California Environmental Protection Agency

AIR RESOURCES BOARD

GUIDANCE FOR THE PERMITTING OF ELECTRICAL GENERATION TECHNOLOGIES

As Approved by the Air Resources Board on November 15, 2001

Stationary Source Division
Project Assessment Branch

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State of California
California Environmental Protection Agency
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Guidance for the Permitting of Electrical Generation Technologies

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Revisions to the Draft Guidance

At a public meeting held on November 15, 2001, the Air Resources Board approved the proposed Guidance for the Permitting of Electrical Generation Technologies, which was initially available September 18, 2001. Specific amendments to the Guidance that were discussed at the Board Meeting have been incorporated into this final version of the Guidance. The changes to the Guidance are summarized below.

At the Board's direction, the recommended Best Available Control Technology (BACT) level for gas turbine based electrical generation was revised to reflect the appropriate levels for simple cycle and combined cycle applications. The appropriate sections discussing the BACT recommendations were also revised to be consistent with the Board's direction.

Technical correction for the Precertification claim requested for the Xonon technology.

The Section providing guidance for emission monitoring was modified to clarify the scope of this guidance, as well as to clarify the recommendations for source test requirements for electrical generating units equipped with continuous emission monitors (CEM).

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I. EXECUTIVE SUMMARY

A. Introduction

Senate Bill (SB) 1298 (Bowen and Peace), which was chaptered on September 27, 2000, required the Air Resources Board (ARB) to issue guidance to districts on the permitting or certification of electrical generation technologies under the district's regulatory jurisdiction. The statue also directs ARB to adopt a certification program and uniform emission standards for electrical generation technologies that are exempt from air pollution control or air quality management districts' (districts) permitting requirements. The proposed certification program is discussed in the ARB report: Proposed Regulation to Establish a Distributed Generation Certification Program, September 2001.

SB 1298 specifies that the guidelines address Best Available Control Technology (BACT) determinations for electrical generation technologies and, by the earliest practical date, shall make the determinations equivalent to the level determined by the ARB to be BACT for permitted central station power plants in California. Finally, this guidance is to address methods for streamlining the permitting and approval of electrical generation units, including the potential for precertification of one or more types of electrical generation technologies.

This executive summary provides an overview of the development of the Guidelines and a summary of the ARB staff's recommendations.

B. Background

This section briefly discusses the contents of this document in a question-and-answer format. The reader is directed to subsequent chapters for more detailed discussions.

1. What is the purpose of this guidance document?

The purpose of this document is to provide guidance to assist districts in making permitting decisions for electrical generation technologies, particularly generation that is near the place of use (distributed generation (DG)). Applicants will also find this guidance useful when developing and planning a proposed electrical generation project.

2. How does this guidance differ from the previously issued ARB report: Guidance for Power Plant Siting and Best Available Control Technology?

The 1999 ARB report entitled Guidance for Power Plant Siting and Best Available Control Technology ("1999 ARB Power Plant Guidance ") provided guidance to the districts on gas turbine electrical generation technologies rated at 50 megawatts (MW) or greater. In addition, the 1999 report provided guidance regarding emission offsets, ambient air quality impact analysis, health risk assessment, and other permitting considerations. This new guidance addresses electrical generation technologies not discussed in the ARB Power Plant Guidance (i.e. distributed generation), and in some cases, updates information regarding control technologies. Electrical generation technologies discussed in this guidance include: gas turbines electrical generation technologies rated at less than 50 MW using either natural gas or waste gases and stationary reciprocating engines using either fossil fuel or waste gases.

3. What does this guidance address?

- Best available control technology (BACT) – the ARB staff's evaluation of recent BACT determinations for gas turbines rated at less than 50 MW and reciprocating engines used in electrical generation; the ARB staff's evaluation of the feasibility of distributed generation technologies achieving emission levels of central station power plants equipped with BACT.

- Other permitting considerations – the ARB staff's evaluation of the air quality benefits of combined heat and power (CHP) electrical generation technologies, and clarification of emissions testing and monitoring requirements.

- Permit Streamlining – the ARB staff's proposed suggestions to streamline the permitting of electrical generation technologies.

4. How was this guidance developed?

The ARB's staff proposal was developed in a public process that involved all affected parties. The ARB staff held five public consultation meetings throughout the state during the development of the guidelines to solicit ideas and comments on proposed guideline levels. A DG work group was formed to assist the ARB staff with identifying and resolving issues during the development of the guidelines. The work group, comprised of over 90 representatives of affected industry, environmental groups and district staff, met six times in Sacramento.

The ARB staff also held several conference calls with district staff to obtain the districts' perspectives on the ARB staff's proposed DG program.

C. Recommendations

1. Best Available Control Technology

Health and Safety Code Section 42300 authorizes delegation of stationary source permitting authority from the State to local air districts. Each district has its own set of definitions and rules. As a result, the definition of BACT and, where used, lowest achievable emission rate (LAER) can vary by district.

Federal BACT is defined in Section 169(3) of the federal Clean Air Act. It states that the "term 'best available control technology' means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques,..."

Federal LAER is defined in Section 171(3) of the federal Clean Air Act. It states that the "The term 'lowest achievable emission rate' means for any source, that rate of emissions which reflects --(A) the most stringent emission limitation which is contained in the implementation plan of any State for such class or category of source, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable, or (B) the most stringent emission limitation which is achieved in practice by such class or category of source, whichever is more stringent."

Most BACT definitions in California are consistent with the federal LAER definition and are often referred to as "California BACT." "California BACT" should not be confused with the less restrictive federal BACT. In the context of this guidance, references to BACT specifically refer to "California BACT."

Tables I-1 and I-2 summarize the recommended BACT emission levels approved by the Board at its November 15, 2001 meeting. These levels reflect the Board's direction that the category for gas turbine based electrical generation be further categorized into combined-cycle and simple-cycle applications and that BACT levels be recommended for these two categories. These oxides of nitrogen (NOx), volatile organic compounds (VOC), carbon monoxide (CO), and particulate matter (PM) levels are expressed in terms of pounds / megawatt-hour (lb/MW-hr). This convention, which is consistent with the ARB's proposed DG certification program, provides recognition for efficient use of fuels and reduced emissions of greenhouse gases.

Table I-1:
Summary Of BACT For The Control Of Emissions From Stationary Gas Turbines Rated at Less Than 50 MW Used In Electrical Generation*

Equipment Category	NOx lb/MW-hr	VOC lb/MW-hr	CO lb/MW-hr	PM lb/MW-hr
< 3 MW	0.5 (9 ppmvd**)	0.1 (5 ppmvd**)	0.4 (10 ppmvd**)	An emission limit corresponding to natural gas with fuel sulfur content of no more than 1 grain/100 standard cubic foot
3 - 12 MW				
Combined-Cycle	0.12 (2.5 ppmvd**)	0.04 (2 ppmvd**)	0.2 (6 ppmvd**)	
Simple-Cycle	0.25 (5 ppmvd**)	0.04 (2 ppmvd**)	0.2 (6 ppmvd**)	
> 12 and < 50 MW				
Combined-Cycle	0.10 (2.5 ppmvd**)	0.03 (2 ppmvd**)	0.15 (6 ppmvd**)	
Simple-Cycle	0.20 (5 ppmvd**)	0.03 (2 ppmvd**)	0.15 (6 ppmvd**)	
Waste gas fired	1.25 (25 ppmvd**)	--	--	--

* all standards based upon 3-hour rolling average and in lb/MW-hr.

** lb/MW-hr standard equivalent to ppmdv value expressed at 15 percent O_2.

Table I-2:
Summary Of BACT For The Control Of Emissions From Reciprocating Engines Used In Electrical Generation

Equipment Category	NOx lb/MW-hr	VOC lb/MW-hr	CO lb/MW-hr	PM lb/MW-hr
Fossil fuel fired	0.5 (0.15 g/bhp-hr or 9 ppmvd*)	0.5 (0.15 g/bhp-hr or 25 ppmvd*)	1.9 (0.6 g/bhp-hr or 56 ppmvd*)	0.06 (0.02 g/bhp-hr)
Waste gas fired	1.9 (0.6 g/bhp-hr or 50 ppmvd*)	1.9 (0.6 g/bhp-hr or 130 ppmvd*)	7.8 (2.5 g/bhp-hr or 300 ppmvd*)	NA

* lb/MW-hr standard is equivalent to g/bhp-hr and ppmdv expressed at 15 percent O_2. Concentration (ppmdv) values are approximate.

The basis for the BACT emission levels in Table I-1 for gas turbines is as follows:

For gas turbines rated at less than 3 MW:

- For NOx, the most stringent emission levels deemed BACT by the South Coast Air Quality Management District;
- For CO, the most stringent emission levels deemed BACT by the South Coast Air Quality Management District; and
- For VOC, the most stringent emission levels deemed BACT by the South Coast Air Quality Management District.

For turbines fueled with natural gas, used in combined-cycle applications, and rated from 3 MW to 50 MW:

- For NOx, the most stringent level achieved in practice based upon annual source tests done at two facilities (two consecutive tests at one facility) and continuous emission monitoring data for another facility;
- For CO, the most stringent level achieved in practice based upon annual source tests at two facilities (four consecutive tests at one facility) and continuous emission monitoring data; and
- For VOC, the most stringent level achieved in practice based upon annual source tests at two facilities (four consecutive tests at one facility) and continuous emission monitoring data.

For turbines fueled with natural gas, used in simple-cycle applications, and rated from 3 MW to 50 MW:

- For NOx, the most stringent level achieved in practice based upon consecutive annual source tests done at two facilities (two consecutive tests at one facility and several consecutive tests at the other facility) and continuous emission monitoring data;
- For CO, the most stringent level achieved in practice based upon several annual source tests at one facility; and
- For VOC, the most stringent level achieved in practice based upon several annual source tests at one facility.

For gas turbines fueled with waste gas:

- For NOx, the most stringent level achieved in practice based upon three annual source tests at one facility and continuous emission monitoring data for this facility.

The basis for the BACT emission levels in Table I-2 for reciprocating engines is as follows:

For reciprocating engines using fossil fuel:

- For NOx, the most stringent level achieved in practice based upon 35 annual source tests done at 12 facilities and one ARB test (some facilities have been tested four consecutive times);
- For CO, the most stringent level achieved in practice based upon 29 annual source tests done at 12 facilities and one ARB test (some facilities have been tested two consecutive times); and
- For VOC, the most stringent level achieved in practice based upon 25 annual source tests done at 11 facilities and one ARB test (some facilities have been tested two consecutive times).

For waste gas fueled reciprocating engines:

- For NOx, the most stringent level achieved in practice based upon 14 annual source tests done at 9 facilities and continuous emission monitoring data for one facility;
- For CO, the most stringent level achieved in practice based upon 14 annual source tests done at 9 facilities and continuous emission monitoring data for one facility; and
- For VOC, the most stringent level achieved in practice based upon 14 annual source tests done at 9 facilities and continuous emission monitoring data for one facility.

2. Achieving Central Station Power Plant Levels

The ARB staff recommends that, to the extend possible, districts encourage electrical generation projects that are also efficient combined heat and power (CHP) applications and that districts recognize the benefits of CHP and grant credit to electrical generation that are used in efficient CHP applications. The credit would only be used toward satisfying the goal that emissions from electrical generation technologies, at the earliest practicable date, be equivalent to emission levels for central station power plants. Only efficient CHP electrical generation projects are likely to achieve the equivalent emissions of central station power plants equipped with BACT. This can be achieved by requiring electrical generation facilities, after applying the CHP credit, to achieve the equivalent emissions of central station power plants equipped with BACT by 2007.

3. Other Permitting Considerations

Recommendations are provided for addressing health risk assessment requirements, source testing, and emissions monitoring. The ARB staff recommended that districts make permitting decisions consistent with the ARB report: Risk Management Guidelines for New and Modified Sources of Toxics Air Pollutants, July 1993. In the case of diesel-fueled engines, the ARB staff recommends that district's permitting decisions be consistent with the ARB report: Diesel Risk Management Guidelines, October 2000.

The ARB staff provided recommendations for source testing, monitoring of emissions and equipment, and recordkeeping of electric generation technologies. In addition, the ARB staff provided suggested permit conditions based upon these recommendations.

4. Permit Streamlining

The ARB staff recommends that the districts, to the extent reasonable, streamline their permitting programs and procedures for electrical generation. However, the ARB staff recognizes that not all permitting requirements can be streamlined without compromising district requirements. The ARB staff recommends that districts evaluate the following areas in their permitting programs for streamlining opportunities: BACT determinations, precertified emission rates, standardized permit applications, and standardized permit conditions. Finally, the ARB staff encourages districts to adopt standardized permitting thresholds.

