Proposed New BACT Guidelines for Distributed Generation

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BACT Scientific Review Committee
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Background

Distributed generation (DG) is stationary, non-emergency electricity generation equipment that produces power primarily for use within the facility in which it is sited and/or another facility with which it has a direct energy interconnection. DG power plants are thus differentiated from utility-owned or merchant power plants, which provide power to the grid, and only when the power is needed.

DG projects, other than those utilizing digester gas, landfill gas refinery gas or other by-product gases, are restricted by South Coast Air Quality Management District's (AQMD) Clean Fuels Policy (in the BACT Guidelines) in their choice of fuels, and virtually all are fueled on natural gas. Most DG plants utilize internal combustion (I.C.) engine or gas turbine technology, and new DG projects are expected to continue to employ these technologies at least in the foreseeable future. Cleaner technologies such as fuel cells are being utilized as they continue to be developed and become more cost competitive. These technologies have electrical efficiencies ranging from approximately 20% to 40%, with the balance of the fuel heating value appearing as waste heat. DG projects are generally not economically justified unless part of the waste heat can be utilized by the host facility, and these projects are almost always configured as "cogeneration" or "combined heat and power (CHP)" projects.

Solar photovoltaic (PV) power is the predominant form of DG in the residential market. Larger PV systems are also being installed in commercial and institutional buildings.

Both fuel cell and PV DG systems do not require an AQMD permit.

Current Status of BACT for DG Projects

DG power plants tend to be much smaller than merchant or central station power plants since they are limited in size to the power demand of the facilities that they serve. Many DG power plants have capacities <1 MW to a few MW, and few are larger than 25 MW. Many DG projects will occur in non-major polluting facilities and will themselves be non-major; and thus criteria pollutant constraints on many of these projects will consist of AQMD's Minor Source BACT (MSBACT) guidelines for gas turbines and I.C engines. MSBACT guidelines for gas turbines and I.C. engines applicable to DG projects are summarized in Tables 1 and 2. The existing guideline for I.C. engines rated at or above 2064 bhp shown in Table 2 includes an update that has been reviewed by the BACT Scientific Review Committee and is expected to take effect July 9, 2004.

Table 1. MSBACT Guidelines for Gas Turbines Applicable to DG Projects

10-20-2000 Rev. 0

Equipment or Process: Gas Turbine

	Criteria Pollutants					
Subcategory/ Rating/Size	**VOC**	**NOx**	**SOx**	**CO**	**PM_{10}**	**Inorganic**
Natural Gas Fired, < 3 MWe		9 ppmvd @ 15% O_2 (10-20-2000)		10 ppmvd @ 15% O_2 (10-20-2000)		9 ppmvd ammonia @ 15% O_2 (10-20-2000)
Natural Gas Fired, ≥ 3 MWe and < 50 MWe		2.5 ppmvd @ 15% O_2 x $\frac{\text{efficiency (\%)}}{34\%}$ (6-12-98)		10 ppmvd @ 15% O_2 (6-12-98)		5.0 ppmvd ammonia @ 15% O_2 (10-20-2000)

Table 2. MSBACT Guidelines for I.C. Engines Applicable to DG Projects

10-20-2000 Rev. 0
6-4-2003 Rev. 1

Equipment or Process: I.C. Engine, Stationary

	Criteria Pollutants					
Subcategory/ Rating/Size	**VOC**	**NOx**	**SOx**	**CO**	**PM_{10}**	**Inorganic**
Non-Emergency, < 2064 bhp	0.15 grams/bhp-hr (4-10-98)	0.15 grams/bhp-hr (4-10-98)	See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)	0.60 grams/bhp-hr (4-10-98)	See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)	
Non-Emergency, ≥ 2064 bhp	25 ppmvd @ 15% O_2 (7-9-2004)	9 ppmvd @ 15% O_2 (7-9-2004)	Same as Above (10-20-2000)	33 ppmvd @ 15% O_2 (5-8-98)	0.045 grams/bhp-hr (5-8-98)	Ammonia: 10 ppmvd @ 15% O_2 (7-2-2004)

CARB Certification Program for DG Equipment Not Requiring District Permits

SB1298, chaptered into law in September 2000 by the California state legislature, recognized that distributed generation that is exempt from district permits could have significantly higher emissions than the extremely low emissions of new central station power plants. Therefore it required the California Air Resources Board (CARB) to institute a certification program for DG technologies to be applied to cases that are exempt from district permits. Furthermore, it required that as soon as practicable, certified DG meet emission standards (expressed as pounds per megawatt-hour[MW-hr] produced) equivalent to the best available control technology for permitted central station power plants in California.

