AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN DIEGO

WORKSHOP REPORT

NEW RULE 69.3.1 - STATIONARY GAS TURBINE ENGINES - BEST AVAILABLE RETROFIT CONTROL TECHNOLOGY AND AMENDED RULE 69.3 - STATIONARY GAS TURBINE ENGINES - REASONABLY AVAILABLE CONTROL TECHNOLOGY

A workshop notice was mailed to owners and operators of stationary gas turbines in San Diego County. Notices were also mailed to all Economic Development Corporations and Chambers of Commerce in San Diego County, the U.S. Environmental Protection Agency (EPA), the California Air Resources Board (ARB), and other interested parties.

The workshop was held on March 18, 1998 and was attended by 20 people. Written comments were also received.

The workshop comments and District responses are as follows:

1. WORKSHOP COMMENT

The Monsanto Company is proposing to retrofit its three existing 7.9 MW turbines fired mainly on natural gas with three 10.3 MW turbines equipped with dry low NOx (DLN) combustors. After combustor replacement, one unit will operate on natural gas only, and the other two units will have dual fuel (natural gas and oil) capabilities.

The two proposed dual fuel turbines when fired on oil will not comply with the 65 ppmv nitrogen oxides (NOx) emission standard of Rule 69.3. The manufacturer's guaranteed NOx emission concentration for these turbines operating on oil is 120 ppmv. The manufacturer is also proposing to conduct a three year development and field testing program at the Monsanto site with a maximum combined total of 500 hours per year of oil firing. It is expected that as a result of this program the turbines will comply with all NOx emission standards of Rule 69.3.

Would these units be subject to the exemption specified Subsection (b)(1)(i) of the rule?

DISTRICT RESPONSE

Subsection (b)(1)(i) exempts gas turbines which operate exclusively for the research, development or testing of turbines or their components. The two proposed dual-fueled DLN retrofitted cogeneration units will be used predominantly to provide electrical power and useful thermal energy to the Monsanto Company facility for industrial use. According to District information, a significant portion of the electrical power generated will also be sold commercially. Therefore, these turbines do not qualify for the exemption.

2. WORKSHOP COMMENT

Is there a mechanism to provide a special exemption in Rule 69.3 for the proposed development and field testing program at the Monsanto facility?

DISTRICT RESPONSE

Any new exemption in Rule 69.3 must comply with the requirements of Section 193 of the Federal Clean Air Act (FCAA). Section 193 specifically prohibits a modification of any control requirement in any area which is a non-attainment area for any air pollutant unless such modification ensures equivalent or greater emission reductions of this air pollutant (or its precursor).

San Diego County is a serious ozone non-attainment area and oxides of nitrogen (NOx) are ozone precursors. Rule 69.3 is a part of federally approved California State Implementation Plan (SIP) that includes NOx emission reduction credits applied toward the District attainment of the National Ambient Air Quality Standard for ozone.

The proposed development and field testing program will result in a significant increase of NOx emissions over three years compared to the level currently allowed by Rule 69.3 which represents Reasonably Available Control Technology (RACT). Unless equivalent NOx emission reductions are provided, such an increase will constitute a SIP rule relaxation and will therefore violate the FCAA. EPA will disapprove such a SIP relaxation.

3. WORKSHOP COMMENT

Is it possible to include a provision in Rule 69.3 requiring a more stringent NOx limit for turbines operating on natural gas than the current one? This rule modification, in effect, would provide an internal offset within the rule for the increase in NOx emissions during oil firing.

DISTRICT RESPONSE

The suggested rule modification would constitute an Alternative Emission Control Plan (AECP) for a single source. Since Rule 69.3 does not currently have the AECP option, it would have to be amended and submitted for EPA approval. This would require significant time and expenditure of District resources and would add an additional uncertainty of EPA timely approval.

Because this issue affects only one source subject to Rule 69.3, a preferred option would be for this source to submit a proposed AECP with all the necessary information for District approval. If approved by the District, the AECP could be submitted to EPA as a Source-Specific SIP revision. Further amendments to Rule 69.3 will not be required.

4. WORKSHOP COMMENT

The Monsanto Company's proposal to retrofit existing units would result in their uprating from 7.9 MW to 10.3 MW. The manufacturer's guaranteed NOx emissions concentrations for operating on natural gas will not comply with the proposed standards of Rule 69.3 for units 10 MW and larger. The Monsanto Company has submitted an analysis to the District which indicates no cost-effective control technology is available for these units to comply with the proposed NOx emission standards of Rule 69.3.1. Is it possible to modify the rule to allow the 10.3 MW turbines be subject to the less stringent NOx emission standards for units with power ratings below 10 MW?

DISTRICT RESPONSE

The District has evaluated the Monsanto Company proposals, and has performed both absolute and incremental cost-effectiveness calculations for several control technology options using cost data provided by Monsanto. The results of this analysis indicate that cost-effective control technologies are available for both the three existing 7.9 MW units and for larger 10.3 MW units to achieve the proposed NOx emission

concentration standards of Rule 69.3.1. Some of the cost-effective control alternatives evaluated also provide significantly greater NOx emission reductions.

5. WORKSHOP COMMENT

Does Subsection (b)(1)(i) apply to gas turbine air start engines used as ancillary support equipment for the testing of aircraft engines? These air start gas turbines are only used to start aircraft engines that are being tested.

DISTRICT RESPONSE

Yes. As stated in the District response to Comment #1, gas turbine engines used exclusively for the purposes of testing are exempt from both Rule 69.3 and 69.3.1. In addition, according to the District information, these air start gas turbines are rated below 0.3 MW and therefore are below the applicability limit of both rules.

6. WORKSHOP COMMENT

Does compliance with Rule 69.3.1 assure that a unit also complies with Rule 69.3?

DISTRICT RESPONSE

Yes. A facility that complies with all requirements of Rule 69.3.1 will also be in compliance with Rule 69.3. Rule 69.3.1 reflects Best Available Retrofit Control Technology (BARCT) requirements that are either similar or more stringent than the RACT requirements of Rule 69.3.

7. WORKSHOP COMMENT

Subsection (d)(2) of proposed Rule 69.3.1 contains a very specific description of a 34.5 MW unit that must comply with less stringent emission standards. This subsection should be revised to make it applicable to a generic class of turbines that were originally installed using Best Available Control Technology as determined at the time of installation prior to 1986.

DISTRICT RESPONSE

Only one existing gas turbine was affected by Subsection (d)(2). This subsection is no longer required. The latest information indicates that this 34.5 MW unit can comply with the emission limits of Subsection (d)(1). Rule 69.3.1 has been revised accordingly.

8. WORKSHOP COMMENT

The District is considering adding a requirement that diesel fuel used in all turbines subject to the standards of the proposed Rule 69.3.1 be certified by the California Air Resources Board (ARB). What does this certification mean?

DISTRICT RESPONSE

Diesel fuel certified for use in California must meet the requirements of a regulation adopted by ARB in 1988 and specified in Title 13, California Code of Regulations, Section 2281 and 2282. The regulation requires all diesel fuel sold in California for use in motor vehicles either to have a specified sulfur and

aromatic hydrocarbon content, or to have an alternative formulation that provide comparable emission benefits. California diesel fuel produces significantly lower emissions than conventional diesel. It is now widely available in California and is slightly more expensive than conventional diesel (by approximately 5¢ a gallon).

However, the District has conducted a cost-effectiveness analysis of using clean diesel fuel for turbines and has concluded that this NOx emission control strategy is not cost-effective for turbines in San Diego County. Accordingly, this requirement will not be included in Rule 69.3.1.

9. WORKSHOP COMMENT

Would the District require that a facility keep current California diesel fuel certification on file?

DISTRICT RESPONSE

This requirement will not be included in Rule 69.3.1. Please see the District response to the previous comment.

10. WORKSHOP COMMENT

Rule 69.3.1 regulates NOx emissions from turbines. It is recommended that the District revise Rule 62 (Sulfur Content of Fuels) to include the requirements for California diesel fuel rather than requiring its use in Rule 69.3.1.

DISTRICT RESPONSE

For the reasons stated in the District response to Comment # 8, this requirements will not be included in Rule 69.3.1.

11. WORKSHOP COMMENT

Would the requirement to use California diesel fuel affect the proposed NOx emission standards in Rule 69.3.1?

DISTRICT RESPONSE

As stated in the District responses to Comment #8, this requirement will not be included in proposed Rule 69.3.1. However, in comparison with regular diesel, clean diesel fuel provides a significant reduction in sulfur dioxide and particulate emissions, together with a 7% reduction in NOx emissions. The District encourages owners of turbines operating on liquid fuel or using diesel as a back-up fuel to consider using California diesel fuel as a pollution prevention technique. The lower NOx emissions from this fuel will also facilitate compliance with the proposed Rule 69.3.1 emission standards.

12. WORKSHOP COMMENT

The District future socioeconomic impact analysis for Rule 69.3.1 should include information related to the electrical utility industry restructuring. The industry will likely have some new cost data that should be included in this report.

DISTRICT RESPONSE

It is unclear how utility industry restructuring would affect the economic impacts of Rule 69.3.1. Emission limits apply to individual units, regardless of who operates them. Restructuring may change the economics of cogeneration but that goes beyond the scope of the District's socioeconomic impact analysis. However, the District will consider any information provided regarding the economic impact the proposed rule may have on affected facilities.

13. WORKSHOP COMMENT

The District's workshop notice requested industry comments on the advisability of specifying the use of California diesel fuel. SDG&E currently has in excess of 2.4 million gallons of diesel fuel in reserves which is not certified as California diesel fuel. This inventory is not expected to be completely consumed for many years. SDG&E requests that Rule 69.3.1 allow the use of non-certified diesel fuel until all reserves on site are exhausted. All future diesel purchases will be exclusively California diesel fuel.

DISTRICT RESPONSE

As stated in the District response to Comment #8, the use of California diesel fuel will not be required by Rule 69.3.1. However, the District encourages SDG&E to use clean diesel fuel as a pollution prevention strategy.

14. WRITTEN COMMENT

SDG&E has 19 peaking units that comply with the proposed NOx emission limits in Rule 69.3.1. These units also may be used in emergency situations. For example, if electrical power from the grid were to be lost these units would be started first. The definition of "Emergency Unit" specifically excludes "Peaking Units". It should be clarified that these peaking units can also be used as emergency units provided that they will be in compliance with the applicable NOx limits.

DISTRICT RESPONSE

Turbines used exclusively in defined emergency situations are exempt from emission control requirements of both Rules 69.3 and 69.3.1 because it is technologically infeasible to control them. Peaking units that routinely operate supplying electricity during high power demand periods can be effectively controlled and are subject to NOx emission limits of both rules. Consequently, they are excluded from the definition of an emergency unit. However, the rules do not preclude the use of any turbine in an emergency situation as long as it complies with the applicable emission standards.