II. OVERVIEW

This report provides guidance to local air pollution control districts and air quality management districts (districts) regarding the permitting of electrical generation technologies. In particular, this report describes DG technologies; discusses existing regulations; addresses best available control technology (BACT) determinations; recommended emission levels for oxides of nitrogen (NOx), volatile organic compounds (VOC), carbon monoxide (CO), and particulate matter (PM); discusses how electrical generation technologies can achieve central station power plant levels; other permitting considerations including testing and monitoring requirements and the inclusion of a CHP credit; and methods to streamline the permitting of electrical generation projects under the regulatory jurisdiction of districts.

A. Background

These Guidelines were prepared to satisfy the requirements of Senate Bill (SB) 1298 (Bowen and Peace), which was signed into law September 25, 2000. SB 1298 requires the Air Resources Board (ARB) by January 1, 2003 to: 1) adopt a certification program for electrical generation technologies that are exempt from district permitting requirements; and 2) issue guidance to assist districts on the permitting or certification of electrical generation under their jurisdiction. The certification program is to include emission standards (expressed in pound per megawatt-hour (lb/MW-hr) that reflect the best performance achieved in practice by electrical generation technologies that are exempt from district jurisdiction. In addition, SB 1298 requires the guidance to address BACT determinations for electrical generation technologies. By the earliest practical date, the determinations shall be made equivalent to the level determined by the ARB to be BACT for permitted central station power plants in California; and identify methods for streamlining the permitting and approval of electrical generating units. Appendix A contains a copy of SB 1298.

The 1999 ARB report entitled Guidance for Power Plant Siting and Best Available Control Technology ("1999 ARB Power Plant Guidance ") provided guidance to the districts on gas turbine electrical generation technologies rated at 50 megawatts (MW) or greater. This new guidance addresses electrical generation not discussed in the ARB Power Plant Guidance (i.e. distributed generation), and in some cases, updates information regarding control technologies.

B. What Is Distributed Generation?

SB 1298 defines distributed generation (DG) as electric generation located near the place of use. A variety of technologies can be used for DG, including photovoltaics, wind turbines, fuel cells, reciprocating engines (external and internal combustion), and gas turbines. Although reciprocating engines and gas turbines can use a variety of gaseous and liquid fuels, most commonly they use natural gas and diesel.

Some DG technologies can be used in combined heat and power (CHP) applications. CHP applications produce both electric power and process heat from the combustion/processing of the same fuel. CHP applications have increased energy efficiency (total useful energy output / energy input) and decreased production of greenhouse gases. Fuel cells, reciprocating engines, and gas turbines have been used as CHP applications.

C. Key Terms

Attainment Areas - an area with ambient air quality, demonstrated by a monitoring program, to be below the ambient air quality standard promulgated by the Air Resources Board or the United States Environmental Protection Agency.

Best Available Control Technology (BACT) - air pollution control technology requirement from district new source review programs. In California, many air pollution control agencies use the term BACT to refer to Lowest Achievable Emissions Rate (LAER). LAER is the emissions control level required of a source seeking a permit in a nonattainment area. LAER is generally considered to be the most stringent level of control required under the federal Clean Air Act.

Best Available Retrofit Control Technology (BARCT) - defined in the California Health and Safety Code, section 40406, but applicable statewide in this case, as “an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source.”

Central Station Power Plant Equipped with BACT - combined cycle gas turbine electrical generation equipped with selective catalytic reduction and oxidation catalyst and achieves 0.06 lb/MW-hr for NOx, 0.02 lb/MW-hr for VOC, and 0.09 lb/MW-hr for CO. If line losses are included, then the emissions are 0.07 lb/MW-hr for NOx, 0.02 lb/MW-hr for VOC, and 0.1 lb/MW-hr for CO.

Combined Heat and Power - applications that produce both electric power and process heat from the combustion/processing of the same fuel. Process heat refers to the thermal energy used such as hot water heated and consumed by occupants at a building and not the potential thermal energy produced by the unit.

Continuous Emission Monitor (CEM) - equipment that continuously measures the emissions of criteria pollutants. Equipment must be periodically calibrated to ensure accuracy of measurements.

Distributed Generation - electrical generation located near the place of use.

Emergency - when electrical or natural gas service fails or emergency pumping of water for fire protection or flood relief is required.

Fossil Fuel – includes fuels such as coal, oil, and natural gas; so-called because they are the remains of ancient plant and animal life. For electrical generation, typical fossil fuels used include diesel, gasoline, natural gas, and propane. These fuels are blends of various types of hydrocarbon compounds, including hydrocarbon compounds derived from other sources (example: biodiesel is developed from vegetable oils), and consequently, the composition of a fuel can vary significantly and still be considered diesel, gasoline, etc.

Portable - a device designed and capable of being carried or moved from one location to another. The device is not portable if it resides at the same location for more than 12 consecutive months.

Reasonably Available Control Technology (RACT) - control technology for existing sources that is generally considered to be those emission limits that would result from the application of demonstrated technology to reduce emissions.

Waste Gas - refers to gases generated at landfills or from the digestion of solid material at waste water treatment plants.

III. DESCRIPTION OF DISTRIBUTED GENERATION TECHNOLOGIES AND APPLICABILITY OF GUIDELINES

As discussed previously, this guideline is intended to be a companion to the 1999 ARB Power Plant Guidance. The 1999 report provides permitting guidance for electrical generation technologies using gas turbines 50 rated at MW and larger. This report will provide additional guidance for other electrical generation technologies not covered in the 1999 Guidance. These technologies include gas turbines that are rated at less than 50 MW and reciprocating engines. The fuels are further broken down into fossil fuels and waste gases such as landfill or digester gas.

This report will not provide guidance for electrical generation technologies that are used in emergency or portable applications. An emergency is when electrical or natural gas service fails or emergency pumping of water for fire protection or flood relief is required. Most emergency electrical generation units are diesel-fueled engines. The Board identified PM from diesel-fueled engines as a Toxic Air Contaminant in 1998. The ARB staff expects to present a proposed control measure, which will include emission standards for diesel-fueled engines, to the Board next year. Small backup generators (rated at less than 50 horsepower) are already required to be certified under the ARB's Small Off-Road Engine (SORE) Program.

Electrical generation that is conducted for peak shaving or demand reduction purposes is governed by these guidelines.

This guidance does not apply to electrical generation equipment registered by the ARB's Statewide Portable Equipment Registration Program (PERP). A portable electrical generation unit which does not stay at any one location for more than 12 consecutive months is usually eligible for the PERP. Additional information on the ARB's PERP can be obtained from the ARB report: Proposed Amendments to the Regulation for the Statewide Portable Equipment Registration Program, October 1998.

IV. SUMMARY OF EXISTING REGULATIONS

A. District Programs

This section discusses the applicable air quality-related requirements for electrical generation at the local district level. These include district New Source Review programs, control measures adopted by districts pursuant to the State Implementation Plan (SIP), and rules and policies for the control of emissions of toxic air contaminants.

1. New Source Review

For most electrical generation sources, the primary air pollution control program of concern is New Source Review (NSR). NSR is a district preconstruction program established by the federal Clean Air Act that governs the construction of major new and modifying stationary sources. NSR is intended to ensure that these sources do not prevent the attainment or interfere with the maintenance of the national ambient air quality standards. Each district has adopted its own NSR rules to regulate the construction of new and modified sources of air pollutants. NSR requires the application of BACT and the mitigation of emission increases with offsets. With a few exceptions, the districts' definitions of BACT are equivalent to the federal requirement for lowest achievable emission rate (LAER). The application of BACT and offsets are discussed in detail in Appendix B of the Power Plant Guidance Report. The specific application of these criteria for electrical generation is discussed in Chapter V of this report.

2. Control Measures In The State Implementation Plan

As part of the effort to attain both State and federal ambient air quality standards, districts have been required to develop plans outlining the steps needed to attain these standards. This includes identifying control measures the district proposes to adopt and implement to generate the necessary emissions reduction. These control measures typically identify the target category and the proposed level of emission reduction. A brief discussion of the most stringent SIP control measures related to electrical generation is provided in Appendix B.

3. Toxic Air Pollutants Programs

There are several programs used by districts to regulate toxic air pollutants, including Toxic New Source Review, the Air Toxics "Hot Spots" Information and Assessment Act, and the ARB's Toxic Air Contaminant Program.

Currently, four districts have adopted Toxic New Source Review rules and approximately 15 districts have policies. Most of these rules and policies use an approach that incorporates risk levels that trigger the installation of Toxic Best Available Control Technology (T-BACT). Risk levels above prescribed thresholds can result in a permit denial.

The Air Toxics "Hot Spots" Information and Assessment Act establishes a formal air toxics emission inventory risk quantification and risk reduction program for districts to manage. The goal of the Air Toxics "Hot Spots" Act is to collect emissions data indicative of routine predictable releases of toxic substances to the air, identify facilities having localized impacts, evaluate health risks from exposure to the emissions, notify nearby residents of significant risks, and reduce risk below the determined level of significance.

The Toxic Air Contaminant Identification and Control Act created California's two-step program to reduce exposure to air toxics. During the first step (risk identification), the ARB and the Office of Environmental Health Hazard Assessment (OEHHA) determine if a substance should be formally identified as a toxic air contaminant (TAC) in California. In the second step (risk management), the ARB reviews the emission sources of an identified TAC to determine if any regulatory action is necessary to reduce the risk. If the ARB subsequently adopts airborne toxic control measures (ATCM), then districts are required to adopt and enforce control measures at least as stringent as those adopted by the ARB. To date, ARB has adopted nine ATCMs.

B. ARB Programs

This section describes various ARB activities related to electrical generation.

1. Guidance for Power Plant Siting and Best Available Control Technology

The ARB’s September 1999 Power Plant Guidance, provides guidance to assist districts in the permitting of electrical generation that is subject to the California Energy Commission's (CEC) power plant siting process for power plants that generate 50 MW or more. Guidance was provided for BACT for criteria pollutant emissions from simple cycle and combined cycle natural gas fired electrical generation technology. In addition, guidance was provided for the other aspects of permitting, such as satisfying emission offset requirements and preparing health risk assessments.

2. Retrofit Of Electrical Generation Facilities

On May 22, 2001, Governor Davis signed SB 28X (Sher). This bill requires the ARB, in consultation with districts and the Independent System Operator, to adopt regulations to establish emission control retrofit requirements for electrical generation facilities in a manner that protects public health and the environment. SB 28X requires the ARB to adopt regulations by July 1, 2002. The mandated retrofits must be completed by December 31, 2004, unless a later date is needed to maintain electric system reliability, or unless the operator intends to repower the facility.

3. Diesel Risk Reduction Plan/Risk Management

In September 2000, the Board approved a comprehensive Diesel Risk Reduction Plan (Plan) to reduce diesel particulate matter emissions from new and existing diesel-fueled engines and vehicles. Diesel particulate was identified as a TAC by the Board in August, 1998. The Plan was promulgated pursuant to the Toxic Air Contaminant Identification and Control Act.

The Plan approved by the Board identifies 14 measures that will be developed over the next several years. The goal of the Plan is to reduce diesel PM emissions and the associated health risk by 75 percent in the year 2010 and 85 percent or more by the year 2020. Some of the proposed measures include: new emissions standards for diesel-fueled engines, retrofit of existing stationary prime and emergency standby diesel-fueled engines (an electrical generation technology), and retrofit of existing portable diesel-fueled engines. See the ARB diesel website (http://www.arb.ca.gov/diesel/dieselrrp.htm) for information about the schedule for developing these various measures.

The Board also approved guidance to assist districts in risk management decisions associated with the permitting of new stationary diesel-fueled engines. The guidance document contains a recommendation that new stationary diesel-fueled engines meet specific technology requirements or an equivalent performance standard to reduce diesel particulate matter. Additional requirements must be satisfied for engines that could operate more than 300 hours annually. In general, the guidance recommends that non-emergency engines satisfy a PM emission standard of 0.02 grams per brake horsepower-hour) (g/bhp-hr). For emergency standby engines, engines that operate 100 hours or less on an annual basis, the guidance recommends that the engines satisfy a 0.1 g/bhp-hr PM performance standard. See the ARB staff report, <u>Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines</u>, October 2000, for more details.

4. Reasonably Available Control Technology (RACT)/Best Available Retrofit Control Technology (BARCT) For Stationary Spark Ignited Engines

The ARB staff has issued a proposed RACT/BARCT determination for stationary spark ignited engines. Recommendations were provided for both RACT and BARCT levels for NOx, VOC, and CO for several categories based upon engine type. The most recent recommendations are contained in the ARB draft staff report entitled Proposed Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology For Stationary Spark-Ignited Internal Combustion Engines, April 2001. The draft report has been circulated among district staff for their review and the report is expected to be finalized in 2002. In addition, in conjunction with the ARB's effort to reduce diesel PM emissions from stationary diesel-fueled engines, the ARB staff will also be evaluating RACT and BARCT levels for NOx, VOC, and CO emissions from stationary diesel-fueled engines.