CARB's DG certification program (Ref. 1) pursuant to this order took effect January 1, 2003. Table 3 summarizes the emission standards that are required by this program.

Table 3. Summary of DG Emission Standards Required by CARB Certification Program

	Effective 1/1/2003 lb/MW-hr		Effective 1/1/2007 lb/MW-hr
	w/o CHP	w/ CHP	
NOx	0.5	0.7	.07*
CO	6.0	6.0	0.1*
VOC	1.0	1.0	.02*
PM	Clean Fuel**	Clean Fuel**	Clean Fuel**

*Allows CHP credit of 1 MW-hr per 3.4 MMBtu waste heat recovered.

**Equivalent to natural gas with maximum sulfur content of 1 gr/100scf.

The 2007 standards are equivalent to emission standards applied to new central station power plants in California.

CARB has certified two fuel cells to meet the 2007 standards and two microturbines to meet the 2003 standards. Only these four DG technologies, and any zero-emission DG technology such as wind and solar power may be sold in California, unless the DG is large enough to require a district permit.

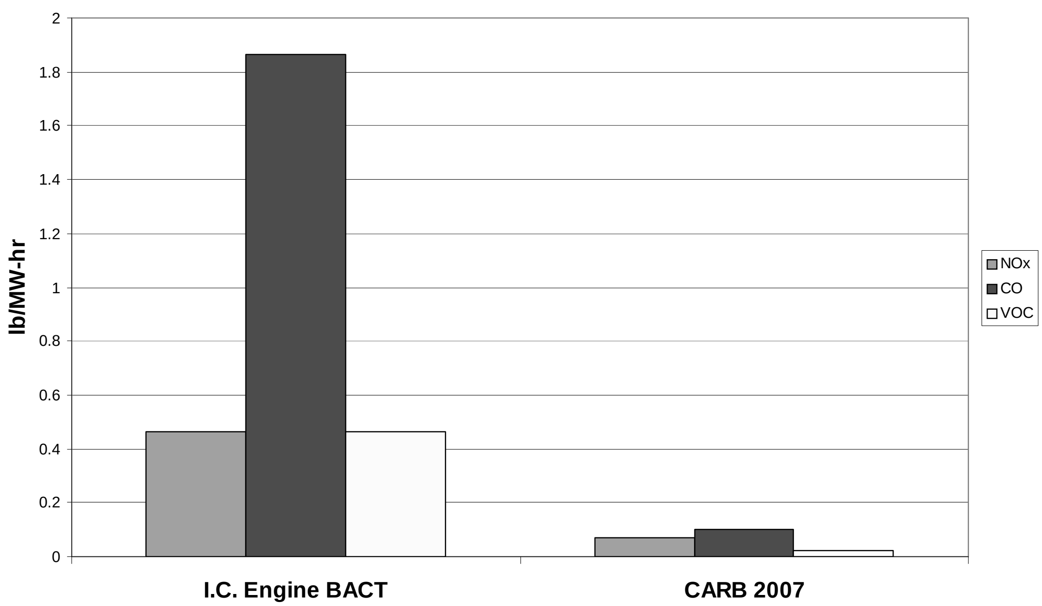
California's Self-Generation Incentive Program

In 2000 the California legislature adopted AB970 that authorized a self-generation incentive program to be administered by the investor-owned utilities until December 31, 2004. The program offers incentives up to 50% of the project cost, depending on the type of self-generation. The legislature extended the program through 2007 by adopting AB1685 in 2003, but will limit the incentives to "ultra-clean" electricity generation. Starting January 1, 2005, combustion-operated DG projects using fossil fuels will only be eligible for an incentive if NOx emissions meet a standard of 0.14 pounds per MW-hr (twice the CARB 2007 DG standard). And by January 1, 2007 only projects complying with the CARB 2007 standard of 0.07 pounds of NOx per MW-hr will qualify.