15. WRITTEN COMMENT

Rule 69.3.1 will require peaking units larger than 4 MW and operating more than 877 hours per year to comply with more stringent NOx emission standards than the peaking units operating below this time limit. The 877 hour threshold is consistent with the ARB RACT/BARCT guidance issued in 1992. This threshold was based on the limited information available to ARB at that time related only to six comparatively new turbines. SDG&E operates older generation peaking units that were not considered by ARB. In addition, in May 1997, SDG&E submitted information to the District showing that there is no technologically or economically feasible control technology that would allow these peaking units to operate in compliance with the NOx emission limits of Subsection (d)(1). It is suggested that the 877 hour annual threshold be deleted.

DISTRICT RESPONSE

The Districts disagrees. Rule 69.3 defines a peaking unit as a turbine that operates intermittently for generation of power during periods of high energy demand. Based on the District emission inventory, between 1992 and 1997 all 19 SDG&E peaking units have operated well below 877 hours per year. In fact, the highest average annual operating time for a peaking turbine during this period was 103 hours and none of the units operated longer than 230 hours per year. Therefore, the proposed 877 hours limit for a peaking turbine operating time provides enough flexibility for a turbine operator in case the period of high power demand significantly exceeds the historical average.

The ARB RACT/BARCT guidance recognized the fact that add-on control technology such as SCR is not technologically feasible for intermittently operating turbines. This was reflected in the higher emissions limits applicable to peaking units which can be met using other emission control techniques such as water or steam injection. All SDG&E peaking units are presently in compliance with the proposed NOx emission limits in Rule 69.3.1 which are also consistent with the ARB RACT/BARCT guidance.

16. WRITTEN COMMENT

It is suggested that if the 877 hours threshold must be kept, Rule 69.3.1 should include the language allowing the District to make specific determination of whether a peaking unit operating for more than 877 hours is capable of achieving lower NOx emission limits and to do so cost-effectively .

DISTRICT RESPONSE

The District disagrees. If SDG&E expects to use any of its peaking units for more than 877 hours, i.e. for purposes other than supplying energy during peak power demand, this turbine will not be considered a peaking unit and would have to comply with more stringent NOx emission limits specified in Subsection (d)(1) which represent BARCT. If the District determines that this unit cannot comply with the BARCT standards because it is technologically or economically infeasible, Rule 69.3.1 may be amended at that time. Using peaking turbines for unlimited amount of time as suggested could result in significant NOx emission increases.

17. ARB COMMENT

Rule 69.3.1 provides a separate limit of 25 ppmv of NOx for the sole existing 34.5 MW gas turbine engine in Subsection (d)(2). It is less stringent than the NOx emission concentration limits in Subsection (d)(1) for this turbine size. The District did not provide sufficient data to justify less stringent emission limits of Subsection (d)(2).

DISTRICT RESPONSE

Subsection (d)(2) has been deleted from the rule. The latest information provided by the operators of this turbine indicated that the turbine will comply with the limits specified in Subsection (d)(1).

18. EPA COMMENT:

The proposed draft revision of Rule 69.3 exempts any portable gas turbine engine located at the stationary source. However, Rule 69.3 approved into the State Implementation Plan (SIP) only exempts turbines located at the source 180 days or less in a consecutive 12-month period as stated in the portable gas turbine definition. The District should either retain the present language or demonstrate that this rule change is not a SIP relaxation prohibited by Sections 110(l) and 193 of the Federal Clean Air Act (FCAA).

DISTRICT RESPONSE:

The definition of a portable gas turbine engine in Rule 69.3 was revised to make it consistent with the definition of a portable internal combustion engine of Section 41751 of the California Health and Safety Code that preempts local districts from regulating portable equipment provided it is registered with the state. The revised definition also conforms to the EPA definition of a portable non-road engine in 40 CFR 85, Subpart Q - Preemption of State Standards and Waiver Procedures for Non-road Engines and Non-road Vehicles.

It should also be noted that all portable turbines located at stationary sources in San Diego County are exempt from Rule 69.3 because of their small size (less than 0.3 MW). Therefore, the proposed revision to the portable gas turbine definition will not result in any emissions increase and will not be a rule relaxation subject to Sections 110(l) and 193 of the FCAA.

19. EPA COMMENT:

It is recommended that the newly added Subsection (b)(1)(iv) in Rule 69.3 be deleted because it represents a SIP rule relaxation referred to in the previous comment.

DISTRICT RESPONSE:

The District disagrees. Subsection (b)(1)(iv) only paraphrases the current language in Section (a) that the rule does not apply to turbines of 1.0 megawatt or less existing on the day of Rule 69.3 adoption, i.e. on September 27, 1994. For clarity, it has been moved from Section (a), Applicability, into Section (b), Exemptions. Therefore, this rule revision does not represent a SIP rule relaxation.

20. EPA COMMENT:

Subsection (e)(6) being referenced should be changed to read (e)(5).

DISTRICT RESPONSE:

The District agrees. The suggested change has been made.

21. EPA COMMENT:

EPA policy memoranda on excess emissions during startup, shutdown, maintenance and malfunctions dated September 28, 1982 and February 15, 1983 restrict automatic exemptions from emission limits during startup and shutdown periods. It is recommended that the District remove the exemption specified in Subsection (b)(2)(ii) of Rule 69.3 or demonstrate that it is consistent with federal policy.

DISTRICT RESPONSE:

The District disagrees. Rule 69.3 is a part of the EPA approved SIP. This issue was never raised by EPA during the rule development process or the lengthy rule approval process (it was submitted to EPA in October 1994 and approved into the SIP in June 1997). In addition, the exemption of turbines from emission limits during startup and shutdowns periods is consistent with the ARB RACT/BARCT Guidance which states that the NOx emission concentration limits apply only to turbines operating under load conditions.

22. EPA COMMENT:

The definition of portable gas turbine in Subsection (c)(8) is referencing the revised Rule 20.1 which is not included in the federally approved SIP. EPA recommends retaining the definition currently in the SIP; or, a revised version of Rule 20.1 should be approved into the SIP before the revised Rule 69.3 can be fully approved.

DISTRICT RESPONSE:

The District has recently submitted revised New Source Review rules including Rule 20.1 for EPA approval. EPA staff has indicated that the NSR rules will likely receive conditional approval into the SIP.

23. EPA COMMENT:

It is recommended that the averaging provision in Subsection (f)(2) be retained because it defines a compliance period. It is important for the clarity, enforceability and stringency of the current rule.

DISTRICT RESPONSE:

The District agrees. Subsection (f)(2) has been restored.

24. EPA COMMENT:

The phrase "unless otherwise specified by the Air Pollution Control Officer" in Subsection (g)(2) should be deleted because it appears to provide director's discretion inconsistent with Section 110(i) of the FCAA. If the District wishes to retain this phrase, it should be modified by adding that the Air Pollution Control Officer action should be approved by ARB and EPA.

DISTRICT RESPONSE:

The District disagrees. This language is a part of Rule 69.3 which has been approved into SIP(June 1997). Similar to the issue in Comment #21, the question of approvability of an alternative time duration between the source tests was not raised either during rule development process or the lengthy EPA SIP approval process.

It should also be noted that while Subsection (g)(2) allows the Air Pollution Control Officer some discretion in the determination of the frequency of compliance source tests, it does not affect actual rule compliance. The primary tool to assure consistent compliance with Rule 69.3 is the continuous monitoring of turbine and emission control system operational parameters required by Subsections (e)(1) and (e)(2). In addition, some turbines have continuous NOx emission monitoring systems. The periodic source testing serves only as an additional tool to ensure compliance. Considering the costs of source tests, it is unreasonable to require frequent source tests for facilities that have a good track record of compliance.

25. EPA COMMENT:

Section (d) in Rules 69.3 should explicitly state that a 15 minute averaging period is required for compliance determination. This will be consistent with the ARB RACT/BARCT Guidance for Stationary gas turbines.

DISTRICT RESPONSE:

The District disagrees. Section (d) specifies NOx emission standards. The 15 minute averaging period is implicitly referenced in Subsection (e)(2) of the rule which refers to part 60.13 (e)(2) of Title 40, Code of Federal Regulations (40 CFR 60).

26. EPA COMMENT:

Recordkeeping sections of Rule 69.3 and Rule 69.3.1 should be revised to require records be kept for five years instead of two years for consistency with Title V of the FCAA and the federal statutes of limitations.

DISTRICT RESPONSE:

The Title V requirements apply only to major stationary sources, i.e. sources emitting 50 or more tons of NOx per year. Rules 69.3. and 69.3.1 apply to both major-and non-major sources. Therefore, for consistency with other District rules they require keeping records for two years. Sources subject to Title V will be issued federal operating permits with recordkeeping requirements that comply with federal policies.

27. EPA COMMENT:

Section (c)(17) in Rule 69.3.1 is missing.

DISTRICT RESPONSE:

Rule 69.3.1 has been revised to correct this problem.

28. EPA COMMENT:

For clarity, ASTM test methods in Subsection (f)(2)(i)and (f)(2)(ii) should include the last two digits representing the year of the last revision of the test method.

DISTRICT RESPONSE:

The District agrees. Subsections (f)(2)(i) and (f)(2)(ii) have been revised as suggested.

8/26/98
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TO: Rule 69.3 Workshop Participants and Other Interested Parties

FROM: Richard J. Smith
Assistant Director

ADDENDUM TO THE WORKSHOP REPORT

PROPOSED NEW RULE 69.3.1 - STATIONARY GAS TURBINE ENGINES - BEST AVAILABLE RETROFIT CONTROL TECHNOLOGY

This report contains District responses for written comments on proposed new Rule 69.3.1 that were provided in a letter from Powers Engineering received on August 5, 1998.

1. WRITTEN COMMENT

The District used pre-and post-project "potential to emit" (PTE) emissions to determine the NOx emission reductions and cost-effectiveness of BARCT control options. The District expressed a willingness to consider an "actual-to actual" emission reduction calculation format if the pre-and post-project actual NOx emission estimates can be substantiated. Based on the estimates of pre- and post-project actual emissions for 7.9. MW turbine provided in Attachment B, the cost-effectiveness of the Selective Catalytic Reduction for the existing 7.9 MW turbine will be approximately $16/lb of NOx reduced. This estimate is much higher than the cost-effectiveness of $4.9/lb of NOx reduced calculated for this control option in the District's June 5, 1998 letter to the Air Resources Board (ARB).

DISTRICT RESPONSE

The District does not object using actual pre-project emissions as a baseline for the emission reduction calculations provided this baseline can be substantiated. However, the District disagrees with the methodology used for estimating the actual post-project emissions. These estimates should be based on the expected control effectiveness of applicable control technology, not on the NOx emission limits in the proposed rule.

The District position is supported by a definition of cost-effectiveness in the California Health & Safety Code, Section 40920.6. The cost-effectiveness is defined as "the cost, in dollars, of the potential control option divided by emission reduction potential, in tons, of the control option."