5. Risk Management Guidelines For New And Modified Sources Of Toxic Air Pollutants

The ARB staff provided guidance to assist districts in making permitting decisions for new and modified stationary sources of toxic air pollutants. This guidance is contained in the ARB staff report: Risk Management Guidelines for New and Modified Sources of Toxic Air Pollutants, 1993. Guidance was provided for managing potential cancer and noncancer health risks and is applicable to electrical generation sources.

C. United States Environmental Protection Agency Programs

This section describes various guidance and programs promulgated by the United States Environmental Protection Agency (U.S. EPA) or contained in the federal Clean Air Act that may affect electrical generation.

1. Permitting Programs

The federal Clean Air Act established two distinct preconstruction permit programs governing the construction of major new and modifying stationary sources: NSR for nonattainment areas and Prevention of Significant Deterioration (PSD) for attainment areas. As discussed above, districts have implemented the requirements of NSR. For PSD, districts with federal delegation implement their own PSD program. Otherwise, U.S. EPA implements the PSD program for districts without federal delegation authority. Both programs require control technology (BACT for PSD and LAER for NSR) and offsets.

2. Other Programs

New source performance standards (NSPSs) are regulations adopted by the U.S. EPA that define emission limits, testing, monitoring and record keeping for certain categories of sources or processes (Sections 111 and 129 of the Federal Clean Air Act; 40 CFR Part 60). There is a NSPS for turbines (Subpart GG of 40 CFR Part 60), previously discussed in the 1999 ARB power Plant Guidance. No NSPS has been proposed for reciprocating engines.

The federal program for national emission standards for hazardous air pollutants (NESHAP) is applicable to new and existing sources emitting over ten tons per year (TPY) of one hazardous air pollutant (HAP) or 25 TPY of a combination of HAPs (Section 112 of the Federal Clean Air; 40 CFR Part 61 and 63). A NESHAP may include a requirement for maximum achievable control technology (MACT). Proposed MACT standards are expected to be released for public comment in 2001 for toxic emissions from spark-ignited and compression ignition engines, as well as, gas turbines.

D. California Energy Commission Program

The California Energy Commission (CEC) has the exclusive authority to approve the construction and operation of power plants that will use thermal energy and have electrical generation capacities of 50 MW or greater. The Power Plant Guidance contains a summary of the CEC power plant siting process.

E. States' Programs Related to Distributed Generation

On May 29, 2001, the State of Texas adopted a regulation allowing the issuance of an air permit (standard permit) for electric generating units if certain requirements are satisfied. Instead of meeting the requirements of the standard permit, applicants in Texas have the option to obtain permits through the normal NSR program.

In the standard permit for electrical generation units, the initial standards for the non-attainment area of Texas are generally consistent with BACT requirements in California, and for the attainment area of Texas, the initial standards are consistent with RACT requirements. For technologies that are rated at less than 10 MW and located in the non-attainment area of Texas, units installed prior to December 31, 2004 are subject to a NOx emission standard of 0.44 lb/MW-hr. Electrical technologies that are rated at less than 10 MW and installed after December 31, 2004, are subject to a more stringent NOx emission standard of 0.14 lb/MW-hr, equivalent to a gas turbine emitting 5 ppmvd NOx. Finally, all electrical technologies rated at 10 MW or more and operated more than 300 hours annually are also subject to the NOx emission standard of 0.14 lb/MW-hr.

Connecticut plans to propose a general permit that will initially be set at RACT levels, but will become more stringent by 2005. If the emissions from the proposed electrical generation unit exceed the standard, the project applicant would be required to mitigate the amount of emissions that is above the standard. New York is establishing a work group to begin the process of developing a program.

Since January 2001, the ARB staff has participated in the Distributed Generation Emissions Collaborative Working Group. The Regulatory Assistance Project (RAP) is organizing and coordinating the activity of the Collaborative Working Group. The Collaborative Working Group is composed primarily of representatives from various State public utility commissions, State air quality programs, manufacturers, and the National Resources Defense Council. The goal of the group is to develop a national model rule for emissions from DG by September 2001. Information on the activities of the Collaborative Working Group is available at http://www.rapmaine.com.

V. BACT FOR ELECTRICAL GENERATION TECHNOLOGIES

A. Introduction

This chapter summarizes the ARB staff analysis of BACT determinations for the following electrical generation technologies: stationary natural gas fired turbines ("gas turbines") having a power rating of less than 50 MW using natural gas or waste gases; and stationary reciprocating engines using fossil fuels or waste gases. This chapter also summarizes information about combustion and add-on control technologies that can be used to reduce emissions of NO_X, CO, and VOC. General guidance for performing a BACT evaluation is contained in Appendix B of the1999 ARB Power Plant Guidance.

In most district permitting rules, BACT is defined as the most stringent limitation or control technique:

1) which has been achieved in practice,

2) is contained in any SIP approved by the U.S. EPA, or

3) any other emission control technique, determined by the Air Pollution Control Officer to be technologically feasible and cost effective.

SB 1298 defined BACT to have the same meaning as defined in the California Health and Safety Code section 40405. Section 40405 defines BACT as an emission limitation that will achieve the lowest achievable emission rate for the source to which it is applied. Lowest achievable emission rate means the most stringent of the following: (1) the most stringent emission limitation that is contained in the SIP for the particular class or category of source, unless the owner or operator of the source demonstrates that the limitation is not achievable; (2) the most stringent emission limitation that is achieved in practice by that class or category or source. This definition is consistent with the first two provisions of the district BACT definition discussed above.

Tables V-1 and V-2 summarize the recommended BACT emission levels approved by the Board at its November 15, 2001 meeting. These levels reflect the Board's direction that the category for gas turbine based electrical generation be further categorized into combined-cycle and simple-cycle applications and that BACT levels be recommended for these categories. These NOx, VOC, and CO levels are expressed in terms of lb/MW-hr. This convention, which is consistent with the ARB's proposed DG certification program, provides recognition for efficient use of fuels and reduced emissions of greenhouse gases.

These recommended BACT emission levels are current at the publishing time of this guidance, and are based upon the most stringent emission level contained in any SIP approved by the U.S. EPA or the most stringent emission level achieved in practice. ARB will use the California Air Pollution Control Officer's Association (CAPCOA) BACT Clearinghouse to keep district staff apprised of changes to BACT levels, particularly in identifying additional achieved in practice determinations.

Table V-1:
Summary Of BACT For The Control Of Emissions From Stationary Gas Turbines Used In Electrical Generation*

Equipment Category	NOx (lb/MW-hr)	VOC (lb/MW-hr)	CO (lb/MW-hr)
< 3 MW	0.5	0.1	0.4
3 - 12 MW			
Combined Cycle	0.12	0.04	0.2
Simple Cycle	0.25	0.04	0.2
> 12 - < 50 MW			
Combined Cycle	0.10	0.03	0.15
Simple Cycle	0.20	0.03	0.15
Waste gas fired	1.25	NA	NA

*all standards based upon 3-hour rolling average

Table V-2:
Summary Of BACT For The Control Of Emissions From Reciprocating Engines Used In Electrical Generation

Equipment Category	NOx (lb/MW-hr)	VOC (lb/MW-hr)	CO (lb/MW-hr)	PM (lb/MW-hr)
Fossil fuel fired	0.5	0.5	1.9	0.06
Waste gas fired	1.9	1.9	7.8	NA

District BACT requirements will change if operational data or advances in technology demonstrate that lower levels have been achieved or are achievable at a reasonable cost. These emission levels should be used by Districts as a starting point in conducting a case-by-case BACT determination. For example, some of the technically feasible technologies discussed below, such as SCONOX or Xonon, should be evaluated as part of the case-by-case BACT determination. Finally, the specific conditions of each application may justify a departure from the ARB's staff recommended BACT emission levels. Factors that may affect a BACT determination include, but are not limited to:

- area attainment status,
- for gas turbines, use of aeroderived versus industrial frame gas turbine for simple-cycle power plant configuration, and
- use and function of electrical generation technology.

It is the responsibility of the permitting agency to make its own BACT determination for the class and category of electrical generation technology application. The BACT emission levels are intended to apply to the emission concentrations as exhausted from the stacks.

B. Gas Turbines Less Than 50 Megawatts

1. Current Control Technologies Being Used

a. State Implementation Plan Measures

There are several SIP control measures specifying reductions in NOx emissions from gas turbines. The most stringent of these measures has been adopted by the South Coast Air Quality Management District (SCAQMD) and Antelope Valley Air Pollution Control District (AVAPCD) with NOx emission standards based upon size, annual operating hours, and control system used. The SCAQMD and AVAPCD requirements vary from 25 parts per million by volume, dry (ppmvd) for the smallest turbines (rated at 0.3 to 2.9 MW) to 9 ppmvd for turbines rated at 2.9 MW or larger.

b. Control Techniques Required As BACT

The control techniques used for gas turbines have been described in detail in the 1999 ARB Power Plant Guidance. In summary, a combination of control techniques are available. For the control of NOx emissions, techniques include combustion modifications and post combustion controls. Combustion modifications include techniques such as Xonon (a catalytic combustion), low NOx combustors, and water/steam injection. Post combustion add-on systems such as selective catalytic reduction (SCR) and SCONOX have been used to achieve the lowest emission levels required by recent BACT determinations.

The efficiency of some NO_X control techniques is affected by exhaust temperature. Catalysts used for SCR are not as efficient in controlling NO_X at the high temperatures associated with uncooled exhaust. Gas turbine emissions from combined-cycle and cogeneration operations remove heat from the exhaust allowing the SCR system to operate at optimum conditions. For simple cycle applications within the size range addressed in this report, the same levels can be achieved with a combination of high temperature catalyst and cooling of the exhaust. For the reduction of VOC and CO emissions, the technology of choice is oxidation catalyst.

The ARB staff reviewed emission limits and BACT determinations conducted by California districts and other states for gas turbines used in power plant configurations. The result of this review supports establishing recommended BACT emission levels for three class or categories based upon the electrical output of the power plant. These categories are turbines rated at less than 3 MW, turbines rated at 3 MW up to 12 MW, and turbines rated at 12 MW and larger. The 12 MW cutoff is based upon the greater efficiencies of gas turbines in this category—a significant consideration when the emission level is expressed in lb/MW-hr. The lower cutoff is based upon the SCAQMD guidelines establishing a BACT standard for turbines rated at less than 3 MW.

1. Gas Turbines Less Than 3 MW

The most stringent BACT levels for gas turbines rated at less than 3 MW are expressed in BACT guidelines for the SCAMQD and Bay Area Air Quality Management District (BAAQMD). BACT Guidelines for the SCAQMD (for turbines rated at less than 3 MW) and BAAQMD (for turbines rated at less than 2 MW), specify BACT at 9 ppmvd at 15 percent O_2 for NOx, 5 ppmvd at 15 percent O_2 for VOC (BAAQMD only), 10 ppmvd at 15 percent O_2 for CO, and 9 ppmvd at 15 percent O_2 for ammonia. In addition, the BAAQMD Guidelines identify as technically feasible and cost effective a NOx level of 5 ppmvd at 15 percent O_2 based upon the application of catalytic combustion or high temperature SCR system with combustion modifications.

The most stringent level expressed in a preconstruction permit is for the Genxon Power Systems facility in Santa Clara. The Genxon Power Systems facility consists of a Kawasaki M1A-13 turbine (1.5 MW) equipped with Xonon combustors. The Xonon technology is discussed in detail in Section V.B.1.d.1 of this document.

2. Gas Turbines From 3 MW To 12 MW

The most stringent level for NOx emissions from gas turbines rated between 3 MW and 12 MW, as required in a preconstruction permit, is 5 ppmvd at 15 percent O_2 averaged over 3 hours. The Saint Agnes Medical Center, the University of California, San Francisco and two projects for Alliance Colton facilities have been permitted at this level. The Saint Agnes Medical Center electrical generation unit consists of a Solar Centaur 40 (3.5 MW) equipped with dry low NOx combustors and SCR. The unit at the University of California, San Francisco uses a Solar Taurus 60 (5 MW) with heat recovery and is equipped with water injection and SCR. Finally, the Alliance Colton units are based upon a General Electric 10B1 (10 MW) operated in simple cycle mode and equipped with either Xonon or SCR. (The BACT levels for the Alliance Colton facilities are based upon a one-hour average.) With regard to ammonia slip, the most stringent BACT level established in a preconstruction permit is 10 ppmvd at 15 percent O_2.

With regard to VOC and CO, the most stringent level appearing in a preconstruction permit is 2 ppmvd at 15 percent O_2 for VOC and 6 ppmvd at 15 percent O_2 for CO. The University of California, San Francisco facility (3-hour rolling average) and the two electrical generation units for Alliance Colton (1-hour rolling average) are permitted at this level. This level, consistent with the 1999 ARB Power Plant Guidance, is achievable using oxidation catalyst.