Possibility of Implementing CARB's 2007 Standards as BACT

CARB's 2003 certification standards are essentially equivalent to or less stringent than AQMD's current BACT guidelines that are applicable to DG equipment (Tables 1 and 2). However, CARB's 2007 standards are significantly more stringent than AQMD BACT. The current BACT requirements for most DG permitted by AQMD result in emissions that are from 6 to 23 times higher than the emissions allowed from new large central station power plants. Figure 1 demonstrates the differences. Also, whereas large central station power plants are required by AQMD's New Source Review program to provide emission offsets for all emission increases to mitigate emission impacts, most DG units are exempt from emission offset requirements. In addition, large central station power plants are required to have continuous emission monitor systems (CEMS) for NOx and CO and to report exceedances to AQMD whereas most DG units are not required to have CEMS. Therefore, DG emission exceedances may go undiscovered.

Figure 1. Current BACT for DG (I.C. Engine) versus CARB's 2007 DG Standards



Since CARB's 2007 standards will be applicable only to equipment not requiring permits, in AQMD's jurisdiction, only gas turbines rated at ≤2.975 MMBtu/hr heat input and I.C. engines rated at ≤50 bhp will be affected (Ref. 3). AQMD is therefore interested in the possibility of requiring that larger DG equipment, which need permits, also meet those standards. Furthermore, AQMD believes that DG technologies already exist that can meet the 2007 standards. Therefore, AQMD management asked the BACT Team to evaluate the possibility of implementing CARB's 2007 standards, or similar standards, in the BACT Guidelines.

The DG technologies that AQMD staff believes can meet CARB's 2007 emission standards are:

- Kawasaki GPB15X Gas Turbine--1.423 gross MW at ISO conditions (sea level, 59°F), guaranteed emission limits of 2.5 ppm NOx, 6 ppm CO and 2 ppm VOC, all dry basis, corrected to 15% O_2, down to 70% of rated load. These emission limits together with heat input of 20.7 MMBtu/hr (LHV) and 53.7% waste heat recovery specified by the manufacturer meet the CARB 2007 standards.

- Fuel Cells--available in increments as small as 10 kW, emissions are equal to or less than the CARB 2007 standards (Ref. 2).
- Large combustion gas turbines with combined heat and power (CHP). These are very similar to the central station combined-cycle power plants that are the basis of the 2007 CARB standards.

Advancements are being made in I.C. engine technologies that may lead to them being able to also achieve the CARB 2007 DG standards. At a recent conference sponsored by the California Energy Commission (CEC) (http://www.energetics.com/recips04.html) and the U.S. Department of Energy, the CEC program manager for the California Advanced Reciprocating Internal Combustion Engine Collaborative reported that they have three I.C. engines projects that will achieve the CARB 2007 DG standards by 2004-2005 by increasing the efficiency and reducing the emissions from I.C. engines. The three projects involve cooled exhaust gas recirculation with a three-way catalyst, homogeneous charge compression ignition, and advanced laser ignition.

Requirements of Health & Safety Code in Amending MSBACT

California Health & Safety Code section 40440.11 requires that AQMD, in amending MSBACT to be more stringent, show that the proposed new MSBACT is based on a technology that has been successfully practiced for at least a year and is cost effective based on established cost effectiveness criteria. Cost effectiveness must be demonstrated on both an "average" and an "incremental" basis. Average cost effectiveness compares the low-emission technology to the uncontrolled case, and incremental cost effectiveness compares the low-emission technology to the next most stringent degree of control.

Commercial and Technical Status of the Low-Emission DG Technologies

The Kawasaki gas turbine employs a catalytic combustor to achieve low NOx emissions while maintaining low emissions of CO and VOC. The first commercial use of a Kawasaki gas turbine equipped with a catalytic combustor was at the Silicon Valley Power plant in Santa Clara, CA, where it was started up in December 1998 and has been in regular use. That unit has undergone several modifications over the years mainly to improve its emissions performance. During the second half of 1999, the catalyst developer conducted emissions monitoring for six months pursuant to a CARB technology verification program, and CARB verified the technology not to exceed 2.5 ppm NOx and 6 ppm CO (dry, 15% O2) when operating at or above 98% of rated capacity. Additional emissions monitoring was conducted under CEC's PIER program, and the results of that monitoring, which covered three phases of hardware modifications, are summarized in Table 4. The history of operation at the Silicon Valley Power plant together with the emission monitoring performed for CARB and CEC establish that the technology has been practiced for more than a year and supports the capability of the technology to meet the emission guarantee offered by the manufacturer. Additional units have been sold, and two more are in operation.