Therefore, in the case of the existing 7.9 MW turbines having water injection that would be further controlled by SCR, the full control efficiency potential of SCR technology must be used to calculate its cost-effectiveness.

Applying the Health and Safety Code definition to the estimates provided in Attachment B of the written comments, it is reasonable to assume that the emission reduction potential of low temperature SCR is 80%. Therefore, the actual post-project NOx emission concentration for the existing 7.9 turbine will be approximately 6 ppm based on the actual pre-project NOx emission concentration of 30 ppm. Assuming that the turbine will operate

at a 20% level below the limit to ensure compliance, the NOx emission concentration after add-on control device will be about 5 ppm. This will translate into the emission reductions of 41.4 tons per year for each turbine (83% of 49.7 tpy of actual pre-project emissions). Additionally, NOx emissions from a duct burner will also be reduced by 7.3 tpy. Therefore, the total NOx emission reduction from each turbine will be 49.4 tpy with the cost-effectiveness of $5.5/lb of NOx reduced. This value is somewhat higher than the cost-effectiveness ($4.9/lb) calculated by the District based on the permitted emission limit for existing 7.9 MW turbines but it is well below the cost-effectiveness of $7/lb of NOx reduced used for other District rules reflecting BARCT.

If the same methodology is applied to the calculations of the SCR cost-effectiveness for a 10.3 MW turbine equipped with DLN and as proposed in the comments, assuming 15.1 ppm "realistic average NOx emission concentration of 15.2 ppm, the incremental cost-effectiveness will be $7.7/lb.

It should be noted, that typically in the course of developing air pollution control regulations a proposed emission limit is first derived using the expected efficiency of applicable control technology provided by a control equipment vendor or manufacturer. In other words, the emission limits are established and the cost-effectiveness is calculated based on the expected emission reduction potential of specific control technology, not the other way around. Such methodology was used by ARB for the calculations of RACT/BARCT NOx emission concentration limits. For example, it was assumed that an application of SCR to a turbine controlled with water or steam injection (WI) will provide additionally 80% NOx emission reductions (p.p.8 and 12 of the RACT/BARCT Guidance). Taking average emission concentration of 42 ppm for turbines with WI the limit was established as 9 ppm (approximately 20% of 42ppm).

2. WRITTEN COMMENT

The District used $7/lb as the cost ceiling when evaluating the economic feasibility of the technology to achieve the BARCT control level in proposed Rule 69.3.1. This cost is much higher than the cost-effectiveness used in the RACT/BARCT Guidance ($3.75/lb). The Monsanto Company has assumed that the District would use the control cost-effectiveness tables in the RACT/BARCT Guidance as the basis for the cost-effectiveness threshold in San Diego county.

DISTRICT RESPONSE

State law (Health & Safety Code Section 40920.6) allows each district to establish its own BARCT based on the district ozone standard attainment status and the necessity to adopt all feasible control measures. The District is a serious non-attainment area for ozone standard and is required to adopt all feasible control measures to reduce emissions of ozone precursors, such as NOx. In general, each air district in California has its own cost-effectiveness threshold based on its non-attainment status, in many of them it is significantly higher than in San Diego

The cost-effectiveness level of $7/lb was established by the District for sources subject to Rule 69.2 adopted in 1994 that reflect BARCT for industrial, institutional and commercial boilers. The ARB RACT/ BARCT Guidance for this source category would require to install control technology in small boilers of limited use with the cost-effectiveness up to $10/lb. The District conducted its own cost-effectiveness analysis and established a threshold of $7/lb based on a projected cost of the control technology for electric utility

boilers in Rule 69 that also reflected BARCT. The analysis also showed that additional emission reductions achieved using the ARB control requirements for limited usage boilers will result in economic hardship for small businesses but only in a marginal emission reduction gain (approximately 5 tons/year).

In the Monsanto Company case, significant NOx emission reductions, up to 150 tons per year for three turbines at a cost-effectiveness below $7/lb can be achieved by the application of add-on control technology such as SCR to 10.3 MW turbines. Therefore, there is no economic or technological justification for relaxing BARCT requirements for these turbines.

3. WRITTEN COMMENT

The District pointed out that the Monsanto Company ability to afford add-on controls was a criteria for determining whether controls are cost-effective. The Monsanto Company is working under assumption that control requirements decisions are made based on a "$/lb of emission controlled" criterion with no consideration given to an individual company's ability to pay for the controls.

DISTRICT RESPONSE

This assumption is incorrect. State law (Health & Safety Code Section 40728.5) requires the District to conduct a Socioeconomic Impact Assessment (SIA) of a proposed rule and to make a good faith effort to minimize adverse socioeconomic impacts. The SIA must include a range of probable costs to industry or business including small businesses. Therefore, the District is required to consider the size of the affected business and its ability to pay for the proposed control equipment.

4. WRITTEN COMMENT

The Monsanto company wants to verify that the proposed 25 ppm limit would apply to upgraded 10.3 MW turbines if they are derated to less than 10 MW.

DISTRICT RESPONSE

Yes, turbines rated less than 10 MW will have to comply with a 25 ppm NOx emission concentration limit when operating on natural gas.

4. WRITTEN COMMENT

The Monsanto Company requests that the compliance schedule be changed to four years to be consistent with the ARB RACT/BARCT timetable. The four-year compliance schedule is appropriate as major turbine overhauls occur approximately every four years. This would also allow the facility to take advantages of turbine efficiencies and expected combustor technology which could obviate the need for costly add-on NOx controls.

DISTRICT RESPONSE

The District disagrees. The proposed two-year compliance schedule is adequate if the Monsanto Company plans to install and operate new turbines with Dry Low NOx (DLN)

combustors derated to 9.9 MW. These turbines will comply with Rule 69.3.1 standards when operated on natural gas without any further modifications.

5. WRITTEN COMMENT

The District scenarios for emission control options overestimate the costs associated with the DLN upgrade. Solar Turbines has estimated a turn-key, installed and operational 10.3 MW combustor retrofit cost will be $650,000.

DISTRICT RESPONSE

The District used the estimated costs provided by the facility. The March 26, 1998 letter from Bill Powers to Don Koeberlein of ARB indicated that the estimated cost of an upgrade to a T15000 turbine/generator set, including dry Low-NOx combustor, is $1,500,000 each.
The latest cost provided by the Monsanto Company does not include other expenses that must be counted as a part of the overall upgrading of their turbine-generator system such as a new larger generator, upgraded gear box, etc. An estimated total capital cost of these upgrades is approximately $950,000. This cost added to the latest estimated turn-key cost of Low NOx combustor will result in $1.6 mln, which is consistent with the estimate provided to ARB.

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN DIEGO

PROPOSED AMENDMENTS TO RULE 69.3

Proposed amendments to Rule 69.3 are to read as follows:

RULE 69.3 STATIONARY GAS TURBINE ENGINES - REASONABLY AVAILABLE CONTROL TECHNOLOGY

(a) APPLICABILITY

This rule shall apply ~~to any existing stationary gas turbine engine with a power rating of 1.0 megawatt (MW) or greater, or~~ to any ~~new~~ stationary gas turbine engine with a power rating of 0.3 megawatt (MW) or greater. Any unit subject to Section (d) of this rule shall not be subject to Rule 68.

(b) EXEMPTIONS

(1) The provisions of this rule shall not apply to the following:

(i) Any gas turbine engine when operated exclusively for the research, development or testing of gas turbine engines or their components.

(ii) Any portable gas turbine engine. ~~located at a stationary source 180 days or less in a consecutive 12 month period~~. It is the responsibility of any person claiming this exemption to maintain records indicating the dates that such gas turbine engine was located at a stationary source. These records shall be maintained for a minimum of two calendar years by the owner or operator of such gas turbine engine and made available to the District upon request.

(iii) ~~New~~ Any stationary gas turbines engine with a power rating less than or equal to 0.4 MW used in conjunction with military tactical ~~deployable~~ support equipment operated at military sites, provided that operations do not exceed 1000 hours per calendar year. It is the responsibility of any person claiming this exemption to maintain records indicating the hours that such gas turbine engine was operated. These records shall be maintained for a minimum of two calendar years by the owner or operator of such gas turbine engine and made available to the District upon request.

(iv) Any stationary gas turbine engine with a power rating ~~of 1 MW or~~ less than 1 MW which was installed and operated in San Diego County on or before September 27, 1994.

(2) The provisions of Section (d) shall not apply to the following:

(i) Any emergency unit provided that operation for ~~maintenance~~ non-emergency purposes to ensure operability in the event of an emergency situation does not exceed 80 hours per calendar year. It is the responsibility of any person claiming this exemption to maintain records in accordance with Subsections (e)~~(2)~~(4) and (e)~~(6)~~ (5) of this rule.

(ii) Any unit during startup, shutdown or a fuel change for a period not to exceed 120 continuous minutes. It is the responsibility of any person claiming this exemption to maintain records in accordance with Subsections (e)(3) and (e)~~(6)~~ (5) of

this rule. Nothing in this rule shall be construed to limit the actual time needed to conduct a startup, shutdown or fuel change.

(c) **DEFINITIONS**

For the purposes of this rule, the following definitions shall apply:

(1) **"Emergency Situation"** means any one of the following:

(i) an unforeseen electrical power failure of the serving utility or of onsite electrical transmission equipment; or

(ii) an unforeseen flood, fire or life-threatening situation.

Emergency situation shall not include operation of any unit for training purposes or other foreseeable event, or operation of any peaking unit for the purpose of supplying power for distribution to an electrical grid.

(2) **"Emergency Unit"** means a stationary gas turbine engine used only in the event of an emergency situation. A peaking unit shall not be considered an emergency unit.

~~(3) **"Existing" or "Existing Unit"** means any stationary gas turbine engine which was installed and operating in San Diego County on or before September 27, 1994.~~

~~(4)~~(3) **"Fuel Change"** means the transitory operating period when a switch occurs between liquid or gaseous fuels, or any combination thereof.

~~(5)~~(4) **"Gaseous Fuel"** means natural gas, digester gas, landfill gas, methane, ethane, propane, butane, or any gas stored as a liquids at high pressure such as liquefied petroleum gas.

~~(6)~~(5) **"Liquid Fuel"** means any fuel which is a liquid at standard conditions including but not limited to distillate oils, kerosene and jet fuel. Liquefied gaseous fuels are not liquid fuels.

~~(7)~~(6) **"Military Tactical ~~Deployable~~ Support Equipment"** means any equipment ~~operated by the United States armed forces or~~ owned by the U.S. Department of Defense or the National Guard and used in combat, combat support, combat service support, tactical or relief operations, or training for such operations ~~which is designed specifically for military use in an off-road, dense terrain and/or hostile environment or on board military combat vessels and is capable of being moved from one location to another. This equipment requires the ability to perform in a uniform manner with a minimum amount of non-emergency which has been standardized throughout the United States military and/or NATO forces~~.