3. Gas Turbines Greater Than 12 MW

The most stringent level required in a preconstruction permit is for the NRG Energy Center Round Mountain facility located in the San Joaquin Valley. The NOx level specified was 2 ppmvd at 15 percent O_2 averaged over 3 hours. The determination is for a General Electric LM6000 enhanced sprint gas turbine with a heat recovery steam generator and equipped with water or steam injection, SCR, and oxidation catalyst. In addition, Northern California Power in Lodi was permitted at 3 ppmvd at 15 percent O_2 averaged over 3 hours for NOx, but with an allowed ammonia slip of 25 ppmvd at 15 percent O_2. The facility consists of a General Electric LM5000 gas turbine operated in a simple-cycle mode and equipped with steam injection, SCR, and oxidation catalyst.

With regard to VOC, CO, and ammonia, the most stringent level appearing in a preconstruction permit is 2 ppmvd at 15 percent O_2 for VOC, and 5 ppmvd at 15 percent O_2 for ammonia for the NRG Energy Center Round Mountain facility. For this project, a BACT determination was not made for CO. For CO, the most stringent level appearing in a preconstruction permit is 6 ppmvd at 15 percent O_2. This has been specified for a number of projects, including Redding Power and the Los Angeles Department of Water and Power’s Valley facility.

c. Emission Levels Achieved In Practice

1. Gas Turbines Less Than 3 MW

The most stringent level achieved in practice is for a Kawasaki turbine (1.5 MW) equipped with the Xonon combustors located at Genxon Power Systems. This turbine has achieved NOx levels of 2-3 ppmvd at 15 percent O_2. The Xonon technology is discussed in detail in Section V.B.1.d.1 of this document.

2. Gas Turbines From 3 MW To 12 MW

Two generating facilities have achieved NOx emission levels of 5 ppmvd at 15 percent O_2. These include the University of California, San Francisco, discussed above, and the generating facility at California Institute of Technology (CalTech), Pasadena. The unit at CalTech consists of a Solar Centaur 50 (4.6 MW) turbine operated in a combined cycle mode and is equipped with water injection and SCR. The University of California, San Francisco facility is also equipped with oxidation catalyst. With the catalyst, the University of California, San Francisco facility has reduced VOC emissions to the detection level and CO emissions are at 1 ppmvd—well under the BACT levels of 2 ppmvd at 15 percent O_2 and 10 ppmvd at 15 percent O_2, respectively. In all cases, these levels have been demonstrated for over three years, based upon three consecutive annual source tests and continuous emissions monitoring (CEM) data.

3. Gas Turbines Greater Than 12 MW

The lowest level achieved in practice is for the above mentioned Northern California Power facility in Lodi, which has operated since early 1999. Based upon CEM data and annual inspections, the unit has met the 3 ppmvd NOx limit since startup. The latest compliance test indicated NOx emissions were below 3 ppmvd at 15 percent O_2, emissions of CO were measured at about 12 ppmvd at 15 percent $O_{2,}$ and ammonia emissions were at 25 ppmvd at 15 percent O_2. In addition, the Carson Energy facility in Sacramento, previously discussed in the 1999 Power Plant Guidance, has operated since 1995 and has demonstrated levels of 5 ppmvd at 15 percent O_2 for NOx, 2 ppmvd at 15 percent O_2 for VOC, and 6 ppmvd at 15 percent O_2 for CO. The Carson Energy facility consists of a General Electric LM6000 turbine operated in simple cycle mode.

Several other facilities in the San Joaquin Valley have been permitted at NOx level between 3.6 to 4.5 ppmvd at 15 percent $O_{2,}$ based upon a 3-hour average. These facilities are Live Oak Limited, Double C Limited, and High Sierra Limited. Double C Limited and High Sierra Limited consists of a General Electric LM2500 turbine (25 MW) and heat recovery steam generator. Live Oak Limited consists of a General Electric LM5000 turbine (49 MW) and heat recovery steam generator. All three facilities produce steam for use at an oilfield, and are equipped with SCR and oxidation catalyst. The Live Oak Limited facility has consistently maintained NOx emission levels below 3 ppmvd at 15 percent O_2 since starting up in 2000. Both the Double C Limited and High Sierra Limited facilities were permitted at a higher NOx limit, 4.5 ppmvd at 15 percent $O_{2,}$ but have typically been between 2.5 to 3.5 ppmvd at 15 percent O_2 based upon three years of annual testing. Finally, the latest compliance test for Live Oak Limited also indicated VOC and CO emissions were below the detection level.

In addition, the Federal Cold Storage Cogeneration facility has demonstrated levels of 2 ppmvd at 15 percent O_2 since 1996, based upon continuous emissions data collected over that period. This facility consists of a 25 MW General Electric LM2500 gas turbine operated in combined cycle mode generating a total of 32 MW. The gas turbine utilized water injection in conjunction with SCONOX.

d. More Stringent Control Techniques

There are a number of NOx control techniques that have not reached full commercial status. These technologies, which include Xonon and SCONOX, have been demonstrated successfully on several applications. However, at this time, they have not been widely implemented.

1. Xonon

At the Genxon Power Systems facility in Santa Clara, a Kawasaki M1A-13 turbine (1.5 MW) equipped with Xonon combustors has operated for over 8,000 hours. The Xonon technology is a flameless catalytic system integrated into the combustor in order to lower temperatures. As discussed above, the Kawasaki turbine equipped with Xonon achieved NOx levels of 2-3 ppmvd at 15 percent O_2, as well as, VOC levels of less than 3 ppmvd at 15 percent O_2, and CO levels of 4 ppmvd at 15 percent O_2. In addition, Catalytica Combustion Systems ("Catalytica"), the manufacturer of Xonon, has applied to the ARB's Equipment and Process Precertification Program requesting an independent verification of their claim that the Kawasaki turbine M1A-13X equipped with Xonon demonstrates emissions as low as 2.5 ppmvd at 15 percent O_2 for a one-hour rolling average at 98 percent or greater operating load based on design capacity.

If this technology is scaled-up and made available for other turbines, it may represent one of the most efficient combustion control options for NO_X for gas turbines. Catalytica is working with General Electric to implement the Xonon technology on larger turbines. Two projects have been proposed using Xonon in a General Electric turbine model 10B1 (10.5 MW) and a General Electric frame 7-F (168 MW).

2. SCONOX

The SCONOX technology has been implemented with success at the Federal Cold Storage Facility and the Genetics Institute facility in Massachusetts. In addition, the University of California, San Diego facility just finished commissioning testing. SCONOX is also proposed for the Redding Power facility in Shasta, which would be the largest turbine application to date for this technology.

The Federal Cold Storage Facility consists of a General Electric LM2500 gas turbine in combined cycle mode for a total electrical generation of 32 MW. The turbine exclusively fires natural gas, utilizes water injection in conjunction with SCONOX, and has demonstrated levels of 2 ppmvd at 15 percent O_2 since 1996, based upon continuous emissions data. The ARB, through its Equipment Precertification Program, has verified the emissions of NOX as low as 2 ppmvd at 15 percent O_2 over a 3-hour rolling average for the Federal Cold Storage Cogeneration facility. A revised formulation suggests that even lower levels of NOx could be achieved.

The Genetics Institute facility consists of a Solar Taurus 60 (5 MW) equipped with dry low NOx combustors and SCONOX. When natural gas is used as the primary fuel, the NOx emissions have been below 2 ppmvd at 15 percent O_2. However, when the turbine operates for long periods of time using oil, which appears to be the normal operating scenario, the SCONOX technology has experienced masking problems which reduces the effectiveness of the technology in reducing NOx emissions. The masking is reversible, but requires cleaning of the catalyst, and therefore shutdown of the turbine. EmeraChem (formerly known as Goal Line Environmental Technologies), the developer of the SCONOX technology, has since made modifications to the SCONOX systems at Genetics Institute such that oil usage no longer adversely affects the SCONOX system.

At University of California, San Diego, two turbines rated at 12.5 MW and control technology have recently become operational. The July 2001 compliance test indicates NOx emissions levels are below 1 ppmvd at 15 percent O_2 for both turbines. However, prior to the compliance test, the facility was operating under a variance because the facility could not meet its permit limits within the commissioning period (90 days) allocated for shakeout and fine-tuning the facility's operation.

The SCONOX technology has relatively few installations and the largest gas turbine on which it is applied is rated at 25 MW (the Federal facility generates a total of 32 MW including the 7 MW steam turbine). Because the technology has not been demonstrated for all sizes of turbines, the ARB staff is not considering the levels achieved by SCONOX for the purposes of establishing guideline levels. However, district staff should continue to consider SCONOX in BACT determinations.

e. Concerns Regarding NOx Emissions Measurement

As discussed above, NO_X emissions from gas-turbine power plants employing advanced combustor design and post-combustion controls have been reduced to levels of approximately 2 to 3 ppmvd at 15 percent O_2. Current emission measurement methods for source testing and CEM were developed for sources with higher emission concentrations. As a result, many federal and State emission measurement methods have become obsolete for emission assessment and enforcement purposes. The ARB convened a Committee on Low Emission Measurement (Committee) to provide recommendations to revise the existing test method. This Committee includes representatives from the U.S. EPA, ARB, districts, manufacturers (testing equipment, turbines, and related equipment), and companies with emission measurement expertise. In addition, the University of California, Riverside (UCR) has been investigating the issue and is expected to issue a report that will include recommendations for revising the measurement methods. The Committee will consider UCR's report in making its recommendations. After the Committee makes its recommendations, the ARB will revise the affected test methods and bring them to the Board for approval.

f. BACT Recommendations

As discussed above, the ARB staff recommends the gas turbine emission category be subdivided based upon the electrical generation capacity of the gas turbine: less than 3 MW, 3 MW to 12 MW, and greater than 12 MW. Table V-1 summarizes the recommended BACT levels, in terms of lb/MW-hr, for each of these classes of categories. Similarly, Table V-3 summarizes the recommended BACT levels, in terms of concentration or ppmvd. The levels in both tables should be based upon a three-hour rolling average. In addition, both Table V-1 and V-3 reflect the Board's direction that the category for gas turbine based electrical generation be further categorized into combined-cycle and simple-cycle applications and that BACT levels be recommended for these categories.

As discussed above, for gas turbines rated at less than 3 MW, the ARB staff recommends using the guidelines levels recommended in the BAAQMD (achieved in practice levels) and SCAQMD BACT Guidelines as BACT. These levels are 9 ppmvd at 15 percent O_2 for NOx, 5 ppmvd at 15 percent O_2 for VOC, and 10 ppmvd at 15 percent O_2 for CO. Ammonia slip was also limited to 9 ppmvd at 15 percent O_2. The ARB staff is not aware of any BACT determinations, other than the Genxon Power Systems facility, for turbines rated at less than 3 MW.

For gas turbines rated from 3 MW to 50 MW, BACT recommendations for NOx are given for combined-cycle and simple cycle-applications. For combined-cycle applications, the recommended NOx level is 2.5 ppmvd at 15 percent O_2, and for simple-cycle applications, the recommended level is 5 ppmvd at 15 percent O_2. Recommendations for BACT levels for VOC and CO for this class and category of gas turbine are 2 ppmvd at 15 percent O_2 and 6 ppmvd at 15 percent O_2, respectively.

The NOx BACT recommendations for gas turbines used in simple-cycle applications, are based upon the levels achieved in practice for the Carson Energy facility in Sacramento and the levels in the preconstruction permit for the Saint Agnes Medical Center. The Carson Energy facility in Sacramento has achieved level of 5 ppmvd at 15 percent O_2 with an ammonia slip of 10 ppmvd at 15 percent O_2. The Carson Energy facility consists of a General Electric LM6000 Turbine. The Northern California Power facility in Lodi has achieved a more stringent level, 3 ppmvd at 15 percent O_2 for NOx since early 1999, but with an ammonia slip that is above 10 ppmdv at 15 percent O_2. The Northern California Power facility consists of a General Electric LM5000 Turbine. In addition, other facilities have been proposed to meet a 3.4 ppmvd at 15 percent O_2 level while limiting ammonia slip to 10 ppmdv at 15 percent O_2. Staff will continue to evaluate the feasibility of achieving a 3 ppmvd NOx level with minimal ammonia slip. Similarly, the preconstruction permit for Saint Agnes Medical Center electrical generation unit specifies a limit of 5 ppmvd at 15 percent O_2. This facility consists of a Solar Centaur 40 (3.5 MW) equipped with dry low NOx combustors and SCR.