Table 4. Summary of Kawasaki Gas Turbine Emissions
Documented for CEC PIER Program

	PPMVD@15%O2, Avg./Max.		
	NOx	CO	VOC
Phase I June-December 1999	1.3/2.8	1.2/9.6	1.0/8.8
Phase II April-August 2000	1.2/1.7	0.5/25.9	0.6/3.5
Phase III May-June 2001	1.1/1.5	0.4/5.5	0.4/3.0

Two fuel cells are certified by CARB for sale in California. They are a 250 kW molten carbonate fuel manufactured by Fuel Cell Energy (FCE) and a 200 kW phosphoric acid fuel cell manufactured by United Technologies Corporation (UTC). FCE has a number of commercial systems operating, and at least one has operated for more than a year. UTC has suspended production of its phosphoric acid product but expects to bring out another version, based on proton exchange membrane (PEM) technology, soon. Another company is developing a solid oxide fuel cell suitable for DG applications, which should be available soon.

Cost Effectiveness Analysis

A cost effectiveness analysis was performed to evaluate use of the Kawasaki gas turbine or a fuel cell system for a DG project as a means of reducing emissions relative to technologies that are normally used. The calculation spreadsheet is presented in Attachment A.

The base case for the analysis was considered to be the use of an I.C. engine, which is the lowest cost DG option and the most common. Since it was evident that the Kawasaki gas turbine would be more cost effective than fuel cell technology, the analysis considered only the Kawasaki gas turbine as the low-emission technology for DG capacity ≥1.3 MW. The 1.3 MW minimum project size for application of the KHI technology was based on 1.423 gross MW produced by the KHI turbine-generator less derates for local temperature and elevation conditions and less parasitic power typically needed for fuel compression. For smaller systems, the analysis considered a FCE fuel cell system as the low-emission technology.

Calculations were done for three DG project sizes: 0.5 MW, 1.3 MW and 2.6 MW. For purposes of the incremental cost effectiveness analysis, the next most stringent degree of control in each case was considered to be the control technology that underlies the MSBACT guideline for that engine size (Table 2). These control technologies consist of a rich-burn engine with a three-way catalyst for the smaller engines (0.5 and 1.3 MW project sizes) and an SCR system with an oxidation catalyst for the larger engine (2.6 MW project size).

As can be seen in Attachment A, both the Kawasaki gas turbine and the fuel cell were found to be cost effective on both an average and an incremental basis for all the project sizes considered.

Because the alternative to self generation is to purchase electric power from the local electric utility or energy service provider, the cost effectiveness of purchased power was analyzed as well.

Purchase of power from Southern California Edison (SCE) or the Los Angeles Department of Water & Power (LADWP) on the rate schedules applicable to small to medium sized commercial facilities was considered. Purchase of power from the grid was found to be cost effective relative to I.C. engine based DG in most cases. The only exception is the case of the large I.C. engine controlled by SCR and oxidation catalyst in the SCE system. Grid power will also result in the fewest emissions in AQMD because: 1) the new central power plants located in AQMD must meet stringent BACT requirements; 2) a significant amount of electric power is imported, resulting in no emissions in AQMD; and 3) California is requiring (Ref. 4) the investor-owned utilities to to increase procurement of electricity from renewable energy sources by at least one percent per year, until 20 percent of utility retail sales are procured from renewable power sources, some of which are zero-emission technologies such as solar and wind.