~~(8) **"New" or "New Unit"** means a stationary gas turbine engine installed in San Diego County after September 27, 1994.~~

~~(9)~~(7) **"Peaking Unit"** means a stationary gas turbine engine that is operated intermittently for generation of electric power during periods of high energy demand.

~~(10)~~(8) **"Portable Gas Turbine Engine"** means a gas turbine engine which meets the definition of a portable emission unit in Rule 20.1. ~~a gas turbine which is designed and equipped to be easily movable and, as installed, easily capable of being moved from one stationary source to another, as determined by the Air Pollution Control Officer. Portable gas turbine engines are periodically moved and may not be located more than 180 days at any one stationary source within any consecutive 12 month period . Days when portable gas turbine engines are stored in a designated holding or storage area shall not be counted towards the 180 day limit, provided the gas turbine engine was not operated on that calendar day except for non-emergency and was in the designed holding area the entire calendar day.~~

~~(11)~~(9) **"Power Augmentation"** means an increase in the gas turbine engine shaft output, or a decrease in turbine fuel consumption, by the addition of energy recovered from exhaust heat.

~~(12)~~(10) **"Power Rating"** means the maximum, continuous power output of a unit, in megawatts (MW) or equivalent, as certified by the manufacturer unless limited by a condition in a District Authority to Construct or a Permit to Operate. Power augmentation shall not be included in power rating.

(11) **"Reasonably Available Control Technology (RACT)"** means the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.

~~(13)~~(12) **"Shutdown"** means an action necessary to cease operation of a unit and includes the amount of time needed to safely do so.

~~(14)~~(13) **"Stationary Gas Turbine Engine"** means any gas turbine engine system, with or without power augmentation, which is permanently attached to a foundation, or is not a portable gas turbine. Two or more gas turbines powering a common shaft shall be treated as one gas turbine.

~~(15)~~(14) **"Stationary Source"** means the same as defined in Rule ~~20.1~~ 2.

~~(16)~~(15) **"Startup"** means an action necessary to begin operation of a unit and includes the amount of time needed for a unit and ancillary equipment to achieve stable operation.

~~(17)~~(16) **"Unit"** means any stationary gas turbine engine.

(d) **STANDARDS**

(1) Except as provided in Section (b), ~~The~~the emissions concentration of oxides of nitrogen (NOx) from any unit subject to this rule, calculated as nitrogen dioxide at 15% oxygen on a dry basis, shall not exceed the following:

(i) 42 parts per million by volume (ppmv) when operated on a gaseous fuel.

(ii) 65 parts per million by volume (ppmv) when operated on a liquid fuel.

(e) **MONITORING AND RECORDKEEPING REQUIREMENTS**

(1) An owner or operator of a unit which is subject to the requirements of Section (d) shall install, calibrate and maintain continuous monitors in accordance with the

manufacturer's recommended procedures to ~~allow for monitoring of~~ monitor the operational characteristics of the unit and of any NOx emissions reduction system, as applicable, to demonstrate continuous compliance, such as:

(i) exhaust gas flow rate;

(ii) exhaust gas temperature;

(iii) ammonia injection rate;

(iv) water injection rate; and

(v) stack-gas oxygen content.

The Air Pollution Control Officer may require recording of one or more of the above parameters as necessary to ensure compliance.

~~(5)~~(2) ~~For any existing unit,~~ An owner or operator of any unit with a continuous emissions ~~monitorings~~ monitoring system (CEMS) which has ~~have~~ been installed to measure NOx emissions pursuant to any federal regulation shall ~~be certified, calibrated and maintained~~ certify, calibrate and maintain the CEMS in accordance with applicable federal regulations including the reporting requirements of Parts 60.7(c), 60.7(d), and 60.13 of Title 40, Code of Federal Regulations Section 60 (40 CFR 60), performance specifications of Appendix B of 40 CFR 60, quality assurance procedures of Appendix F of 40 CFR 60, and a protocol approved in writing by the Air Pollution Control Officer.

(3) An owner or operator of any unit subject to this rule shall maintain an operating log and record actual times and duration of all startups, shutdowns and fuel changes, and the type and quantity of each fuel used.

~~(4) Continuous monitors shall be installed, calibrated and maintained in accordance with applicable federal regulations and a protocol approved in writing by the Air Pollution Control Officer.~~

~~(2)~~(4) An owner or operator of an emergency unit shall maintain an operating log and record the hours of operation for ~~maintenance~~ non-emergency purposes and during ~~an~~ each emergency situation. At a minimum, these records shall include the dates and actual times and duration of all startups and shutdowns, total cumulative annual hours of operation for ~~maintenance~~ non-emergency purposes, and a description of ~~any~~ each emergency situation.

~~(6)~~(5) ~~The~~ An owner or operator of any unit subject to this rule shall maintain all records required by Section (e) for a minimum of ~~three~~ two calendar years. These records shall be maintained on the premises and made available to the District upon request.

(f) TEST METHODS

(1) To determine compliance with Section (d), measurement of oxides of nitrogen and stack-gas oxygen content shall be conducted in accordance with the ~~ARB~~ District Source Test Method 100, or the Air Resources Board (ARB) Test Method 100, as approved by the U.S. Environmental Protection Agency (EPA).

(2) The averaging period to calculate NOx emssions concentration shall be any thirty consecutive minute period.

~~(3) Measurements of emissions concentrations shall not include calibration or span check measurements of the emissions testing equipment.~~

(g) **SOURCE TEST REQUIREMENTS AND COMPLIANCE DETERMINATION**

(1) Any required ~~S~~source testing shall be performed at no less than 80% of the power rating. If an owner or operator of a ~~an existing~~ turbine demonstrates to the satisfaction of the Air Pollution Control Officer that the turbine cannot operate at these conditions, then emissions sources testing shall be performed at the highest achievable continuous power rating.

(2) A unit subject to the requirements of Section (d) shall be tested for compliance at least annually before the Permit to Operate renewal date ~~once every 12 months~~, unless otherwise specified in writing by the Air Pollution Control Officer. Testing shall be conducted in accordance with Section (f) and a source test protocol approved in writing by the Air Pollution Control Officer.

(3) Test reports shall include the operational characteristics, as described in Subsection (e)(1), of the unit and of all add-on NOx control systems.

(4) For the purposes of a compliance determination based on source testing, the NOx emissions concentration shall be calculated as an average of three subtests.

(5) For the purposes of a compliance determination based on CEMS data, the averaging period to calculate NOx emissions concentration shall be one clock hour.

~~(h) COMPLIANCE SCHEDULE~~

~~(1) An owner or operator of an existing unit shall be in compliance with all applicable provisions of this rule no later than May 31, 1995.~~

~~(2) Any person installing a new unit subject to the provisions of this rule shall comply with the applicable provisions of Section (d) upon initial installation and commencement of operation.~~

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN DIEGO

PROPOSED AMENDMENTS TO RULE 69.3

Proposed amendments to Rule 69.3 are to read as follows:

RULE 69.3 STATIONARY GAS TURBINE ENGINES - REASONABLY AVAILABLE CONTROL TECHNOLOGY

(a) APPLICABILITY

This rule shall apply ~~to any existing stationary gas turbine engine with a power rating of 1.0 megawatt (MW) or greater, or~~ to any ~~new~~ stationary gas turbine engine with a power rating of 0.3 megawatt (MW) or greater. Any unit subject to ~~Section (d) of~~ this rule shall not be subject to Rule 68.

(b) EXEMPTIONS

(1) The provisions of this rule shall not apply to the following:

(i) Any gas turbine engine when operated exclusively for the research, development or testing of gas turbine engines or their components.

(ii) Any portable gas turbine engine. ~~located at a stationary source 180 days or less in a consecutive 12 month period~~. It is the responsibility of any person claiming this exemption to maintain records indicating the dates that such gas turbine engine was located at a stationary source. These records shall be maintained for a minimum of two calendar years by the owner or operator of such gas turbine engine and made available to the District upon request.

(iii) ~~New~~ Any stationary gas turbines engine with a power rating less than or equal to 0.4 MW used in conjunction with military tactical ~~deployable~~ support equipment operated at military sites, provided that operations do not exceed 1000 hours per calendar year. It is the responsibility of any person claiming this exemption to maintain records indicating the hours that such gas turbine engine was operated. These records shall be maintained for a minimum of two calendar years by the owner or operator of such gas turbine engine and made available to the District upon request.

(iv) Any stationary gas turbine engine with a power rating ~~of 1 MW or~~ less than 1 MW which was installed and operated in San Diego County on or before September 27, 1994.

(2) The provisions of Section (d) shall not apply to the following:

(i) Any emergency unit provided that operation for ~~maintenance~~ non-emergency purposes to ensure operability in the event of an emergency situation does not exceed 80 hours per calendar year. It is the responsibility of any person claiming this exemption to maintain records in accordance with Subsections (e)~~(2)~~(4) and (e)~~(6)~~(5) of this rule.

(ii) Any unit during startup, shutdown or a fuel change for a period not to exceed 120 continuous minutes. It is the responsibility of any person claiming this

exemption to maintain records in accordance with Subsections (e)(3) and (e)~~(6)~~ (5) of this rule. Nothing in this rule shall be construed to limit the actual time needed to conduct a startup, shutdown or fuel change.

(c) **DEFINITIONS**

For the purposes of this rule, the following definitions shall apply:

(1) **"Emergency Situation"** means any one of the following:

(i) an unforeseen electrical power failure of the serving utility or of onsite electrical transmission equipment; or

(ii) an unforeseen flood, fire or life-threatening situation.

Emergency situation shall not include operation of any unit for training purposes or other foreseeable event, or operation of any peaking unit for the purpose of supplying power for distribution to an electrical grid.

(2) **"Emergency Unit"** means a stationary gas turbine engine used only in the event of an emergency situation. A peaking unit shall not be considered an emergency unit.

~~(3) **"Existing" or "Existing Unit"** means any stationary gas turbine engine which was installed and operating in San Diego County on or before September 27, 1994.~~

~~(4)~~(3) **"Fuel Change"** means the transitory operating period when a switch occurs between liquid or gaseous fuels, or any combination thereof.

~~(5)~~(4) **"Gaseous Fuel"** means natural gas, digester gas, landfill gas, methane, ethane, propane, butane, or any gas stored as a liquids at high pressure such as liquefied petroleum gas.

~~(6)~~(5) **"Liquid Fuel"** means any fuel which is a liquid at standard conditions including but not limited to distillate oils, kerosene and jet fuel. Liquefied gaseous fuels are not liquid fuels.

~~(7)~~(6) **"Military Tactical ~~Deployable~~ Support Equipment"** means any equipment ~~operated by the United States armed forces or~~ owned by the U.S. Department of Defense or the National Guard and used in combat, combat support, combat service support, tactical or relief operations, or training for such operations ~~which is designed specifically for military use in an off-road, dense terrain and/or hostile environment or on board military combat vessels and is capable of being moved from one location to another. This equipment requires the ability to perform in a uniform manner with a minimum amount of non-emergency which has been standardized throughout the United States military and/or NATO forces~~.