The NOx BACT recommendations for gas turbines used in combined-cycle applications, are based upon the levels achieved in practice for several electric generating facilities located at oil fields, including the Live Oak Limited, Double C Limited, and High Sierra Limited facilities and the requirements in a recent preconstruction permit issued to the NRG Energy Center. The Live Oak Limited facility have been below 3 ppmvd at 15 percent O_2 for NOx. This facility consists of a General Electric LM5000 gas turbine and heat recovery steam boiler. Both the Double C Limited and High Sierra Limited facilities, which utilize General Electric LM2500 turbines and heat recovery steam generators, were permitted at a higher NOx limit, 4.5 ppmvd at 15 percent O_2, but have typically been between 2.5 to 3.5 ppmvd at 15 percent O_2. Finally, the BACT determination for the NRG Energy Center Round Mountain facility was 2 ppmvd at 15 percent O_2 for NOx averaged over 3 hours. The determination is for a General Electric LM6000 enhanced sprint gas turbine with a heat recovery steam generator and equipped with water or steam injection, and SCR.

The recommendations for BACT levels for VOC and CO are based upon the levels achieved in practice for several electric generating facilities. These include the University of California, San Francisco facility, Live Oak Facility, and the Carson Energy facility in Sacramento, previously discussed in the 1999 Power Plant Guidance. The San Francisco facility's VOC and CO emissions were measured at less than 0.6 ppmvd at 15 percent O_2 for VOC (the detection level) and 1 ppmvd at 15 percent O_2 for CO. In addition, the emissions for the Live Oak Limited facility were measured at less than 1 ppmvd at 15 percent O_2 for VOC (the detection level), 2 ppmvd at 15 percent O_2 for CO, and below 10 ppmvd at 15 percent O_2 for ammonia.

The above recommendations are largely based upon levels achieved in practice. District permitting staffs are encouraged to evaluate these BACT levels represented by these projects as part of the technical feasibility portion of the case-by-case BACT determination for electrical generation projects. For example, district permitting staffs are encouraged to evaluate the technical feasible and cost effectiveness of more stringent BACT levels or the use of advance control technologies including the SCONOX or Xonon technologies. Finally, the levels are consistent with the recommended BACT level from the 1999 ARB Power Plant Guidance.

The following table summarizes the recommended levels for stationary gas turbines used in electrical generation:

Table V-3:
Summary Of BACT For The Control Of Emissions From Stationary Gas Turbines Rated at Less Than 50 MW Used In Electrical Generation*

Equipment Category	NOx (ppmvd @ 15% O_2)	VOC (ppmvd @ 15% O_2)	CO (ppmvd @ 15% O_2)
< 3 MW	9	5	10
3MW - <50 MW			
Combined-Cycle	2.5	2	6
Simple-Cycle	5	2	6

*all standards based upon 3-hour rolling average

2. Future Developments

SB 1298 directs the ARB, at the earliest practicable date, to make its BACT determination guidance to the districts equivalent to that of permitted central station power plants in California. In order for all electrical generation technologies to achieve the same emission level as a central station power plant equipped with BACT emission control technologies will need to improve, as will the efficiencies of reciprocating engines.

The control technologies proposed for turbines rated at less than 50 MW are the same technologies being used for the central station power plants. For smaller turbines, the levels achieved are approaching the same level achieved by central station power plants equipped with BACT, in terms of concentration (or ppmvd). However, because of the higher efficiency of the gas turbine combined cycle power plants, the 2 ppmvd at 15 percent O_2 NOx level achieved by a 45 MW turbine will be less stringent, based upon lb/MW-hr, than the level achieved by a central station power plant equipped with BACT.

As discussed above, the larger turbines are more efficient than the smaller turbines. Large turbines are approaching efficiencies of 40 percent in converting the energy content of the fuel to electrical energy, and when used in a combined cycle application, the efficiency approaches 56 percent. By comparison, turbines rated at less than 10 MW have efficiencies of 32 percent or less. There are efforts underway to improve the efficiencies of the smaller turbines. For example, Solar Turbines is working with the Department of Energy (DOE) to develop an advance combustion system turbine that can achieve 40 percent efficiency--the same efficiency level enjoyed by the large turbines.

In summary, for gas turbines rated at 50 MW and less, to reach the equivalent emission levels, expressed as lb/MW-hr, as central station power plants equipped with BACT, the emission control systems will have to reduce emissions further and the efficiency of the turbines will have to improve.

C. Reciprocating Engines Using Fossil Fuel

1. Current Control Technologies Being Used

a. State Implementation Plan Measures

Several districts have adopted SIP control measures specifying reductions in NOx emissions from reciprocating engines. The most stringent of these measures has been adopted by SCAQMD, AVAPCD, and Ventura County Air Pollution Control District (VCAPCD). Both measures set emission standards for NOx, VOC, and CO. The SCAQMD and AVAPCD requires reciprocating engines, with no distinction as to the type of fuel used, to meet the following emission standards: 36 ppmvd at 15 percent O_2 for NOx, 250 ppmvd at 15 percent O_2 for VOC, and 2,000 ppmvd at 15 percent O_2 for CO. Alternate levels, which are higher than the general requirement, for NOx and VOC are allowed, based upon the efficiency of the engine.

The VCAPCD requirements for reciprocating engines vary based upon the type of engine and whether the standard can be satisfied by meeting an emission standard or achieving a specified percentage of emission reduction. NOx emission standards are set at 25 ppmvd at 15 percent O_2 for rich-burn engines, 45 ppmvd at 15 percent O_2 for lean-burn engines, and 80 ppmvd at 15 percent O_2 for diesel-fueled engines. Similarly, the VOC standard varies from 250 to 750 ppmvd at 15 percent O_2 and the CO standard is 4,500 ppmvd at 15 percent O_2 for all type of engines. The emission reduction component applies to NOx only and reductions of 90 to 96 percent must be achieved, with the specific level based upon the engine type.

b. Control Techniques Required As BACT

As discussed below, some districts are beginning to develop BACT requirements that are fuel neutral. For example, the SCAQMD BACT Guidelines for minor sources specifies that reciprocating engines used in nonemergency applications and less than 2,064 bhp satisfy the following levels: 0.15 grams/brake horsepower-hour (g/bhp-hr) for NOx and VOC, and 0.6 g/bhp-hr for CO. Larger engines are subject to a NOx standard that is based upon the efficiency of the engine. Based upon this approach, the NOx BACT level can only be satisfied by a well-controlled natural gas fueled reciprocating engine. At this time, diesel-fueled engines cannot achieve this emission level. Consequently, the discussion below focuses only on the emission levels achieved by natural gas fueled reciprocating engines.

To reduce NOx emissions from natural gas fueled reciprocating engines to the levels required by SCAQMD, post-combustion controls are necessary. Nonselective catalytic reduction (NSCR) or three-way catalyst technology is used for rich-burn engines and SCR for lean-burn engines. The major difference between rich-burn and lean-burn engines is in the amount of excess air used for combustion. Rich-burn engines use a nearly equal mixture of air and fuel, while lean-burn engines use significantly more air than fuel. Three-way catalyst technology, because of technical operating requirements, works well with rich-burn engines and is not applicable to lean-burn engines. In addition, to achieve the 0.15 g/bhp-hr level, a premium catalyst is necessary that is more efficient in reducing NOx emissions than the standard catalyst.

Conversely, lean-burn engines are significantly more efficient in converting the energy in the fuel into electrical energy. Because the ARB staff is recommending BACT levels in terms of lb/MW-hr, electrical generation technologies with higher electrical efficiency will have an advantage. Lean-burn engines typically achieve 38 percent electrical efficiency, with some lean-burn engines exceeding 40 percent electrical efficiency. In comparison, rich-burn engine's electrical efficiency is typically 32 percent, but can be as low as 20 percent.

Similarly, BACT levels for CO and VOC emissions are also based upon post-combustion controls. NSCR also reduces CO and VOC emissions while oxidation catalyst is used to reduce CO and VOC emissions from lean-burn engines.

The most stringent limits for a rich-burn engine that have been specified in a preconstruction permit is for the Aera Energy facility located at an oilfield in the San Joaquin Valley. The limits are 0.071 g/bhp-hr (4 ppmvd at 15 percent O_2)[1]

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1 the concentrations provided with the equivalent g/bhp-hr are estimates and actual concentrations may vary. See Appendix C for methodology used to convert between concentrations to g/bhp-hr or to lb/MW-hr.

for NOx, 0.069 g/bhp-hr (11 ppmvd at 15 percent O_2) for VOC, and 0.6 g/bhp-hr (56 ppmvd at 15 percent O_2) for CO. This determination is based upon a vendor guarantee for the emission level for either a 800 bhp Superior 8G-825 natural gas fired engine or a 1,478 bhp Waukesha 7042 GSI engine, depending upon which engine the project proponent is ultimately provided, equipped with a three-way catalyst. Once installed, these engines would be driving natural gas compressors.

Prior to the issuance of the Aera Energy permit, the most stringent limits appearing in a preconstruction permit for a rich-burn engine were: 0.15 g/bhp-hr for NOx and VOC, and 0.6 g/bhp-hr for CO. As discussed above, this level has been specified as BACT for reciprocating engines (applicable to both rich-burn and lean-burn natural gas fueled engines as well as diesel-fueled engines) used in nonemergency applications in the SCAQMD BACT Guidelines and has been specified as BACT in the SCAQMD since 1998. This BACT level has been applied to a number of engines in other districts, including Santa Barbara County Air Pollution Control District and VCAPCD.

For lean-burn engines, the most stringent limits that have been specified in a preconstruction permit is for NEO California Power LLC for their facility at Chowchilla. The limits are 0.07 g/bhp-hr (5 ppmvd at 15 percent O_2) for NOx, 0.15 g/bhp-hr (30 ppmvd at 15 percent O_2) for VOC, 0.1 g/bhp-hr (10 ppmvd at 15 percent O_2) for CO, and ammonia slip is limited to 10 ppmvd at 15 percent O_2. This determination is for a 4,157 hp Deutz TBG632V16 lean burn engine equipped with SCR and oxidation catalyst. These engines began operation in mid-June, 2001 and compliance tests results should be available by the end of 2001. Similar determinations have been made in preconstruction permits for NEO California Power LLC for their facility at Red Bluff and for JST Energy LLC for their facility at Red Bluff. In this case, both determinations are for 3,928 hp Wartsilla 18V220S engines equipped with SCR and oxidation catalyst. The NEO California Power LLC facility at Red Bluff initiated operation in August, 2001.

c. Emission Levels Achieved In Practice

The most stringent levels achieved in practice for a rich-burn engine are 0.15 g/bhp-hr (9 ppmvd at 15 percent O_2) for NOx, 0.15 g/bhp-hr (25 ppmvd at 15 percent O_2) for VOC, and 0.6 g/bhp-hr (56 ppmvd at 15 percent O_2) for CO. A number of engines varying in size from 86 bhp to 747 bhp engines equipped with three-way catalyst have satisfied these emission standards. The emissions during initial operation are typically very low (50 percent or less of the applicable BACT standard--see information in Appendix B) in the first year due to the high efficiency of the fresh catalyst. As the catalyst ages, the efficiency of the catalyst decays due to masking and poisoning of the catalyst until the catalyst can no longer perform well enough to meet the applicable BACT standard. At that point the catalyst needs to be either washed to increase the activity of the catalyst or replaced. With proper maintenance of both the engine and the three-way catalyst system, the catalyst typically lasts two years, based on continuous operation, before replacement becomes necessary.

The most stringent levels achieved in practice for a lean-burn engine are 0.2 g/bhp-hr (14-17 ppmvd at 15 percent O_2) for NOx and 0.2 g/bhp-hr (25-27 ppmvd at 15 percent O_2) for CO. This determination is for a Waukesha 12VAT27GL lean-burn engine equipped with SCR and oxidation catalyst. The levels achieved in practice are 70 percent lower than the limit established in the preconstruction permit.

d. More Stringent Control Techniques

1. SCONOX

As discussed above, the SCONOX technology has been used for reducing NOx emissions from gas turbines. EmeraChem has adapted the SCONOX technology to reduce NOx emissions from engines. For example, SCONOX was installed on two large natural gas-fueled engine generators at a Texas Instruments facility in Texas. However, the facility closed prior to the commercial operation of the two engines. In addition, EmeraChem is working with Cummins to adapt the SCONOX technology to diesel engines.

In summary, it appears that SCONOX technology could be applied to lean-burn or rich-burn engines. However, the technology has not been used to control the emissions from an engine outside of a laboratory setting. In the application of the technology on gas turbines, there have been technical issues at each of its installations regarding the initial implementation of the technology. Consequently, commercial demonstrations are needed to dispel these concerns. In addition, it is unclear what the overall cost effectiveness of the SCONOX technology is relative to other control techniques used for engines.

e. BACT Recommendations

The most stringent BACT levels achieved in practice for a fossil fuel fired engine is the emission levels currently specified as BACT in the SCAQMD. These emission levels are 0.15 g/bhp-hr (9 ppmvd at 15 percent O_2) for NOx, 0.15 g/bhp-hr (25 ppmvd at 15 percent O_2) for VOC, and 0.6 g/bhp-hr (56 ppmvd at 15 percent O_2) for CO. These emission standards have represented BACT since 1998, and Appendix B has examples of engines satisfying these levels for over four years. In addition, engines varying in size from 86 bhp to 747 bhp engines have been equipped with three-way catalyst to satisfy these emission standards.