Proposed MSBACT Amendment

The proposed amendment to MSBACT for DG projects is shown in Attachment B. It is proposed that a new equipment category entitled "Distributed Generation" be created to encompass all DG projects, regardless of the DG technology that is chosen by the applicant. The proposed guideline would require that the project meet the CARB 2007 standards for NOx, CO and VOC. AQMD's Clean Fuels Policy would be referenced as the guideline for SOx and PM. Ammonia emission guidelines for gas turbines and I.C. engines would be referenced as the guideline for inorganic emissions. This would constrain ammonia emissions in case an applicant chooses to meet the CARB 2007 NOx limit by using SCR technology.

The proposed DG BACT guidelines would not apply to DG projects fueled by digestor gas, landfill gas, refinery gas or stranded natural gas.

Since an applicant normally selects either gas turbine or I.C. engine technology for a DG project, the guidelines for those equipment categories will be modified to direct the applicant to the Distributed Generation category, as shown in Attachment B.

Proposed DG BACT Guidelines for Major Sources

BACT for major sources is based on federal Lowest Achievable Emission Rate (LAER) (Ref. 5) and is not required to pass a cost-effectiveness test. Therefore, staff recommends that new DG equipment at major sources be required henceforth to comply with the CARB 2007 standards as well, with the exception of DG equipment fueled by digestor gas, landfill gas, refinery gas or stranded natural gas. Major sources can use large combustion gas turbines with CHP, the smaller 1.4 MW Kawasaki gas turbine with CHP, equipment certified by CARB to meet the 2007 standards, or zero-emission technology such as solar or wind power.

Summary of Comments and Responses

Comment: This proposal runs counter to the state effort to promote DG, e.g., AB970 funds subsidizing new DG installations. The proposed MSBACT would effectively stop new DG installations in SCAQMD that are in the sub-7 MW size range.

Response: The self-generation incentive program authorized by the California Public Utilities Commission does provide rebates for some qualified DG. However, it also shows preference for zero and near-zero emission technologies and renewable technologies by providing them larger incentives. In 2003 the state legislature further restricted the incentive program by limited it to DG technologies that emit no more than 0.14 lbs/MW-hr by January 1, 2005 and 0.07 lbs/MW-hr by January 1, 2007. The state legislature also adopted SB1298 in 2000 that requires CARB and local districts to require, as soon as practicable, electrical generation technologies to meet emission standards equivalent to BACT for permitted central station power plants. Electrical generation technologies exist now to meet these standards for DG projects.

Comment: Essentially all new DG installations are I.C. engines. Installations do not go ahead unless the payback is 5 years or less. The payback for a KHI system is well over 5 years.

Response: I.C engines do cost less, but their NOx, CO and HC emissions exceed those of clean central station plants by 500% to 2200%. SB 1298 does not include payback or cost as a factor to consider. Neither do AQMD BACT for major sources or federal Lowest Achievable Emission Rate.

Comment: The KHI system is well suited only to facilities having 1.4 MW electrical load (or a multiple of 1.4 MW) and a 2:1 ratio of thermal to electrical load.

Response: The CPUC incentive program requires fossil fuel-fired DG to recover waste heat in order to qualify. Without heat recovery, DG efficiencies are poor compared to central station plants. The large amount of waste heat recoverable from gas turbines is a bonus, not a drawback.

Comment: A small turbine cannot follow load changes nearly as well as an I.C. engine. Of DG systems 500 kW or larger that have been installed, approximately 80% are required to follow load changes part of the time or all of the time.

Response: Because the current economics of new DG discourage export of electrical power and non-use of recovered thermal energy, we would expect DG to not be sized to serve peak loads and to not have to follow facility electrical loads as much. However, the manufacturer reports that the KHI gas turbine generator is an excellent load follower.

Comment: CARB chose 1/1/07 for the effective date because no suitable technology is available now.

Response: CARB's standards are statewide and apply to areas that comply with the ambient air quality standards as well as those that don't. AQMD has the worst air quality in the nation, and cannot wait until 2007 to require clean DG technologies when cleaner alternatives exist now. The proposed BACT is based on currently available technology.

Comment: This proposal should be aired in additional public forums to give more DG equipment manufacturers a chance to comment. SCE's DG group should be included in one such meeting.

Response: AQMD will follow its usual procedure when more stringent BACT is proposed. There will be a 30-day public comment period. In addition, the AQMD Board will consider the adoption of the new standards for minor sources at a public hearing.