~~(8) **"New" or "New Unit"** means a stationary gas turbine engine installed in San Diego County after September 27, 1994.~~

~~(9)~~(7) **"Peaking Unit"** means a stationary gas turbine engine that is operated intermittently for generation of electric power during periods of high energy demand.

~~(10)~~(8) **"Portable Gas Turbine Engine"** means a gas turbine engine which meets the definition of a portable emission unit in Rule 20.1. ~~a gas turbine which is designed and equipped to be easily movable and, as installed, easily capable of being moved from one stationary source to another, as determined by the Air Pollution Control Officer. Portable gas turbine engines are periodically moved and may not be located more than 180 days at any one stationary source within any consecutive 12 month period . Days when portable gas turbine engines are stored in a designated holding or storage area shall not be counted towards the 180 day limit, provided the gas turbine engine was not operated on that calendar day except for non emergency and was in the designed holding area the entire calendar day.~~

~~(11)~~(9) **"Power Augmentation"** means an increase in the gas turbine engine shaft output, or a decrease in turbine fuel consumption, by the addition of energy recovered from exhaust heat.

~~(12)~~(10) **"Power Rating"** means the maximum, continuous power output of a unit, in megawatts (MW) or equivalent, as certified by the manufacturer unless limited by a condition in a District Authority to Construct or a Permit to Operate. Power augmentation shall not be included in power rating.

(11) **"Reasonably Available Control Technology (RACT)"** means the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.

~~(13)~~(12) **"Shutdown"** means an action necessary to cease operation of a unit and includes the amount of time needed to safely do so.

~~(14)~~(13) **"Stationary Gas Turbine Engine"** means any gas turbine engine system, with or without power augmentation, which is permanently attached to a foundation, or is not a portable gas turbine. Two or more gas turbines powering a common shaft shall be treated as one gas turbine.

~~(15)~~(14) **"Stationary Source"** means the same as defined in Rule ~~20.1~~ 2.

~~(16)~~(15) **"Startup"** means an action necessary to begin operation of a unit and includes the amount of time needed for a unit and ancillary equipment to achieve stable operation.

~~(17)~~(16) **"Unit"** means any stationary gas turbine engine.

(d) **STANDARDS**

(1) Except as provided in Section (b), ~~The~~the emissions concentration of oxides of nitrogen (NOx) from any unit subject to this rule, calculated as nitrogen dioxide at 15% oxygen on a dry basis, shall not exceed the following:

(i) 42 parts per million by volume (ppmv) when operated on a gaseous fuel.

(ii) 65 parts per million by volume (ppmv) when operated on a liquid fuel.

(e) **MONITORING AND RECORDKEEPING REQUIREMENTS**

(1) An owner or operator of a unit which is subject to the requirements of Section (d) shall install, calibrate and maintain continuous monitors in accordance with the

manufacturer's recommended procedures to ~~allow for monitoring of~~ monitor the operational characteristics of the unit and of any NOx emissions reduction system, as applicable, to demonstrate continuous compliance, such as:

(i) exhaust gas flow rate;

(ii) exhaust gas temperature;

(iii) ammonia injection rate;

(iv) water injection rate; and

(v) stack-gas oxygen content.

The Air Pollution Control Officer may require recording of one or more of the above parameters as necessary to ensure compliance.

~~(5)~~(2) ~~For any existing unit,~~ An owner or operator of any unit with a continuous emissions ~~monitorings~~ monitoring system (CEMS) which has ~~have~~ been installed to measure NOx emissions pursuant to any federal regulation shall ~~be certified, calibrated and maintained~~ certify, calibrate and maintain the CEMS in accordance with applicable federal regulations including the reporting requirements of Parts 60.7(c), 60.7(d), and 60.13 of Title 40, Code of Federal Regulations Section 60 (40 CFR 60), performance specifications of Appendix B of 40 CFR 60, quality assurance procedures of Appendix F of 40 CFR 60, and a protocol approved in writing by the Air Pollution Control Officer.

(3) An owner or operator of any unit subject to this rule shall maintain an operating log and record actual times and duration of all startups, shutdowns and fuel changes, and the type and quantity of each fuel used.

~~(4) Continuous monitors shall be installed, calibrated and maintained in accordance with applicable federal regulations and a protocol approved in writing by the Air Pollution Control Officer.~~

~~(2)~~(4) An owner or operator of an emergency unit shall maintain an operating log and record the hours of operation for ~~maintenance~~ non-emergency purposes and during ~~an~~ each emergency situation. At a minimum, these records shall include the dates and actual times and duration of all startups and shutdowns, total cumulative annual hours of operation for ~~maintenance~~ non-emergency purposes, and a description of ~~any~~ each emergency situation.

~~(6)~~(5) ~~The~~ An owner or operator of any unit subject to this rule shall maintain all records required by Section (e) for a minimum of ~~three~~ two calendar years. These records shall be maintained on the premises and made available to the District upon request.

(f) TEST METHODS

(1) To determine compliance with Section (d), measurement of oxides of nitrogen and stack-gas oxygen content shall be conducted in accordance with the ~~ARB~~ District Source Test Method 100, or the Air Resources Board (ARB) Test Method 100, as approved by the U.S. Environmental Protection Agency (EPA).

(2) The averaging period to calculate NOx emssions concentration shall be any thirty consecutive minute period.

~~(3) Measurements of emissions concentrations shall not include calibration or span check measurements of the emissions testing equipment.~~

(g) SOURCE TEST REQUIREMENTS AND COMPLIANCE DETERMINATION

(1) Any required ~~S~~source testing shall be performed at no less than 80% of the power rating. If an owner or operator of a ~~an existing~~ turbine demonstrates to the satisfaction of the Air Pollution Control Officer that the turbine cannot operate at these conditions, then emissions sources testing shall be performed at the highest achievable continuous power rating.

(2) A unit subject to the requirements of Section (d) shall be tested for compliance at least annually before the Permit to Operate renewal date ~~once every 12 months~~, unless otherwise specified in writing by the Air Pollution Control Officer. Testing shall be conducted in accordance with Section (f) and a source test protocol approved in writing by the Air Pollution Control Officer.

(3) Test reports shall include the operational characteristics, as described in Subsection (e)(1), of the unit and of all add-on NOx control systems.

(4) For the purposes of a compliance determination based on source testing, the NOx emissions concentration shall be calculated as an average of three subtests.

(5) For the purposes of a compliance determination based on CEMS data, the averaging period to calculate NOx emissions concentration shall be one clock hour.

~~(h) COMPLIANCE SCHEDULE~~

~~(1) An owner or operator of an existing unit shall be in compliance with all applicable provisions of this rule no later than May 31, 1995.~~

~~(2) Any person installing a new unit subject to the provisions of this rule shall comply with the applicable provisions of Section (d) upon initial installation and commencement of operation.~~

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN DIEGO

PROPOSED NEW RULE 69.3.1.

Proposed new Rule 69.3.1 is to read as follows:

RULE 69.3.1. STATIONARY GAS TURBINE ENGINES - BEST AVAILABLE RETROFIT CONTROL TECHNOLOGY

(a) APPLICABILITY

This rule shall apply to any existing stationary gas turbine engine with a power rating of 1.0 megawatt (MW) or greater, or to any new stationary gas turbine engine with a power rating of 0.3 MW or greater. Any unit subject to Section (d) of this rule shall not be subject to Rule 68.

(b) EXEMPTIONS

(1) The provisions of this rule shall not apply to the following:

(i) Any gas turbine engine when operated exclusively for the research, development or testing of gas turbine engines or their components.

(ii) Any portable gas turbine engine. It is the responsibility of any person claiming this exemption to maintain records indicating the dates that such gas turbine engine was located at each stationary source. These records shall be maintained for a minimum of two calendar years by the owner or operator of such gas turbine engine and made available to the District upon request.

(iii) Any stationary gas turbine engine with a power rating less than or equal to 0.4 MW used in conjunction with military tactical support equipment operated at military sites, provided that operations do not exceed 1000 hours per calendar year. It is the responsibility of any person claiming this exemption to maintain records indicating the hours that such gas turbine engine was operated. These records shall be maintained for a minimum of two calendar years by the owner or operator of such gas turbine engine and made available to the District upon request.

(2) The provisions of Section (d) shall not apply to the following:

(i) Any emergency unit provided that operation for non-emergency purposes to ensure operability in the event of an emergency situation does not exceed 80 hours per calendar year. It is the responsibility of any person claiming this exemption to maintain records in accordance with Subsections (e)(5) and (e)(8) of this rule.

(ii) Any unit during startup, shutdown or a fuel change for a period not to exceed 120 continuous minutes. It is the responsibility of any person claiming this exemption to maintain records in accordance with Subsections (e)(4) and (e)(8) of this rule. Nothing in this rule shall be construed to limit the actual time needed to conduct a startup, shutdown or fuel change.

~~(iii) Any unit with a power rating less than 4 MW provided that such unit operates less than 877 hours per calendar year. It is the responsibility of any person~~

~~claiming this exemption to maintain records in accordance with Subsections (e)(7) and (e)(8) of this rule.~~

(c) **DEFINITIONS**

For the purposes of this rule, the following definitions shall apply:

(1) **"Best Available Retrofit Control Technology (BARCT)"** means 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.

(2) **"Emergency Situation"** means any one of the following:

(i) an unforeseen electrical power failure of the serving utility or of onsite electrical transmission equipment; or

(ii) an unforeseen flood, fire or life-threatening situation.

Emergency situation shall not include operation of any unit for training purposes or other foreseeable event, or operation of any peaking unit for the purpose of supplying power for distribution to an electrical grid.

(3) **"Emergency Unit"** means a stationary gas turbine engine used only in the event of an emergency situation. A peaking unit shall not be considered an emergency unit.

(4) **"Existing" or "Existing Unit"** means any stationary gas turbine engine which was installed and operating in San Diego County on or before (*date of adoption*).

(5) **"Fuel Change"** means the transitory operating period when a switch occurs between liquid or gaseous fuels, or any combination thereof.

(6) **"Gaseous Fuel"** means natural gas, digester gas, landfill gas, methane, ethane, propane, butane, or any gas stored as a liquid at high pressure such as liquefied petroleum gas.

(7) **"Higher Heating Value (HHV)"** means the total heat liberated, including the heat of condensation of water, per mass of fuel burned (Btu per pound) when fuel and dry air at standard conditions undergo complete combustion and all resultant products are brought to standard conditions.

(8) **"Liquid Fuel"** means any fuel which is a liquid at standard conditions including but not limited to distillate oils, kerosene and jet fuel. Liquefied gaseous fuels are not liquid fuels.

(9) **"Lower Heating Value (LHV)"** means the total heat liberated, excluding the heat of condensation of water, per mass of fuel burned (Btu per pound) when fuel and dry air at standard conditions undergo complete combustion and all resultant products are brought to standard conditions.