The most stringent level for a reciprocating engine was required in the preconstruction permits for NEO California Power LLC (for two locations: Chowchilla and Red Bluff), JST Energy LLC located at Red Bluff, and Aera Energy for engines located in the oil fields of San Joaquin Valley. The determination for NEO California Power and JST Energy was made for lean-burn engines (4,157 bhp Deutz model TBG632V16 and 3,928 bhp Wartsila model 18V220SG) equipped with SCR and oxidation catalyst. Emission levels were specified at 0.07 g/bhp-hr for NOx, 0.15 g/bhp-hr for VOC, and 0.6 g/bhp-hr for CO. The other determination for Area Energy was for a rich-burn engine (either an 800 bhp Superior 8G-825 engine or a 1,478 bhp Waukesha 7042 GSI engine) equipped with a three-way catalyst. Emission levels were specified at 0.071 g/bhp-hr for NOx, 0.069 g/bhp-hr for VOC, and 0.6 g/bhp-hr for CO.

Of the lean-burn engines required to meet this stringent BACT level, both the Chowchilla and Red Bluff facilities have begun operating. Source tests for both facilities should be available by late fall, 2001 and the ARB staff expects the 0.07 g/bhp-hr NOx level to be considered achieved in practice for that class and category sometime next year. The lowest emissions achieved in practice are for the 2,113 bhp Waukesha model 8LAT27GL engine located at the SB Linden facility located in New Jersey. The BACT determination limited emissions of the engine to 50 ppmvd at 15 percent O_2 for NOx, 58 ppmvd at 15 percent O_2 for VOC, and 76 ppmvd at 15 percent O_2 for CO. The engine has been in operation since 1997 and emission tests conducted in 1997 indicated NOx emissions at less than 17 ppmvd at 15 percent O_2 and CO less than 27 ppmvd at 15 percent O_2. The equivalent g/bhp-hr is 0.2 for both NOx and CO. VOC emissions were measured with a test method not consistent with methods used in California and therefore, is not included in this analysis. Given that the same emission control technology used at the SB Linden facility will be used for the lean-burn engines used at the NEO California Power and JST Energy facilities, the ARB staff believes it is technically feasible to achieve the levels specified in the preconstruction permits for these facilities. To achieve these more stringent levels, additional catalyst and higher consumption of ammonia/urea will be necessary beyond that required for the SB Linden facility.

For rich-burn engines, most of the recent BACT determinations and all the available emission test information has been for complying with the BACT NOx level of 9 ppmvd at 15 percent O_2 or 0.15 g/bhp-hr. For the engines subject to this level, 60 percent of all engines with test data (See Appendix B) achieved 5 ppmvd at 15 percent O_2 or 0.07 g/bhp-hr emission level for NOx or better. Additionally, 65 percent of the engines achieved 5 ppmvd at 15 percent O_2 or 0.07 g/bhp-hr emission level for NOx or better in the initial compliance test. This level has been achieved for a wide range of engine horsepower sizes. The examples included in Appendix B range from about 80 bhp up to about 750 bhp. In addition, one engine at Los Alamos Energy, a 713 bhp Caterpillar G398TAHC engine has operated with a three-way catalyst since 1997 and over this period, has been below 5 ppmvd at 15 percent O_2 for three years.

The Aera Energy preconstruction permit, as discussed above, specifies a NOx level at 0.071 g/bhp-hr. The same technology would be used to meet the more stringent levels, with the major difference being the use of about 50 percent more catalyst. No additional change to the other equipment, such as the O_2 sensor or air/fuel ratio controller would be required. Additionally, maintenance requirements and the catalyst life are expected to be the same at 0.15 g/bhp-hr or 0.07 g/bhp-hr.

Based upon the above, the ARB staff recommends establishing a BACT level based upon the achieved in practice levels of the SCAQMD requirements for nonemergency engines. As discussed above, the ARB staff believes the 0.07 g/bhp-hr level proposed in the permits for Aera Energy and for NEO California Power is technically achievable. Consequently, district permitting staffs are encouraged to evaluate these BACT levels represented by these projects as part of the technical feasibility portion of the case-by-case BACT determination for electrical generation projects. In addition, once the NEO California Power has demonstrated achievement of the 0.07 g/bhp-hr NOx level, the ARB staff will consider this level to be achieved in practice for its class and category. Finally, an emission limit for PM is recommended. This PM level is consistent with the technology requirements of the ARB diesel risk management guidance.

The following table summarizes the recommended levels for reciprocating engines:

Table V-4:
Proposed Emission Levels For
Fossil-Fueled Reciprocating Engines

Equipment Category	NOx (g/bhp-hr)	VOC (g/bhp-hr)	CO (g/bhp-hr)	PM (g/bhp-hr)
Fossil fueled engines	0.15	0.15	0.6	0.02

2. Future Developments

SB 1298 directs the ARB, at the earliest practicable date, to make its BACT determination guidance to the districts equivalent to that of permitted central station power plants in California. In order for all electrical generation technologies to achieve the same emission level as a central station power plant equipped with BACT emission control technologies will need to improve, as will the efficiencies of reciprocating engines.

A number of the engine manufacturers and the DOE are working together on the Advanced Reciprocating Engine Systems (ARES) program. The goals of this program are to create a natural gas powered engine that will be at least 50 percent efficient and will have NOx emissions of 0.1 g/bhp-hr (0.31 lb/MW-hr). The program began in November 2000 and the goal is to have a prototype of an engine meeting these standards by the end of the decade. As discussed previously, the goals for the emission levels proposed for the ARES program have already been exceeded. For example, the engines used in the NEO California Power facility in Chowchilla are subject to a BACT limit for NOx of 0.07 g/bhp-hr. However, where the program will have the most impact is improving the electrical efficiency of reciprocating engine generators. The most efficient engines are large lean-burn reciprocating engines that are about 40 percent efficient. Improving the efficiency of the engine from 40 to 50 percent will decrease the emissions in the Chowchilla project from 0.2 lb/MW-hr to 0.15 lb/MW-hr, which is still three times more emissions than a central power plant equipped with BACT.

In summary, even with a dramatic increase in electrical efficiency, to reach the goal of emissions that are equivalent to central station power plant equipped with BACT, breakthroughs will be needed in emission control systems that can result in near zero emissions.

D. Engines and Turbines Using Waste Gas

Waste gas refers to gases generated at landfills or in the disgestion of solid materials at waste water treatment plants. Both reciprocating engines and gas turbines have been used to generate electricity from waste gas.

The recently promulgated NSPS (40 Code of Federal Regulation 60, subpart Cc and WWW) requires most landfills to collect and destroy the gas produced by the landfill. At a minimum, landfill operators are required to flare the landfill gas. Many landfills have opted to develop energy projects that allow for the generation of electricity while disposing of the gas. Generally, large reciprocating engine generator sets, typically larger than 800 KW, have been used for these applications. In a few cases, gas turbines have been used instead of reciprocating engines.

Wastewater treatment facilities have commonly utilized digester gas in cogeneration facilities. Digester gas can be burned in a reciprocating engine to generate electricity for the facility and the heat generated by the engine can be used for the digestion process. (The ARB staff is aware of only one gas turbine used in this same way.)

1. Current Control Technologies Being Used

a. State Implementation Plan Measures

While there are no SIP control measures specifying reductions from waste gas combustion, many of the SIP measures affecting reciprocating engines or gas turbines have provisions affecting engines used in waste gas applications.

The most stringent of SIP measures for reciprocating engines have been adopted by SCAQMD, AVAPCD, and San Diego County Air Pollution Control District (SDCAPCD). Both measures set emission standards for NOx, VOC, and CO. The SCAQMD and AVAPCD requires reciprocating engines using waste gas to meet the following emission standards: 50-63 ppm at 15 percent O_2 for NOx, 350-440 ppm at 15 percent O_2 for VOC, and 2000 ppm at 15 percent O_2 for CO, with the applicable NOx and VOC standard depending upon the efficiency of the engine. SDCAPCD does not regulate waste gas usage, but requires lean-burn engines to achieve either 65 ppmvd at 15 percent O_2 or 90 percent reduction for NOx.

For gas turbines, the most stringent of these measures has been adopted by SCAQMD and AVAPCD. For the turbines typically used in landfill applications, these measures limit the NOx emissions from 9 to 25 ppmvd at 15 percent O_2, based upon the size and efficiency of the turbine. In addition, a limit of 25 ppmvd applies to turbines rated between 2.9 and 10 MW that use a fuel with a minimum percentage of 60 percent digester gas.

b. Control Techniques Required As BACT

1. Reciprocating Engines

Waste gas contains impurities that, if combusted will likely poison catalyst based post-combustion control systems. Consequently, the approach for combusting waste gas in either a reciprocating engine or gas turbine has focused on combustion processes that result in minimal NOx being produced and noncatalytic control systems. For reciprocating engines, lean-burn engines have been the choice because these types of engines produce the lowest emission of NOx without using post combustion treatment technologies. In the case of gas turbines, the control techniques used in these applications include either low NOx combustors or water/steam injection to reduce NOx emissions.

For reciprocating engines, the most stringent emission level specified in a preconstruction permit for either landfill or digester gas is for the Riverside Country Waste Management's Badlands facility. The permit established a limit of 0.31 g/bhp-hr for NOx, 0.02 g/bhp-hr for VOC, and 1.49 g/bhp-hr for CO. The determination is for a 1,777 bhp Deutz model TBG620 lean-burn engine using landfill gas. This determination is based upon a vendor guarantee and the engine is not yet installed.

2. Gas Turbines

For gas turbines, the most stringent emission level specified in a preconstruction permit for use of waste gas (with some supplemental natural gas) is for the Joint Water Pollution Control Plant in Carson. The permit established a limit of 25 ppmvd at 15 percent O_2 for NOx emissions. The determination is for three Solar Mars 90 (10 MW) combined cycle units generating a total of 34.8 MW. The level is achieved with water injection.

The most stringent BACT determination for waste gas that has appeared in a preconstruction permit is for the University of California, Los Angeles (UCLA) Energy Systems facility. The facility consists of two General Electric LM1600 gas turbines and one common steam turbine. The combined cycle system initially burned a mixture of landfill gas and natural gas in a 30/70 mixture, respectively, based on energy. The amount of landfill gas has declined over time and the current mix is 15/85. Additionally, the landfill gas is treated extensively to remove potential poisons prior to being combusted in the gas turbines. The permit established a limit of 9 ppmvd at 15 percent O_2 for NOx emissions. SCR can be used to achieve this level because of the low percentage of landfill gas and the extensive treatment of the gas mixture prior to combustion in the gas turbine.

c. Emission Levels Achieved In Practice

1. Reciprocating Engines

The most stringent emission levels achieved in practice by reciprocating engines using waste gases are a function of the quality of the waste gas that has been burned (the energy content of the gas and the percentage of CO_2 in the waste gas). In general, the latest engines are able to demonstrated compliance with a BACT level of 0.6 g/bhp-hr for NOx. For landfill gas-fueled engines, the results of the testing varied from 0.31 to 0.48 g/bhp-hr of NOx, which demonstrates the variability of the landfill gas composition and its impact on the engine's NOx emissions. Similar results were seen for engines using digester gas in that the results of the testing varied from 0.36 to 0.52 g/bhp-hr of NOx. For the engines used in landfill applications, the engines tested range from 850 bhp to 4,300 bhp. Similarly, for digester gas fueled engines, the tested engines range from 260 bhp to 1,400 bhp.

For CO and VOC, there have been similar variations in emission levels. Some of this variation can be explained by operators focusing on meeting NOx levels at the expense of CO or VOC emissions. For landfill gas fueled engines, VOC emission levels have varied from 0.05 to 0.32 g/bhp-hr, and for digester gas, VOC emission levels have varied from 0.2 to 0.5 g/bhp-hr. Similarly, for CO emission levels, the emission levels have varied from 1.6 to 3.9 g/bhp-hr for landfill gas and, the emission levels have varied from 1.5 to 2 g/bhp-hr for digester gas.

2. Gas Turbines

For gas turbines using a waste gas, the above mentioned Joint Water Pollution Control Plant achieved between 19 and 22 ppmvd at 15 percent O_2 for NOx levels and 8 to 19 ppmvd at 15 percent O_2 for CO levels.

d. BACT Recommendations

1. Reciprocating Engines

The most stringent emission levels in a preconstruction permit for a reciprocating engine using a waste gas is 0.31 g/bhp-hr for NOx, 0.02 g/bhp-hr for VOC, and 1.49 g/bhp-hr for CO. This determination is for a Deutz TBG620 lean-burn engine at the Badlands Landfill in Riverside. This level is based upon a vendor guarantee for equipment that has not yet been installed.