Comment: BACT should identify a control technology, not an alternative basic technology.

Response: Section 41514.10 of the California State Health and Safety Code (CSHSC) requires BACT determinations "for electrical generation technologies" to be "equivalent to the level determined by the state board to be the best available control technology for permitted central station power plants in California." It does not distinguish between different types of electrical generation technologies. The target is the same for all.

BACT is defined by Section 40405 of the CSHSC to be "the most stringent emission limitation", not the most stringent control technology.

Section 40440.11 of the CSHSC requires AQMD to "consider only control options *or emission limits* to be applied to the basic production or process equipment existing in that source category *or a similar source category*."

Certainly, state law provides for requiring all electrical generation technologies to meet the same stringent emission limits.

Comment: If you are going to compare DG emissions to grid power emissions, the emissions from a boiler that may be displaced by the DG may not be at BACT levels.

Response: The cost effectiveness calculations have been refined and are now based on typical boiler emissions, not BACT.

Comment: The KHI installation at the Silicon Valley Power plant, which is the achieved-in-practice case cited by AQMD for this technology, is not a DG installation and does not have permit limits as low as the CARB 2007 standards.

Response: The KHI gas turbine generator is electric generation technology that can be used for DG. The extensive emission testing shows that it can meet the CARB 2007 DG emission standards.

Comment: CARB and EPA have verified the KHI technology to achieve very low emissions, compliant with CARB's 2007 standards; however, only at or above 98% load.

Response: The testing was only conducted at full load, but the manufacturer says that emissions are guaranteed down to 70% load.

Comment: SCE uses the term "distributed generation" to designate small power plants owned by or contracted to an electric utility to support weak areas of the grid when high demand is pulling power away from those areas. SCE is concerned that the two different usages of the term may lead to problems.

Response: It was not staff's intention for the proposed DG requirements to apply to the large power plants that provide power only to the grid. Staff will work with SCE to better understand SCE's concerns.

<u>Cost Effectiveness Comments</u>

Comment: The installed cost of the KHI system that you used seems low compared to costs we quoted to potential customers.

Response: AQMD has received better cost information and redone the cost calculations.

Comment: How can the maintenance cost for the KHI system be less than for the IC engine?

Response: The basis for each cost factor is provided with the calculations. There was an error in catalyst replacement cost for the I.C. engine technology, but it is still higher than the KHI annual maintenance cost. IC engines require significantly more routine maintenance.

Comment: The calculations did not consider the effects of temperature, elevation or turndown on gas turbine efficiency or power output.

Response: The cost effectiveness analysis has been refined, and these factors are now included.

Comment: The calculations do not appear to have included the cost (capital and maintenance) and parasitic load of a compressor, which is needed for the KHI system but not for an I.C. engine.

Response: The source of our cost data confirms it includes compressor costs. The effect on net power output and efficiency has been included.

Comment: Since many installations may not be multiples of 1.4 MW, the calculations for the KHI system should consider the case of a unit operating consistently below rated load.

Response: Derated applications of both a fuel cell system and a KHI system were evaluated for cost effectiveness versus correctly sized I.C. engines. This is conservative since I.C. engines also are available only in discrete sizes. The results of these calculations are shown in Attachment A. In the sub-1 MW size range, it was found that a fuel cell system remains cost effective versus an I.C. engine based system when derated as much as 11%. For systems sized at 0.9 MW and above, a KHI system can be derated as much as 30% and still be cost effective versus I.C. engine based systems.

Comment: Taking credit for reduction in boiler emissions is valid only in cases which have adequate thermal load to use all the recoverable waste heat. In calculating these emission credits, the assumption of 12 ppm NOx is probably not appropriate since most facilities have older boilers producing higher levels of NOx.

Response: Natural gas-fired DG technology electrical efficiencies are only 50 to 80% as much as new central station power plants, so they are an environmentally poor option unless there is an opportunity to recover waste heat from the DG. The boiler emissions have been recalculated based on typical boiler emissions instead of BACT.