(10) **"Manufacturer's Rated Thermal Efficiency (MRTE)"** means the manufacturer's continuous rated percent thermal efficiency of the gas turbine engine

equipped with air pollution control equipment, at peak load, after correction to lower heating value.

(11) **"Military Tactical Support Equipment"** means any equipment owned by the U.S. Department of Defense or the National Guard and used in combat, combat support, combat service support, tactical or relief operations, or training for such operations.

(12) **"New" or "New Unit"** means a stationary gas turbine engine installed in San Diego County after *(date of adoption)*.

(13) **"Peaking Unit"** means a stationary gas turbine engine that is operated intermittently for generation of electric power during periods of high energy demand.

(14) **"Portable Gas Turbine Engine"** means a gas turbine engine which meets the definition of a portable emission unit in Rule 20.1.

(15) **"Power Augmentation"** means an increase in the gas turbine engine shaft output, or a decrease in turbine fuel consumption, by the addition of energy recovered from exhaust heat.

(16) **"Power Rating"** means the maximum, continuous power output of a unit, in megawatts (MW) or equivalent, as certified by the manufacturer unless limited by a condition in a District Authority to Construct or a Permit to Operate. Power augmentation shall not be included in power rating.

~~(18)~~(17) **"Selective Catalytic Reduction (SCR)"** means a post-combustion control technology that utilizes a reducing agent, such as ammonia, injected into the exhaust gas stream where it converts oxides of nitrogen (NOx) to molecular nitrogen in the presence of a catalyst.

~~(19)~~(18) **"Shutdown"** means an action necessary to cease operation of a unit and includes the amount of time needed to safely do so.

~~(20)~~(19) **"Stationary Gas Turbine Engine"** means any gas turbine engine system, with or without power augmentation, which is permanently attached to a foundation, or is not a portable gas turbine. Two or more gas turbines powering a common shaft shall be treated as one gas turbine.

~~(21)~~(20) **"Stationary Source"** means the same as defined in Rule 2.

~~(22)~~(21) **"Startup"** means an action necessary to begin operation of a unit and includes the amount of time needed for a unit and ancillary equipment to achieve stable operation.

~~(23)~~(22) **"Unit"** means any stationary gas turbine engine.

~~(24)~~(23) **"Unit Thermal Efficiency (E)"** means the percent thermal efficiency of the gas turbine engine and is calculated as follows:

$$E = \frac{(MRTE)\ (LHV)}{(HHV)}$$

A gas turbine engine with an efficiency lower than 25 percent shall be assigned a unit efficiency of 25 percent.

(d) STANDARDS

(1) Except as provided for in Section (b) and Subsection (d)(2), the emissions concentration in parts per million by volume (ppmv) of nitrogen oxides (NOx) from any unit subject to this rule, calculated as nitrogen dioxide at 15% oxygen on a dry basis, shall not exceed the following:

Power Rating (Megawatts)	NOx Emissions Concentration (ppmv)	
	Gaseous Fuel	Liquid Fuel
≥0.3 and <2.9 (new units)	42	65
≥1.0 and <2.9 (existing units)	42	65
≥2.9 and <10.0	25 x E/25	65
≥10.0 without post -combustion control	15 x E/25	42 x E/25
≥10.0 with post -combustion control	9 x E/25	25 x E/25

(2) The emissions concentration in parts per million by volume (ppmv) of nitrogen oxides (NOx) from any unit subject to this rule and described below, calculated as nitrogen dioxide at 15% oxygen on a dry basis, shall not exceed the following:

Unit Description	NOx Emissions Concentration (ppmv)	
	Gaseous Fuel	Liquid Fuel
Peaking units ≥ 4 MW and operating less than 877 hours per calendar year	42	65
~~Existing 34.5 MW General Electric unit LM 5000 with SCR~~	~~25~~	~~25 x E/25~~
Units < 4 MW and operating less than 877 hours per calendar year	42	65

(e) MONITORING AND RECORDKEEPING REQUIREMENTS

(1) An owner or operator of a unit which is subject to the requirements of Section (d) shall install, calibrate and maintain continuous monitors in accordance with the manufacturer's recommended procedures to monitor the operational characteristics of the unit and of any NOx emissions reduction system, as applicable, to demonstrate continuous compliance, such as:

(i) exhaust gas flow rate;

(ii) exhaust gas temperature;

(iii) ammonia injection rate;

(iv) water injection rate; and

(v) stack-gas oxygen content

The Air Pollution Control Officer may require recording of one or more of the above parameters as necessary to ensure compliance.

(2) An owner or operator of any unit with a power rating of 10 MW or more that operates more than 4000 hours per calendar year shall install and operate a continuous emission monitoring system (CEMS) to measure and record NOx emissions. The CEMS shall be certified, calibrated and maintained in accordance with all applicable federal regulations including the requirements of Parts 60.7(c), 60.7(d), and 60.13 of Title 40, Code of Federal Regulations, Section 60 (40 CFR 60), performance specifications of Appendix B of 40 CFR 60, quality assurance procedures of Appendix F of 40 CFR 60, and a protocol approved by the Air Pollution Control Officer.

(3) An owner or operator of any unit with a continuous emissions monitoring system which has been installed to measure NOx emissions pursuant to any federal regulation shall certify, calibrate and maintain the CEMS in accordance with applicable federal regulations including the requirements of Parts 60.7(c), 60.7(d), and 60.13 of Title 40, Code of Federal Regulations Section 60 (40 CFR 60), performance specifications of Appendix B of 40 CFR 60, quality assurance procedures of Appendix F of 40 CFR 60, and a protocol approved in writing by the Air Pollution Control Officer.

(4) An owner or operator of any unit subject to this rule shall maintain an operating log and record actual times and duration of all startups, shutdowns and fuel changes, and the type and quantity of each fuel used.

(5) An owner or operator of an emergency unit shall maintain an operating log and record the hours of operation for non-emergency purposes and during each emergency situation. At a minimum, these records shall include the dates and actual times and duration of all startups and shutdowns, total cumulative annual hours of operation for non-emergency purposes, and a description of each emergency situation.

(6) An owner or operator of a peaking unit shall maintain an operating log and record the hours of operation during periods of high energy demand, and the total cumulative hours of operation during each calendar year.

(7) An owner or operator of any unit with a power rating less than 4 MW and operating less than 877 hours per calendar year ~~claiming the exemption of Subsection (b)(2)(iii)~~ and subject to Subsection (d)(2) shall maintain an operating log and record total cumulative hours of operation during each calendar year.

(8) An owner or operator of any unit subject to this rule shall maintain all records required by Section (e) for a minimum of two calendar years. These records shall be maintained on the premises and made available to the District upon request.

(f) **TEST METHODS**

(1) To determine compliance with Section (d), measurement of oxides of nitrogen and stack-gas oxygen content shall be conducted in accordance with the District Source

Test Method 100, or the Air Resources Board (ARB) Test Method 100 as approved by the U.S. Environmental Protection Agency (EPA).

(2) The higher heating value and lower heating value of a fuel shall be determined by ~~the most current version of~~ the following methods or their most current versions and can be provided by a fuel supplier:

(i) ASTM Test Method D240-92 or D2382-88 for liquid fuels, and

(ii) ASTM Test Method D1826-94, or D1945-96, in conjunction with ASTM Test Method D3588-91 for gaseous fuels.

(3) The averaging period to calculate NOx emissions concentrations shall be any thirty consecutive minute period.

(g) SOURCE TEST REQUIREMENTS AND COMPLIANCE DETERMINATION

(1) Any required source testing shall be performed at no less than 80% of the power rating. If an owner or operator of a gas turbine engine demonstrates to the satisfaction of the Air Pollution Control Officer that the turbine cannot operate at these conditions, then emissions source testing shall be performed at the highest achievable continuous power rating.

(2) A unit subject to the requirements of Section (d) shall be tested for compliance at least annually before the Permit to Operate renewal date, unless otherwise specified in writing by the Air Pollution Control Officer. Testing shall be conducted in accordance with Section (f) and a source test protocol approved in writing by the Air Pollution Control Officer.

(3) Test reports shall include the operational characteristics, as described in Subsection (e)(1), of the unit and of all add-on NOx control systems.

(4) For the purposes of a compliance determination based on source testing, the NOx emissions concentration shall be calculated as an average of three subtests.

(5) For the purposes of a compliance determination based on CEMS data, the averaging period to calculate NOx emissions concentration shall be one clock hour.

(h) COMPLIANCE SCHEDULE

(1) An owner or operator of an existing unit requiring modification, replacement or installation of air pollution control equipment pursuant to Section (d) requirements shall meet the following increments of progress:

(i) By (*twelve months after date of adoption)* submit an application to the Air Pollution Control Officer for an Authority to Construct and Permit to Operate the modified or replacement air pollution control equipment necessary to meet the emission standards of Section (d) of this rule.

(ii) By (*twenty-four months after date of adoption*) demonstrate compliance with the emission standards specified in Section (d) and all other applicable provisions of this rule.

(2) By (*six months after date of adoption)* , an owner or operator of an existing unit not requiring modification, replacement or installation of additional air pollution control equipment pursuant to Section (d) shall submit an application to modify conditions on the Permit to Operate as necessary to comply with the applicable requirements of Sections (d) and (e).

(3) An owner or operator of a new or replacement unit shall comply with all applicable provisions of this rule upon initial installation and commencement of operation.

mailed 9/18/98

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN DIEGO

September 17, 1998

TO: Rules 69.3 and 69.3.1 Workshop Participants and Other Interested Parties

FROM: Richard J. Smith
Assistant Director

RULE 69.3.1 - STATIONARY GAS TURBINE ENGINES, BEST AVAILABLE RETROFIT CONTROL TECHNOLOGY

SOCIOECONOMIC IMPACT ASSESSMENT

Attached for your review is the Socioeconomic Impact Assessment for proposed new Rule 69.3.1. This rule, together with the proposed amended Rule 69.3 (Stationary Gas Turbine Engines - Reasonably Available Control Technology), will likely be scheduled for public hearing in December 1998.

If you have any questions or comments, please call Natalie Zlotin at (619) 694-3312 or me at (619) 694-3303.

Richard J. Smith

RICHARD J. SMITH
Assistant Director

Attachment

RJSm:NZ:ls

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SOCIOECONOMIC IMPACT ASSESSMENT

PROPOSED RULE 69.3.1-
STATIONARY GAS TURBINE ENGINES -
BEST AVAILABLE RETROFIT CONTROL TECHNOLOGY

DRAFT

SEPTEMBER 1998

San Diego County
Air Pollution Control District
9150 Chesapeake Drive
San Diego, CA 92123

DRAFT SOCIOECONOMIC IMPACT ASSESSMENT

PROPOSED RULE 69.3.1-
STATIONARY GAS TURBINE ENGINES -
BEST AVAILABLE RETROFIT CONTROL TECHNOLOGY

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EXECUTIVE SUMMARY

This report presents the results of a socioeconomic impact analysis (SIA) of the San Diego County Air Pollution Control District's proposed new Rule 69.3.1 (Stationary Gas Turbine Engines - Best Available Retrofit Control Technology). The rule implements best available retrofit control technology (BARCT) requirements of the California Health and Safety Code.

