely to address peaker plants, including smaller area sources.

Application of Air Pollution Regulations for Existing Facilities

Many air pollution control regulations have been imposed on existing sources in Illinois and under federal law, although, in some instances requirements are more stringent for new sources than they are for existing sources. Listed below are examples of regulations or types of regulations that require existing sources to reduce emissions.

- Parts 218 and 219 of the Board's rules (35 Ill. Adm. Code Parts 218 and 219) impose control requirements on existing facilities in ozone non-attainment areas in Illinois. These regulations are part of the federally enforceable SIP for Illinois and fulfill, in part, CAA requirements under Section 182 that Illinois demonstrate a reduction in existing emissions and require major sources of emissions to apply reasonably available control technology. Additionally, the Board has imposed requirements on existing sources of VOM in attainment areas within the State (35 Ill. Adm. Code 215), and existing sources of particulate matter emissions (35 Ill. Adm. Code 212), sulfur emissions (35 Ill. Adm. Code 214), carbon monoxide emissions (35 Ill. Adm. Code 216), and nitrogen oxide emissions (35 Ill. Adm. Code 217).

- Under the CAA, existing sources of hazardous air pollutants are required to comply with NESHAPs under Section 112(d) of the CAA. Section 111(d) of the CAA requires the promulgation of performance standards for certain existing sources that would be subject to an NSPS if new. Additionally, Section 129(b) of the CAA requires the regulation of existing solid waste combustion sources.

Control Required of Peaker Plants in Other States

To provide additional information to the Board, the Agency checked the Internet and canvassed the other Region 5 states and the states neighboring Illinois to learn how they treat new peaker plants.

Indiana

Indiana requires Best Available Control Technology (BACT) of all new projects that will emit greater than 25 tons per year of volatile organic material (VOM) regardless of type. According to Indiana Air Permitting personnel, only one or two proposed peaker plants have triggered this applicability requirement in Indiana, as the majority are synthetic minor facilities, *.i.e.*, they accept emission limitations that prevent them from triggering the BACT requirement. Indiana Air permitting personnel reported that most of the new peaker plants in Indiana are being located in industrial areas, although some have sought location in rural areas.

Iowa

According to Air Quality Permit staff in Iowa, there are no additional permit requirements for peak-load plants beyond the federally required permits. The major source threshold is 250 tons. Iowa implements no toxics requirements beyond the MACT standards and NESHAPs. Peaker plants are limited in hours of operation. Each peaker application is reviewed for acid rain potential and, in come cases, new sources must purchase credits from U.S. EPA

Kentucky

Kentucky has no additional permit requirements for peak-load plants beyond the federally required permits. The major source threshold is 250 tons per year for Title V major sources. Kentucky may impose a limitation on total hours of operation. Kentucky has seen a rise in applications for peaker plant construction since deregulation.

Michigan

Michigan requires BACT for all new sources of VOC emissions. Mich. Admin. Code Rule 702. According to Michigan air permitting personnel, the new peakers in Michigan are locating in areas already zoned industrial.

Minnesota

Minnesota has legislation called the Power Plant Siting Act that applies to facilities greater than 50 MWe and considers health and environmental impacts in locating large electrical power facilities. Minn. Admin. Code § 116C.51-69. Under this the Act, the Environmental Quality Board must hold a public hearing in the county where the proposed facility is to be located. Minnesota air permitting personnel state that most applications for peaker facilities have not required PSD review. They further stated that the environmental impact of natural gas-fired turbines has been insignificant and, as a result, Minnesota has issued permits without challenge. Minnesota air permitting personnel noted that where turbines have been located in urbanized areas (as opposed to rural areas), they have replaced coal-fired units, thus reducing pollution levels.

Missouri

According to Missouri personnel, Missouri follows federal procedures and classifies major sources as facilities where the potential to emit (PTE) is greater than 100 tons per year or facilities where the PTE for any single hazardous air pollutant (HAP) is greater than 10 tons per year or greater than 25 tons per year for any combination of HAPs or facilities subject to any New Source Performance Standards (NSPS), National Emission Standards for HAPs (NESHAP), or Maximum Available Control Technology (MACT) standard. Missouri staff reports that the request level for permits for peaker plants is climbing only slightly.

New York

New York's Public Service Commission is in charge of the siting and approval of all new power plants. Article X of the Public Service Law sets forth a unified and expedited review process in New York State for consideration of any application to construct and operated an electric generating facility with a capacity of 80 megawatts or more. While their law includes a provision for an expedited process, it appears to be fairly detailed and in-depth. In addition to the siting process, applicants are required to establish an intervenor fund at $1,000 per megawatt of capacity proposed up to $300,000 N.Y. Comp. Codes R. & Regs. Article X § 164. Despite its name, the funds may be used to help defray the expenses associated with siting review. Siting may take as long as 18 months. According to New York air permitting personnel, New York issued only one permit for a gas-fired power plant, which was in May 2000 following 16 1/2 months of review. Information regarding New York's processes can be accessed on the Internet at <www.dps.state.ny.us/articlex.htm>.

Ohio

Ohio has a power siting board within its Public Utilities Commission that must approve all major utility facilities (50 MWe or more) before the facility may commence construction. Ohio Rev. Code § 4906. This board holds hearings on these proposed facilities. Ohio regulations require that certain minor sources must apply Best Available Technology (BAT) subject to a list of exemptions such as is included in Illinois' rules at 35 Ill.Adm.Code 201.146 and that major sources must apply BACT consistent with federal requirements. In recent permitting actions, Ohio reported that the BACT limit for NOx for simple cycle turbines is 15 ppm while burning natural gas and 42 ppm while burning oil. According to Ohio air permitting personnel, most new peakers in Ohio are locating in areas already zoned industrial.

Wisconsin

Wisconsin has no set-back or additional requirements beyond federal major source new source requirements. Siting is required for facilities greater than 12,000 kilowatts. Environmental impact statements are required for some facilities. According to Wisconsin air permitting personnel, the greatest opposition to new peakers in Wisconsin has come from those wishing to locate in rural areas, as peaker plants are not considered to integrate well with the aesthetics of rural Wisconsin.