References

1. California Code of Regulations, Title 17, Division 3, Chapter 1, Subchapter 8, Article 3, Sections 9400-94214, www.arb.ca.gov/energy/dg/dg.htm.
2. Performance and Cost Trajectories of Clean Distributed Generation Technologies", Energy Nexus Group, May 2002
3. AQMD Rule 219, Equipment not Requiring a Written Permit Pursuant to Regulation II.
4. Senate Bill 1078, Sher, Chapter 516, Statutes of 2002
5. AQMD BACT Guidelines, Part A-Policies and Procedures for Major Polluting Facilities

Attachment A. Cost Effectiveness Analysis

Attachment B. Proposed MSBACT Amendment

8-2-2004 Rev. 0

Equipment or Process: Distributed Generation [1)]

	Criteria Pollutants					
Rating/Size	**VOC**	**NOx**	**SOx**	**CO**	**PM_{10}**	**Inorganic**
All	.02 lb/MW-hr [2)] (8-2-2004)	.07 lb/MW-hr [2)] (8-2-2004)	See Clean Fuels Policy in Part C of the BACT Guidelines (8-2-2004)	0.1 lb/MW-hr [2)] (8-2-2004)	See Clean Fuels Policy in Part C of the BACT Guidelines (8-2-2004)	See Appropriate Guideline for Gas Turbine or Stationary I.C. Engine (8-2-2004)

1) Applies to any electricity generation project producing electricity primarily for use within the facility in which it is sited and/or another facility(ies) with which it has a direct energy interconnection(s). Does not include distributed generation fueled by by-product gases such as digester gas , landfill gas or refinery gas or stranded natural gas. Stranded natural gas is natural gas that is being flared or for which processing to meet pipeline quality requirements and/or connecting to the nearest commercial pipeline clearly cannot be economically justified.

2) Calculation of lb/MW-hr may consider both electrical generation and waste heat utilization (3.413 MMBtu of waste heat is equivalent to 1 MW-hr).

10-20-2000 Rev. 0
8-2-2004 Rev. 1

Equipment or Process: Gas Turbine

	Criteria Pollutants					
Subcategory/ Rating/Size	**VOC**	**NOx**	**SOx**	**CO**	**PM_{10}**	**Inorganic**
Distributed Generation[1)]	See Distributed Generation Guideline (8-2-2004)					
Natural Gas Fired, < 3 MWe		9 ppmvd @ 15% O_2 (10-20-2000)		10 ppmvd @ 15% O_2 (10-20-2000)		9 ppmvd ammonia @ 15% O_2 (10-20-2000)
Natural Gas Fired, ≥ 3 MWe and < 50 MWe		2.5 ppmvd @ 15% O_2 x efficiency (%) / 34% (6-12-98)		10 ppmvd @ 15% O_2 (6-12-98)		5.0 ppmvd ammonia @ 15% O_2 (10-20-2000)
Natural Gas Fired, ≥ 50 MWe	2.0 ppmvd (as methane) @ 15% O_2, 1-hour avg. OR 0.0027 lbs/MMBtu (higher heating value) (10-20-2000)	2.5 ppmvd @ 15% O_2, 1-hour rolling avg. OR 2.0 ppmvd @ 15 %O_2, 3-hour rolling avg. x efficiency (%) / 34% (10-20-2000)		6.0 ppmvd @ 15% O_2, 3-hour rolling avg. (10-20-2000)		5.0 ppmvd ammonia @ 15% O_2 (10-20-2000)
Emergency		See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)	See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)		See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)	
Landfill or Digester Gas Fired		25 ppmv, dry, corrected to 15 %O_2 (1990)	Compliance with Rule 431.1 (10-20-2000)	130 ppmv, dry, corrected to 15 %O_2 (10-20-2000)	Fuel Gas Treatment for Particulate Removal (1990)	

1) Applies to any electricity generation project producing electricity primarily for use within the facility in which it is sited and/or another facility with which it has a direct energy interconnection(s). Does not include distributed generation fueled by by-product gases such as digester gas, landfill gas or refinery gas or stranded natural gas. Stranded natural gas is natural gas that is being flared or for which processing to meet pipeline quality requirements and/or connecting to the nearest commercial pipeline clearly cannot be economically justified.