The purpose of the rule is to provide BARCT level control of nitrogen oxides (NOx) emissions from stationary gas turbines. It imposes limits on the NOx emission concentrations in the turbine exhaust depending on turbine size, type of fuel used and the mode of operations and annual hours of turbine operation. If implemented, the rule will reduce NOx emissions in a range between 22.5 and 135 tons per year at an estimated overall cost-effectiveness between $2.2 and $5.9 per pound of NOx reduced.

Rule 69.3.1 applies to 32 turbines in San Diego county located at businesses and public institutions representing nine different industries. The majority of turbines (27) are already in compliance with all rule requirements. It is expected that two turbines at one facility will be taken out of service and will not be replaced. The other facility operating the three remaining turbines is expected to replace them with new, larger turbines. Several options for complying with the rule were considered for the existing and replacement turbines. None of them will result in significant economic impacts on the affected facility.

1. INTRODUCTION

Section 40728.5 of the State Health & Safety Code requires the Air Pollution Control District to perform a socioeconomic impact assessment for any new or amended rules that will significantly affect air quality or emissions limitations.

The Health and Safety Code specifies the following elements to be included in the socioeconomic impact assessment:

a. The necessity of adoption, amending, or repealing the rule or regulation in order to attain state and federal ambient air quality standards.

b. The type of industries or business, including small business, affected by the rule or regulation.

c. The range of probable costs, including costs to industry or business, including small business, of the rule or regulation.

d. The emission reduction potential of the rule or regulation.

This report contains the assessment of the socioeconomic impacts of new proposed Rule 69.3.1 - Stationary Gas Turbine Engines - Best Available Retrofit Control Technology.

2. THE NECESSITY OF ADOPTING RULE 69.3.1

Fuel combustion processes that occur in gas turbines result in emissions of nitrogen oxides, mostly nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is a criteria pollutant regulated under both Federal Clean Air Act and California Clean Air Act. In addition, NOx together with volatile organic compounds (VOC) are precursors of another criteria pollutant - ozone that forms as a result of photochemical reactions in the presence of sunlight.

San Diego County attains both federal and state standards for nitrogen dioxide. However, it does not meet the federal and state ambient air quality standards for ozone. The county is classified by both Environmental Protection Agency (EPA) and California Air Resources Board (ARB) as a serious ozone non-attainment area. Reducing emissions of NOx to the atmosphere is a key part of the San Diego's ozone standard attainment strategy.

The California Clean Air Act requires San Diego County to provide a plan that includes every feasible measure to control ozone precursors and attain the state ambient air quality standard for ozone at the earliest practicable date. The 1991 San Diego County Regional Air Quality Strategy (RAQS) is San Diego County's plan to attain the state ambient air quality standard for ozone and includes further control of stationary gas turbines as a feasible measure to reduce NOx emissions from combustion sources.

In addition, the California Clean Air Act requires that serious ozone nonattainment areas reduce emissions from existing stationary sources by installation of BARCT. BARCT is defined as achieving the maximum degree of emissions reduction considering energy, environmental and economic impacts. A statewide BARCT determination for stationary gas turbines was published by ARB in 1992.

New proposed Rule 69.3.1 will reflect BARCT for stationary gas turbines as required by state law. Rules similar to proposed Rule 69.3.1 have already been adopted by other California air districts that do not attain state air quality standards for ozone.

3. RULE 69.3.1 REQUIREMENTS

Currently, NOx emissions from turbines in San Diego County are regulated by Rule 69.3 - Stationary Gas Turbine Engines. This rule was adopted in 1994 and subsequently approved into the State Implementation Plan (SIP) by EPA and meets the Reasonably Available Control Technology (RACT) requirements of the Federal Clean Air Act. It applies to any stationary turbine with a power rating of 0.3 megawatts (MW) or greater and requires the turbines to meet the NOx emission concentration limits specified for gaseous and liquid fuels. In addition, the rule specifies monitoring, recordkeeping and testing requirements to ensure compliance. The rule also identifies turbines that are exempt from the emission standard requirements.

New Rule 69.3.1 will apply to all existing stationary gas turbines in San Diego County that have a power rating of 1.0 MW or greater and to any new stationary gas turbine that has a power rating of 0.3 MW or greater. Specifically, the proposed rule will:

- Establish NOx emission concentration limits for turbines based on their use, power rating and thermal efficiency. The rule limits are presented in Table 1.
- Require installation of continuous monitors to measure and record appropriate operational parameters of turbines and NOx emissions reduction systems.
- Require installation of continuous emission monitoring systems (CEMS) on any turbine with a power rating of 10 MW or greater that operates more than 4,000 hours per calendar year.
- Specify that CEMS installed pursuant to any federal regulation must be certified, calibrated and maintained in accordance with all applicable federal regulations.
- Specify records be kept for all turbines subject to or exempt from rule requirements.

- Specify source test requirements and require annual source testing for all turbines subject to the emission concentration standards unless otherwise specified by the Air Pollution Control Officer.
- Specify test methods for determining compliance with the rule.
- Specify separate procedures for determining compliance based on CEMS data and source test results.
- Provide a compliance schedule for turbines that will require modification, replacement or installation of air pollution control equipment to comply with the rule requirements. New turbines will be required to comply with all applicable provisions upon initial installation and startup.

Rule 69.3.1 will exempt portable gas turbines and turbines used exclusively for research, development and testing of turbine engines or their components. Stationary turbine engines with a power rating 0.4 MW or less used in conjunction with military tactical support equipment will also be exempt if they do not operate more than 1,000 hours per year. In addition, the emission concentration limits of the rule will not apply to any turbines during startup, shutdown or a fuel change, nor to turbines used in emergency situations.

Concurrently with adopting new Rule 69.3.1, the District will amend existing Rule 69.3 to provide necessary updates and clarifications. The title of Rule 69.3 will also be revised by adding "Reasonably Available Control Technology" to indicate that its requirements represent federal RACT. Following adoption, amended Rule 69.3 will be submitted to EPA as a SIP revision and applied only to federal major sources of NOx emissions (sources emitting 50 tons of NOx per year or more). Once approved by EPA, amended Rule 69.3 will be a federally applicable requirement for major sources of NOx emissions under the Federal Operating Permit Program (Title V). Until then, existing Rule 69.3. will apply to the Title V sources .

Proposed new Rule 69.3.1 will apply state BARCT requirements to turbines in San Diego County located at major and non-major sources. The District does not intend to submit Rule 69.3.1 for inclusion in the SIP . Thus, Rule 69.3.1 will not be a federally applicable or enforceable requirement. Separating RACT (Rule 69.3) and BARCT (Rule 69.3.1) requirements will also allow the District to simplify and clarify implementation and enforcement procedures for local, state and federal purposes.

The comparison between existing Rule 69.3 and proposed new Rule 69.3.1 shows that the rules have many similarities. Both have the same format, similar turbine size applicability limit, the same exemptions and similar monitoring and recordkeeping requirements. Rule 69.3.1 does not introduce any other administrative requirements that will result in additional costs for the affected facilities. The NOx emission limits in both rules are the same for small turbines (less than 2.9 MW) and peaking turbines.

However, Rule 69.3.1 imposes more stringent emission limits on turbines 2.9 MW and larger and operating more than 877 hours per year. Rule 69.3.1 also requires installation of CEMS for units of 10 MW and larger. In addition, it establishes two different sets of NOx emission concentration limits for turbines with or without add-on control equipment. The higher limits for turbines without add-on controls follow the statewide RACT/ BARCT Guidance and are intended to encourage the application of combustion modifications such as dry low NOx technology as a pollution prevention technique.

The economic impact of the Rule 69.3.1 requirements that are more stringent than current Rule 69.3 will be discussed in this report. The economic impacts of Rule 69.3 were previously assessed at the time of its adoption (1994).

TABLE 1. PROPOSED RULE 69.3.1 - NOx EMISSION CONCENTRATION LIMITS FOR STATIONARY GAS TURBINE ENGINES

Power Rating (Megawatts)	NOx Emissions Concentration (ppmv)	
	Gaseous Fuel	Liquid Fuel
≥0.3 and <2.9 (new units)	42	65
≥1.0 and <2.9 (existing units)	42	65
≥2.9 and <10.0	25 x E/25	65
≥10.0 without post -combustion control	15 x E/25	42 x E/25
≥10.0 with post -combustion control	9 x E/25	25 x E/25

Unit Description	NOx Emissions Concentration (ppmv)	
	Gaseous Fuel	Liquid Fuel
Peaking units ≥ 4 MW and operating less than 877 hours per calendar year	42	65
Units less than 4 MW and operating less than 877 hours per calendar year	42	65

The emissions concentration in parts per million by volume (ppmv) of NOx is calculated as nitrogen dioxide at 15% oxygen on a dry basis.

E is a turbine unit thermal efficiency calculated according to a formula provided in the rule.

4. TYPE OF INDUSTRIES REGULATED BY RULE 69.3.1

The proposed rule will apply to 32 turbines owned by businesses and public institutions representing nine different industries as shown in Table 3. None of them can be characterized as a small business.

TABLE 2
INDUSTRIES REGULATED BY RULE 69.3.1

SIC Code	Industries	Affected Companies	Number of Turbines
2711	Newspaper	1	1
2833	Medicinals & Botanicals	1	3
3728	Aircraft Engines and Parts	1	2
4931	Electric & Other Services	1	19
7373	Computer Systems	1	1
7999	Amusement & Rec. Services	1	1
8221	Universities	1	1
9223	Correctional Institutions	1	1
9711	Military Installations	3	3
	Total	21	32

There are 13 cogeneration turbine units used for electricity and steam generation and 19 peaking turbine units owned by electric utility company that provide electricity in periods of high power demand.

5. STATUS OF TURBINES SUBJECT TO NEW EMISSION LIMITS OF RULE 69.3.1

All turbines subject to the emission standards of current Rule 69.3 must comply with a NOx emission concentration limit of 42 ppmv when operating on gaseous fuel and 65 ppmv when operating on liquid fuel.

New Rule 69.3.1 separates these turbines into several categories depending on a turbine size and usage and specifies the NOx emission limits for each category. The present status of turbines which will be the subject of new emission or operating time limitations is as follows.

A. Turbines rated 10 MW and larger.

There are four such turbines in San Diego County. They are all combined cycle cogeneration turbines larger than 20 MW equipped with water injection following by post-combustion NOx emission control - Selective Catalytic Reduction (SCR). The emission controls on these turbines were installed to satisfy the Best Available Control Technology (BACT) requirements of the District's New Source Review rules. These units will be able to comply with Rule 69.3.1 NOx emission concentration standards without additional modifications. These turbines also have CEMS installed and already meet the new monitoring requirements of Rule 69.3.1.