The most stringent level achieved in practice for reciprocating engines using waste gas is 0.31 g/bhp-hr for NOx, 0.1 g/bhp-hr for VOC, and 1.59 g/bhp-hr for CO. This determination is for a 4,230 bhp Caterpillar G3616 lean-burn engine, an engine much larger than the Deutz engine, at the Tajiguas Landfill in Santa Barbara. NOx emissions for this same engine at other landfills varied from 0.39 to 0.56 g/bhp-hr indicating the influence of the quality of the landfill gas on NOx emissions.

Based on the levels achieved in practice, the ARB staff recommends the following levels for a reciprocating engine using a waste gas: 0.6 g/bhp-hr for NOx, 0.6 g/bhp-hr for VOC, and 2.5 g/bhp-hr for CO. Individual engines operating with waste gas may perform better than these proposed levels, but these proposed emission levels are achievable for all engines using a waste gas. In addition, these levels are consistent with the SCAQMD's BACT guidance for this category of sources. Finally, the VOC and CO are set at higher levels to allow operators flexibility in combustion modifications to meet stringent NOx levels.

2. Gas Turbines

For gas turbines, the most stringent emission level in a preconstruction permit for use of a waste gas is for the Joint Water Pollution Control Plant in Carson. The permit established a limit of 25 ppmvd at 15 percent O_2 for NOx emissions for each of three Solar Mars 90 turbines. Subsequent testing indicated this level can be achieved in practice. Additionally, the BACT determination for the UCLA energy project was not considered typical of waste gas applications because of the high percentage of co-fired natural gas.

The ARB staff recommends the BACT level for gas turbines using a waste gas is 25 ppmvd at 15 percent O_2 for NOx emissions.

2. Future Developments

SB 1298 directs the ARB, at the earliest practicable date, to make its BACT determination guidance to the districts equivalent to that of permitted central station power plants in California. In order for all electrical generation technologies to achieve the same emission level as a central station power plant equipped with BACT emission control technologies will need to improve, as will the efficiencies of reciprocating engines.

Because the impurities in waste gas can poison catalysts, options for reducing emissions from waste gas combustion are limited. As discussed above, significant reductions of NOx are only possible with post combustion pollution cleanup systems. Cleanup systems to remove the impurities have been considered, but have either had limited success or have not been cost effective. Consequently, for reciprocating engines, most of the focus in reducing emissions has been based upon improving the emission characteristics of lean-burn engines. In addition, the previously discussed ARES program is applicable in that the goal of developing a 50 percent electricity efficient will improve the emissions of engine burning waste gas on a lb/MW-hr basis.

Similarly, for gas turbines, the most advanced post combustion pollution cleanup systems cannot be used in waste gas applications. Emission reductions will focus on improved combustion techniques such as improving low NOx combustors or demonstrating catalytic combustion technology on waste gas fuels. Low NOx combustors have been developed for larger turbines that can achieve 9 ppmvd at 15 percent O_2.

Overall, this category of using waste gas to generate power will have the most difficulty in attaining the goal of equivalent emissions to a central station power plant equipped with BACT. However, this difficulty should be balanced with the recognition that historically waste gases were either not collected or were flared without controls.

E. Microturbines

Microturbines are an emerging technology generally sized (30 to 75 kW) below the permitting threshold for gas turbines. Consequently, there are no SIP requirements or BACT determinations made for this equipment category.

Beginning in January 1, 2003, emissions from new microturbines will be regulated through the ARB DG certification program. The ARB staff recommends that districts permitting microturbines after January 1, 2003 require the units to be certified by the ARB DG certification program.

F. Fuel Cells

A fuel cell is an electrochemical device that combines hydrogen with oxygen from the air to produce electricity, heat, and water. Some districts have added fuel cells to the list of equipment exempted from district permit requirements. The stationary fuel cell community is currently served by one commercial product, a 200 kW phosphoric acid fuel cell. However, the fuel cell manufacturing community is engaged in a strong commercialization effort with other fuel cell types (e.g., proton exchange membrane, solid oxide, and molten carbonate) and is currently establishing a manufacturing capability to meet an emerging market. Fuel cells themselves do not emit air pollutants, but the reformers used to supply the hydrogen fuel can emit small quantities of pollutants. Source tests conducted on a fuel cell with a reformer indicate that emissions of NOx are about 2 ppmvd at 15 percent O_2 or about 0.06 lb/MW-hr—near the emission level of a central station power plant equipped with BACT. The ARB staff has no additional recommendations regarding BACT requirements for fuel cells.

G. Stirling-Cycle Engines

A Stirling-cycle engine is a closed loop engine where a heat source is provided outside the engine to move a piston. Heat sources used to operate a Stirling-cycle engine can include waste heat, solar energy, and combustion gases. The first commercial electrical generation applications of the Stirling-cycle engine are expected to be available next year. The manufacturer reports that emissions from prototype products have been very low. However, until a commercial product is available, and the emissions evaluated, it is premature for the ARB staff to evaluate BACT requirements for this category.

VI. ACHIEVING CENTRAL STATION POWER PLANT EMISSION LEVELS

SB 1298 directs the ARB, at the earliest practicable date, to make its BACT determination guidance to the districts equivalent to that of permitted central station power plants in California. In order for all electrical generation technologies to achieve equivalent emissions of a central station power plant equipped with BACT, control technologies will need to improve, as will the conversion efficiency from fossil fuel to electrical energy. In addition, as discussed below, the ARB staff is recommending that the achievement of central station power plant levels recognizes the contributions from combined heat and power applications (CHP). It should be noted that the emission levels currently achieved by the various electrical generation technologies discussed in this report has significantly improved from that which was achievable even five years ago.

A. Gas Turbines

For gas turbines rated at 50 MW or less, the same control technologies being used on central station power plants are being used for the smaller gas turbines. However, because of the lower efficiencies of the small turbines, a 5 MW turbine achieving a NOx level of 5 ppmvd at 15 percent O_2 emission level will have a higher lb/MW-hr emission rate than the central station power plant achieving a 5 ppmvd at 15 percent O_2. Consequently, if the efficiencies of the smaller turbines do not improve, achieving the same emission level as central station power plants will require the smaller turbines to achieve significantly greater emissions reductions. To meet the emission level achieved by central station power plants, emission levels approaching 1 ppmvd at 15 percent O_2 will be necessary. The only technology that has the potential to reduce emissions to this level is SCONOX. However, as discussed above, SCONOX is still an emerging technology that has not been demonstrated on the full size range of electrical generation technologies.

In the case of CHP applications, the thermal energy produced and subsequently used is displacing thermal energy that would have likely been provided by a boiler. If the energy represented by the thermal energy is credited toward the electrical generation facility's total energy production, then the emission level (lb/MW-hr) will be near the level of central station power plant equipped with BACT. For example, for a turbine electrical generation facility achieving the proposed NOx emission level of 0.12 lb/MW-hr (3 ppmvd at 15 percent O_2), the thermal energy credit for an efficient CHP application would result in an equivalent emission rate of 0.06 lb/MW-hr. Efficient CHP is defined as CHP applications that achieve a minimum of 60 percent efficiency and 75 percent efficiency on an annual basis. Consequently, CHP applications that achieve a NOx emission level of 3 ppmvd at 15 percent O_2 will have the equivalent emissions of a central station power plant equipped with BACT.

Similarly, for VOC and CO, the central station power plant levels will be very difficult to achieve for turbines based upon technology alone. The same control technologies used for central station power plants are used on the smaller turbines—oxidation catalysts. In addition, turbines rated at 50 MW or less, have achieved the same ppmvd levels as central station power plants, 2 ppmvd at 15 percent O_2 for VOC and 6 ppmvd at 15 percent O_2 for CO. Because of the lesser efficiencies of the smaller turbines, the emissions in lb/MW-hr are higher. However, if an energy credit for CHP is included, turbines controlled to the same concentration levels as central station power plants and used in efficient CHP applications, would emit the equivalent emission levels achieved by central station power plants.

In summary, the ARB staff recommends that districts encourage the development of electrical generation facilities that are also efficient CHP applications versus generation facilities that are electrical generation only or are considered inefficient CHP. Only those gas turbine based electrical generation facilities used in efficient CHP applications and achieving certain emission levels are capable of achieving the equivalent emissions of central station power plants equipped with BACT.

B. Reciprocating Engines

In general, reciprocating engines will have a difficult time achieving the equivalent emissions of a central station power plant. To achieve the central station power plant NOx emission level, 1 ppmvd at 15 percent O_2 or 0.015 g/bhp-hr would have to be achieved, assuming the efficiency of the engine does not change. This would represent an additional 90 percent reduction from the lowest emission level achieved in practice.

As discussed earlier, one of the major goals of the ARES program is to increase engine efficiencies to 50 percent, which is a significant improvement. This would decrease the emissions in the Chowchilla project from 0.2 lb/MW-hr to 0.15 lb/MW-hr, which is still three times more emissions than a central power plant equipped with BACT. The Chowchilla project is using engines that are very efficient for a reciprocating engine, achieving an efficiency of about 40 percent. These levels can only be achieved by the largest lean-burn reciprocating engines--the efficiencies of smaller engines is closer to 30 percent. In addition, the Chowchilla engines are expected to achieve 0.07 g/bhp-hr NOx level--the cleanest engines installed in California.

If an energy credit for CHP is included, the engine achieving the proposed NOx emission level of 0.2 lb/MW-hr would be equivalent to 0.1 lb/MW-hr. Consequently, engines units used in CHP applications could achieve the equivalent NOx emissions of a central station power plant equipped with BACT if the benefits of CHP is included and compared to the levels already achieved, there is either a 30 percent reduction in emission or an equivalent increase in electrical efficiency.

For the other pollutants, VOC and CO, the current levels achieved in practice are substantial higher than central station power plant levels. For example, the proposed CO level of 1.9 lb/MW-hr is based upon 90 percent control of CO emissions. An additional 95 percent reduction would be necessary to achieve the central station power plant levels of 0.09 lb/MW-hr. Similarly, for VOC, an additional 95 percent reduction would be necessary to achieve the central station power plant levels of 0.02 lb/MW-hr. Consequently, consideration of the benefits of efficient CHP will lower the overall lb/MW-hr levels, but not to the equivalent emissions of a central station power plant equipped with BACT.

In summary, the ARB staff recommends that districts encourage the development of electrical generation facilities that are used in efficient CHP applications versus generation facilities that are electrical generation only or are considered inefficient CHP. Reciprocating engine based electrical generation satisfying BACT requirements and used in efficient CHP applications will have less environmental impact than electrical generation only applications or inefficient CHP applications.

C. Waste Gas

Neither reciprocating engines nor gas turbines using waste gas as a fuel are likely to achieve the emission levels for central station power plants. Because waste gas contains impurities that, if combusted, will likely poison post-combustion control systems that are based upon catalysts, the emissions from this category cannot be reduced to the same levels that have been achieved with engines and turbines using natural gas as a fuel. Without advance post-combustion control systems, engines and turbines using waste gas will not be able to achieve the equivalent emission levels for central station power plants.

Finally, CHP applications involving waste gas is common only at waste water treatment facilities. At waste waster treatment facilities, there is a need for both process steam and electricity. Consequently, encouraging CHP applications is not likely to result in significant increases of CHP applications.

D. Recommendations

The ARB staff recommend that districts grant credit to electrical generation that are used in efficient CHP applications and the credit would only be used toward satisfying the goal that emissions from distributed generation, at the earliest practicable date, be equivalent to emission levels for central station power plants equipped with BACT. Procedures for determining the CHP credit are discussed in the next Section.

The ARB staff further recommend that, to the extend possible, districts encourage electrical generation projects that are also efficient CHP applications. As discussed above, only efficient CHP electrical generation projects are likely to achieve the equivalent emissions of central station power plants equipped with BACT. This can be achieved by requiring fossil fuel based electrical generation facilities, after applying the CHP credit, to achieve the equivalent emissions of central station power plants equipped with BACT by 2007. As discussed above, gas turbine based electrical generation facilities that achieve emission levels of 3 ppmvd at 15 percent O_2 for NOx, 2 ppmvd at 15 percent O_2 for VOC, and 6 ppmvd at 15 percent O_2 for CO and are efficient CHP applications will have the equivalent emissions of a central station power plant equipped with BACT. For reciprocating engine-based electrical generation, even with the CHP energy credit, achieving this level will depend upon improvements in engine efficiency and improvements in the control technology for reducing CO and VOC emissions. Staff will review the feasibility of achieving central station power plant levels as part of the 2005 technology review that is proposed for the ARB's DG certification program.

Finally, as discussed above, based upon the technology available today, waste gas-based electrical generation is unlikely to achieve the equivalent emission levels for central station power plants. However, the inability to achieve central station power plant levels should be balanced with the understanding that waste gas is typically flared. While there are additional emissions associated with using waste gas in an electrical generation project as compared to the emissions from flaring the waste gas, the value from the energy produced offsets the emissions impacts. In addition, to the extent possible, waste gas based electrical generation should also incorporate CHP.