10-20-2000 Rev. 0
6-4-2003 Rev. 1
8-2-2004 Rev. 2

Equipment or Process: I.C. Engine, Stationary

	Criteria Pollutants					
Subcategory/ Rating/Size	**VOC**	**NOx**	**SOx**	**CO**	**PM_{10}**	**Inorganic**
Distributed Generation[1)]	See Distributed Generation Guideline (8-2-2004)					
Emergency[2)], Compression-ignition[3)]	1.0 grams/bhp-hr (4-10-98) See Table 1 for Tier 2 limits and schedule. (6-6-2003)	6.9 grams/bhp-hr (4-10-98) See Table 1 for Tier 2 limits and schedule. (6-6-2003)	Diesel Fuel Sulfur Content ≤ 0.05% by Weight (4-10-98) On or after June 1, 2004 the user may only purchase diesel fuel with a sulfur content no greater than 0.0015% by weight (Rule 431.2). (6-6-2003)	8.5 grams/bhp-hr (4-10-98) See Table 1 for Tier 2 limits and schedule. (6-6-2003)	0.38 grams/bhp-hr (4-10-98) See Table 1 for Tier 2 limits and schedule. (6-6-2003)	
Emergency[2)], Spark Ignition[4)]	1.5 grams/bhp-hr (10-20-2000)	1.5 grams/bhp-hr (10-20-2000)	See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)	2.0 grams/bhp-hr (10-20-2000)	See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)	
Landfill or Digester Gas Fired	0.8 grams/bhp-hr (4-10-98)	0.60 grams/bhp-hr (4-10-98)	Compliance with Rule 431.1 (10-20-2000)	2.5 grams/bhp-hr (4-10-98)		
Non-Emergency, < 2064 bhp	0.15 grams/bhp-hr (4-10-98)	0.15 grams/bhp-hr (4-10-98)	See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)	0.60 grams/bhp-hr (4-10-98)	See Clean Fuels Policy in Part C of the BACT Guidelines (10-20-2000)	

Non-Emergency, ≥ 2064 bhp	25 ppmvd @ 15% O_2 (7-9-2004)	9 ppmvd @ 15% O_2 (7-9-2004)	Same as Above (10-20-2000)	33 ppmvd @ 15% O_2 (5-8-98)	0.045 grams/bhp-hr (5-8-98)	Ammonia: 10 ppmvd @ 15% O_2 (7-9-2004)

1) Applies to any electricity generation project producing electricity primarily for use within the facility in which it is sited and/or another facility(ies) with which it has a direct energy interconnection(s). Does not include distributed generation fueled by by-product gases such as digester gas , landfill gas or refinery gas or stranded natural gas. Stranded natural gas is natural gas that is being flared or for which processing to meet pipeline quality requirements and/or connecting to the nearest commercial pipeline clearly cannot be economically justified.

2) An emergency engine is an engine which operates as a temporary replacement for primary mechanical or electrical power sources during periods of fuel or energy shortage or while a primary power source is under repair. This includes fire pumps, emergency electrical generation and other emergency uses. Exceptions to the requirements in Table 1 may be made for emergency fire pumps if it is demonstrated that there are no UL-listed fire pumps that meet the Tier 2 emission limits.

3) AQMD restricts operation of emergency compression-ignition engines to 50 hours per year for maintenance and testing and a maximum of 200 hours per year total operation. For engines used to drive standby generators, operation beyond 50 hours per year for maintenance and testing is allowed only in the event of a loss of grid power or up to 30 minutes prior to a rotating outage provided that the electrical grid operator or electric utility has ordered rotating outages in the control area where the engine is located or has indicated that it expects to issue such an order at a certain time, and the engine is located in a utility service block that is subject to the rotating outage.

4) AQMD restricts operation of emergency spark-ignition engines to 50 hours per year for maintenance and testing and a maximum of 200 hours per year total operation. For emergency spark-ignition engines used to drive standby generators, operation beyond 50 hours per year for maintenance and testing is allowed only during emergencies resulting in an interruption of service of the primary power supply or during Stage II or III electrical emergencies declared by the electrical grid operator. Operators are allowed to use emergency spark-ignition engines as part of an interruptible electric service program. An interruptible electric service program is a program in which the facility receives payment or reduced rates in return for a requirement to reduce its electric load on the grid when requested to do so by the utility, the grid operator, or other organization.