VII. OTHER PERMITTING CONSIDERATIONS

Much of the guidance provided in the 1999 ARB Power Plant Guidance regarding emissions offsets, ambient air quality impact analysis, and health risk assessment is still applicable. This section provides specific guidance related to distributed generation.

A. Applicability

Microturbines and small reciprocating engines are typically below permitting thresholds for many districts. In some cases, several of these units can be used at one site and the number of units operating at any moment would depend upon the needs of the facility. The ARB staff recommends that districts, that do not already do so, consider modifying their permitting regulations such that the emissions from all the units are treated collectively as opposed to considering the applicability on a unit by unit basis.

B. Combined Heat and Power

For efficient CHP applications, the ARB staff supports allowing credit for process heat that can be use toward meeting the central station power plant emission level. Because CHP applications improve energy efficiency, emissions of greenhouse gases are also reduced.

Typical electrical efficiency of the various technologies addressed by this report range from about 20 percent for microturbines (based on output of electrical generation versus the energy represented by the fuel consumed by the technology) to about 40 percent for larger gas turbines and lean-burn engines. CHP applications can increase efficiency of energy conversion to over 80 percent.

For CHP applications that maintain a minimum efficiency of 60 percent and an annual average efficiency of 75 percent in the conversion of the energy in the fossil fuel to electricity and process heat, the ARB staff recommends that the process heat used be credited as energy production. (The efficiency determination would exclude startup, shutdown, and the facility is shutdown.) That is, the facility's overall lb/MW-hr can be determined by dividing the emissions of the facility, on a pollutant-by-pollutant basis, by the facility's total energy production. The total energy production is the sum of the net electrical production, in MW, and the actual process heat consumed in a useful manner, converted to MW. A more detailed methodology for calculating this credit is provided in Appendix D.

C. Health Risk Assessment Requirements

The 1999 ARB Power Plant Guidance provided a summary of the information that should be addressed by a health risk assessment (HRA) and identified some of the documents that should be consulted in the preparation of a HRA. In addition, for most generating resources covered by this guidance, the ARB staff recommends that the district make permitting decisions consistent with the ARB report: Risk Management Guidelines for New and Modified Sources of Toxics Air Pollutants, July 1993. In the case where diesel-fueled engines are used for emergency electrical generation, the ARB staff recommends that district's permitting decisions be consistent with the ARB report: Diesel Risk Management Guidelines, October 2000.

D. Suggested Permit Conditions

The 1999 ARB Power Plant Guidance provided a number of recommendations to assure compliance with an air permit. This guidance provides recommendations regarding source testing and monitoring for districts that do not already have procedures and requirements for monitoring the emissions from electrical generation technologies. In addition, sample permit conditions for emission testing and monitoring are contained in Appendix E.

1. Source Testing and Emissions Monitoring

As stated in the 1999 ARB Power Plant Guidance Report, source testing and monitoring requirements need to be established within the permit to assure compliance with the BACT determinations and other applicable emission standards that are established through the district's NSR program. Compliance with BACT levels and other emission standards are demonstrated by either CEM or periodic source testing. In the case of source testing, districts have typically required an initial compliance test to demonstrate compliance with the requirements of the preconstruction permit and periodic tests are required thereafter.

a. Commissioning Period

Prior to the initial source test, the operation of the prime mover and the add-on control equipment undergo commissioning during which the prime mover is tuned and the add-on control equipment is installed and calibrated. The ARB staff recommends that an applicant be required to submit a plan for this activity during the commissioning period. The goal of the plan is to determine the conditions for operation of both the prime mover and the add-on control equipment that minimizes the emissions of air contaminants. For example, for a gas turbine equipped with low NOx combustors and SCR and oxidation catalyst, commissioning activity could include tuning of the low NOx combustor, optimizing both the SCR and oxidation catalyst systems, and calibrating and implementing the CEM. The plan would indicate the procedure the operator will follow to complete the goals of optimizing the performance of each of these components.

Emissions during the commissioning period may be higher than allowed by the permit during normal operation because the emission control equipment is not fully installed and/or not operated at full efficiency. Consequently, to minimize emissions during the commissioning period, the ARB staff recommends: permits limit the time period for commissioning activities; and emissions released during commissioning be counted toward the facility's annual emission limits.

Because of the potential impact and the importance of the activities occurring during the commissioning period, the ARB staff recommends that for major projects, particularly those involving the larger gas turbines, the requirements related to the commissioning period should be spelled out as conditions to the permit. For smaller projects where the impacts are not as significant, issues related to the commissioning period could best be handled through the district’s variance process.

b. Continuous Emission Monitors

In general, all but the smallest gas turbines have typically been subject to both CEM and annual source testing. For the Genxon Power Systems facility, where the power is generated by a 1.5 MW Kawasaki gas turbine, CEMs were not required. As discussed in the next section, the BAAQMD allowed the use of periodic monitoring in lieu of both the CEM and annual source testing.

In contrast, reciprocating engines have typically only been subject to periodic source testing. Depending upon the district, an operator of an engine is required to have independent emission testing performed every one to three years. Because of the cost to the project proponent, few districts have required CEM for engines. Only the SCAQMD has required, per Rule 1110.2, <u>Emissions from gaseous and liquid fueled internal combustion engines</u>, engines rated at 1,000 hp or more and operated more than two million bhp-hr per calendar year to be equipped with CEM for NOx. (For example, a 1,000 hp engine would be required to be equipped with a CEM if the engine operated more than 2,000 hours.) Otherwise, some large engines have been required to use CEM through a preconstruction review.

The ARB staff recommends that a CEM, which meets the requirements of 40 CFR Part 60, be required to monitor continuous compliance with emission limits for: 1) all gas turbines rated at 2.9 MW or larger (for NOx, CO and VOC); and 2) engines rated at 1,000 hp or more and operated more than two million bhp-hr per calendar year (for NOx). These recommendations are consistent with SCAQMD's CEM requirements for these source categories. In addition to reporting measurement results in terms of ppmvd at 15 percent O_2 and pound/hour, the CEM results should also be reported in terms of lb/MW-hr.

c. Annual Emissions Testing

After the initial source test, periodic tests are necessary to demonstrate compliance with the emission standards.

As discussed above, most engines and the smallest gas turbines are not equipped with CEMs. Many districts subject reciprocating engines to annual source tests. In addition, both Santa Barbara County Air Pollution Control District and the SJVUAPCD have also required used of portable analyzers by the operator to periodically monitor emissions of the engine between each source test. The analyzers are used as a screening tool to monitor the effectiveness of the catalyst. As discussed above, because the catalyst loses efficiency over time the use of an analyzer would assist the operator in determining when the catalyst needs servicing or replacement and therefore limit potential exceedances of an emission standard.

As mentioned above, the operator of the Kawasaki gas turbine (1.5 MW) at the Genxon Power Systems facility, was periodically allowed to measure NOx, VOC, and CO emissions in lieu of either installing a CEM or annual source tests. The monitoring requirement is satisfied by weekly periodic measurement of three consecutive hours.

Because of the nature of the emission control technologies being used to reduce emissions from electrical generation technologies, periodic monitoring is an important aspect to ensuring compliance with BACT emission levels. The ARB staff recommends that periodic monitoring be combined with a periodic source test requirement. Periodic monitoring would involve using portable analyzers on at least a quarterly basis to ensure NOx emissions are below permit limits. In conjunction with the periodic monitoring, source test should be required every two to three years.

In addition, for small engines less than 100 bhp, where the cost of annual source test is not cost effective relative to the cost of the engine, the ARB staff recommends quarterly monitoring with portable analyzers be sufficient for the purposes of monitoring emissions. Annual or periodic source test should not be required for small engines, although the district would have the ability to request a source test.

d. Field Enforcement

As discussed above, BACT levels for reciprocating engines have historically been expressed in terms of g/bhp-hr. Standards expressed in terms of g/bhp-hr are difficult to enforce because of the difficulty and uncertainty in measuring brake horsepower. Consequently, some districts have moved to expressing BACT levels for reciprocating engines in concentration or an equivalent ppmvd at 15 percent O_2 and in lb/hr. The ARB staff supports adding additional provisions to the permit that allow for enforceable BACT limits. In the case of reciprocating engines, permit conditions could express BACT levels in equivalent ppmvd at 15 percent O_2 as well as in lb/MW-hr.

Similarly, for gas turbines, where BACT levels are typically expressed in permit conditions as "ppmdv at 15 percent O_2", ARB staff supports the continued use of BACT levels expressed as equivalent ppmvd at 15 percent O_2, for enforcement purposes, as well as in lb/MW-hr.

2. Equipment Monitoring and Recordkeeping

Because the emission control equipment used to meet the proposed BACT levels must operate at very high efficiencies, guidance is provided here regarding monitoring to ensure that the emission control equipment is operating properly. The ARB staff recommends that, on a weekly basis, certain parameters be observed and recorded in a log--typically the same parameters that were identified during the commissioning period as important for minimizing emissions. These parameters include, but are not limited to: temperature at the inlet and outlet of the catalyst bed; for SCR, injection rate of reducing reagent; and O2 concentration. In addition, the operator should ensure that the parameters are within the range of optimum performance and if the value is outside this range, the log should identify the steps the operator took to correct the problem. Finally, because maintenance plays a strong role in the long-term effectiveness of any add-on control system, the ARB staff recommends that the operator should be required to maintain a log of all maintenance done for the generating unit, as well as the air pollution control system.

E. Permitting of Equipment Exempted From Permit

On occasion, districts are requested to permit a source that is exempted by regulation from district permitting requirements. Applicants do so for a variety of reasons, typically to officially preserve its legal grandfathering rights.

Beginning January 1, 2003, the ARB distributed generation certification will subject electrical generation sources not subject to district permitting requirements to certain requirements. Consequently, the ARB staff recommends that if districts issue permits, after the above date, to electrical generation sources that are not subject to permitting requirements by regulations, that the permit be conditions to meet the same requirements as if the generating source was subject to the ARB distributed generation certification program.

VIII. PERMIT STREAMLINING

A. District Programs

Both the BAAQMD and SCAMQD offer programs to allow manufacturers to certify equipment as meeting all the applicable air quality requirements of that respective district. Because the precertification is equipment specific, the manufacturer would need to demonstrate that the equipment would satisfy the district's BACT requirements and permit conditions. Once this equipment has been pre-approved as meeting district requirements, permits can be issued more expeditiously than the standard permit process. In the case of the SCAQMD program, the permit fees are also significantly reduced.

Several districts have programs for expedited permit issuance. These programs are available for select source categories and are intended for small emission units or temporary activities such as gas stations, dry cleaning machines, and contaminated soil cleanup. The source categories covered must meet certain emission standards.

The SCAQMD offers streamlined standard permits. This program is only available for lithographic printers, replacement dry cleaners, and soil excavation plans. For these three sources, total facility emissions must also be less than four tons per year and the facility cannot be next to a school. Finally, the equipment must meet all the requirements shown in the streamlined standard permit application.

B. ARB's Distributed Generation Certification Program

As required by SB 1298, ARB is required to develop and implement a certification program for generating technologies that are not subject to district permitting requirements. To obtain state certification, the generating technology must satisfy certain requirements, including emission standards for NOx, VOC, PM, and CO. This program will only be available for electrical generation technologies that are not subject to permitting requirements in any of the 35 local districts. For electrical generation technologies not otherwise subject to the DG certification program, the ARB's Equipment and Process Precertification Program is the vehicle for manufacturers seeking to validate emission claims. For details regarding the ARB's DG certification program, see the ARB staff report: Initial Statement of Reasons for the Proposed Regulation to Establish a Distributed Generation Certification Program, September 2001.

C. Recommendations

The district precertification programs discussed above are designed for small simple sources or sources that have minimal air quality impact. Electrical generation equipment does not fit this profile in that emissions impacts can be significant, the offset provisions of district NSR programs may be triggered, and a number of site specific issues may have to be addressed. Each electrical generation facility proposal tends to be unique and has to be evaluated against its own merits. Consequently, precertification or accelerated review programs are typically not appropriate for the permitting of electrical generation.

ARB staff encourages districts to review their permitting programs and look at areas in the permitting process for electrical generation equipment that can be streamlined. For example, elements that could be streamlined include standardized permit applications, precertified emission rates for standardized products (however, a source test would still be required to convert the Authority to Construct to a Permit to Operate), rapid decisions on BACT, and standardized permit conditions.

Finally, the threshold for permits varies greatly between the local districts. For example, permit thresholds for reciprocating engines vary from engines larger than 50 bhp to exempting from permitting requirements all engines fueled with natural gas. Districts should make information regarding exemption levels easily accessible (i.e., on a website) to interested parties. To the extent that uniform permit thresholds would simplify both the certification and permitting process for electrical generation equipment, the ARB staff encourages districts to revise permitting thresholds affecting electrical generation units.

IX. REFERENCES

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