B. Turbines rated at 2.9 MW or higher but less than 10 MW.

This category of turbines consists of six small cogeneration units rated at 2.9 MW, or slightly above, and three 7.9 MW units.

Under proposed Rule 69.3.1, one unit rated at 3 MW and operating less than 877 hours per year will be subject to the same NOx emission concentration standards as currently in Rule 69.3. The turbine is in compliance with this rule and no modifications will be required to comply with Rule 69.3.1.

Five turbines will be subject to the more stringent limits of 25 ppm while operating on gaseous fuel. The limits for liquid fuel will remain the same. These turbines presently use water injection as an emission control technique. The results of source tests conducted in the past few years showed that three of the five turbines can comply with the Rule 69.3.1 NOx emission concentration limits without additional modifications.

The two remaining turbines in this group are rated at 3.5 MW and will require an increase in water injection rate in order to comply with Rule 69.3.1 emission limits. However, based on information provided by the facility, these turbines are already planned to be taken out of service in the near future because they are close to the end of their useful life. In addition, the facility stated that it is currently not cost-effective to use these turbines for power generation because it is cheaper to buy electricity from outside sources.

The three 7.9 MW turbines in this category all located at the same facility and are used for cogeneration. These turbines will be subject to a more stringent NOx emission concentration limit of 25 ppmv (gaseous fuel) than the prese it Rule 69.3 limit of 42 ppm. Emission limits for liquid fuel operations will remain at the same level, 65 ppmv. These three turbines will require significant modification or add-on control equipment to comply with proposed Rule 69.3.1. The impacts on this facility are discussed in detail in Section 6 of this report.

C. Peaking Turbines

There are 19 peaking units in the District rated at 18 MW or higher. All currently use water injection to reduce NOx emissions and comply with emission limits of Rule 69.3. Rule 69.3.1 will require these units to comply with the same NOx emission standards as the current rule. Therefore, these units will not need to be modified to comply with Rule 69.3.1 limits for peaking turbines.

Rule 69.3.1 will limit peaking turbines operation time to less than 877 hours per year. Rule 69.3 has no operation time constraints. However, the proposed time limitation should not affect the operation of these units because historically they have been used for much shorter time than 877 hours per year. In the period between 1992 and 1997, the highest average annual operating time of any peaking unit was about 100 hours and none of the units operated more than 230 hours in any single year.

The data presented in this section show that, with the exception of three 7.9 MW units, all existing turbines in the District will be able to operate in compliance with the emission limits and monitoring requirements of proposed Rule 69.3.1. Therefore, the rule is expected to affect only these three turbines at one facility. A discussion of these turbines and the facility's control options is provided below.

6. COGENERATION FACILITY AFFECTED BY RULE 69.3.1 EMISSION LIMITS

The existing three 7.9 MW units (90-T-12000 Solar Mars turbines) are part of a cogeneration plant located at a facility (SIC Code 2833) that manufactures specialized additives (alginates and biogums) used in the pharmaceutical industry and in food processing, and other industries. The turbines are currently derated to an output of 7.9 MW each. They are equipped with water injection to reduce NOx emissions and are presently in compliance with all Rule 69.3 requirements including the NOx emission limits of 42 ppmv and 65 ppmv when firing on gas and oil, respectively.

Proposed new Rule 69.3.1 will impose stricter NOx emission limits (25 ppmv) on these turbines when operating on gaseous fuel , consistent with state BARCT requirements. The NOx emission limits for operating on liquid fuel will remain the same at 65 ppmv. To comply with the proposed emission limits, the facility will have to retrofit existing turbines either with combustion modifications (e.g., dry low NOx combustor) or with post-combustion controls (e.g., selective catalytic reduction). Information provided by the facility[1] and the manufacturer of the existing turbines indicates that a retrofit dry low NOx combustor that will comply with Rule 69.3.1 NOx emission concentration limits is not available for turbines of this size. The other option - the installation of post-combustion control is technically feasible and is presently used on similar turbines in California. The expected NOx emission reductions, capital and annual costs and cost-effectiveness of this option are provided in Table 3.

TABLE 3. EXISTING 7.9 MW TURBINES - NOx EMISSION REDUCTIONS AND COST OF COMPLIANCE WITH RULE 69.3.1

Turbine Description	Add-on control technology	NOx emission reductions, tons/year *	Total Capital Costs, $M	Total Annual Costs, $M/yr	Cost-effectiveness/$/lb NOx reduced
7.9 MW with water injection	SCR	135	4.4	1.6	5.9

The table shows that Selective Catalytic Reduction (SCR) retrofit of these existing turbines will result in a capital expenditure of $4.4 million and annual operational costs of approximately $1.6 million. It will provide 135 tons per year NOx emission reductions at a cost-effectiveness of $5.9 per pound of NOx reduced. While capital and annual operating costs of turbines retrofit with SCR are significant, the cost-effectiveness of this technology is below the estimated cost-effectiveness of $7 per pound for District Rule 69.2 reflecting BARCT requirements for NOx emissions from industrial and commercial boilers, heaters and steam generators.

The facility most significantly affected by proposed Rule 69.3.1 is a large company with annual sales of approximately $300 million in 1994[22] . The company was acquired by Monsanto in 1995 and is now a part of Monsanto's Nutrition and Consumer Products segment. Economic data, such as company's profitability or other financial indicators, necessary for the quantitative determination of probable economic impacts on this facility were not available to the District. However, the 1997 Monsanto annual report states that "biogum sales grew 14 percent because of record consumer demand" in 1997, and approximately 15% in the previous year[3]. It may be assumed that the annual

* Emission reductions were calculated using the District 1997 Emission Inventory as a baseline.

sales of biogum and alginate products manufactured by the facility subject to Rule 69.3.1 was at least $400 million in 1997. Therefore, the annual cost of compliance with Rule 69.3.1, if the option described above is chosen, would amount to less than 0.5% of the annual sales and is not expected to significantly impact the company's operations.

The facility has informed the District that the existing turbines are close to the end of their useful life and it intends to replace them with three new 10.3 MW units within the next 18 months. These new units are proposed to be equipped with Dry Low NOx combustor (DLN) technology and operate exclusively on natural gas. The manufacturer guarantees NOx emission concentrations of 25 ppmv. The facility is planning to sell the excess power produced by these three turbines to outside customers.

As proposed, these turbines will not comply with Rule 69.3.1 emission standards. The rule requires the NOx emission concentration limits for turbines 10 MW and larger and operating on gaseous fuel to be not more than 9 ppmv with post-combustion control and not more than 15 ppmv without add-on control. Based on the expected 30% thermal efficiency of the turbines, the limits will be 12 ppmv and 18 ppmv, respectively (see Table 1). In addition, the replacement turbines will have to comply with the District New Source Review rules that require the installation of BACT. The District is presently evaluating BACT requirements that will apply to these turbines.

After extensive discussions with the affected facility, the District has evaluated several control options available for the proposed and alternative replacement turbines in order to comply with Rule 69.3.1 requirements. The cost information used in this evaluation was provided by the facility and equipment manufacturers[2]. These options are as follows:

1. Post-combustion NOx emission control for the proposed 10.3 MW turbines equipped with DLN combustors. This assumes that the facility will install SCR as add-on control technology.

2. Post-combustion control for alternative 10.3 MW replacement turbines with standard combustors and water injection. This assumes that the replacement turbines will have a conventional combustor equipped with water injection followed by SCR.

3. Derating the proposed 10.3 MW turbines equipped with DLN technology to 9.9 MW to comply with the 25 ppm NOx emission concentration limit for this turbine size. No additional control is needed for this option.

It should be noted that although the turbine manufacturer only guarantees NOx emission rates of 25 ppm, test cell data for these turbines indicate they may be able to meet an 18 ppm efficiency adjusted limit. It is also possible this performance level can be achieved in actual operating conditions. In this case, Option 3 may be needed only as a temporary measure until compliance with Rule 69.3.1 limits at full-rated capacity can be demonstrated.

Table 4 presents a summary of available control options and their costs for the proposed 10.3 MW replacement turbines. The fourth option represents the hypothetical case discussed above where the replacement turbines would comply with the applicable limit of Rule 69.3.1 without derating. The cost of installing and operating new turbines equipped with DLN combustors (or conventional combustors with water injection) was not included in the cost-effectiveness calculations because the proposed rule does not require the facility to install new, larger turbines. Replacing the existing turbines with more powerful ones is the company's business decision driven by the intent to sell a significant portion of the generated electrical power. This approach is also consistent with a company request that the working assumption in cost calculations for Rule 69.3.1 should be that 10.3 MW turbines with DLN are installed and operational[4]. Therefore, for the purpose of estimating the cost

impact of the proposed rule, only the costs of add-on controls (or other turbine modifications) to comply with Rule 69.3.1 emission standards were considered. The cost of additional monitoring, recordkeeping and source testing requirements were included in the calculations of the operational costs of add-on controls. No such costs were considered for Options 3 or 4 (turbine replacement) because monitoring, recordkeeping and source testing requirements of Rule 69.3.1 are identical to current Rule 69.3.

It was also assumed that the new 10.3 MW turbines will be in compliance with the New Source Review rule BACT requirements.

Table 4 shows that the application of add-on control technology would provide significantly higher emission reductions than the use of turbines with DLN derated below 10 MW. This is a result of the much higher emission control potential of SCR versus combustion modifications. The cost-effectiveness of SCR is also below the estimated cost-effectiveness of District Rule 69.2 ($7/lb) that established BARCT limits for NOx emissions from industrial and commercial boilers.

However, the application of add-on control technology to the replacement turbines will require a sizable capital investment and significant on-going annual operating costs. The additional cost of turbine derating resulting in the loss of power sales at times of peak power load demand and some heat rate penalty is comparatively low.

It is expected that this facility will choose to comply with Rule 69.3.1 limits by derating the 10.3 MW turbines to 9.9 MW because it is the most economically attractive option. The NOx emission reductions and the cost-effectiveness in this case as shown in Table 4 are 22.5 tons per year of NOx reduced and $2.2/lb, respectively.

It is also expected that during the two-year period before the rule's final implementation date, the facility will collect actual NOx emission concentration data. As discussed previously, the turbine manufacturer's test cell data show it is possible that the turbines will comply with the NOx emission limit (18 ppm on gaseous fuel) of Rule 69.3.1 for turbines rated at 10 MW and larger. If the limit (18 ppm) is achieved continuously during actual turbine operations, the derating will not be necessary. In this case, the expected NOx emission reductions will be approximately 56 tons per year without any additional costs to the facility beyond those associated with the turbine replacements.

In both cases, whether the 10.3 MW turbines equipped with the low NOx combustor are used with or without derating, compliance with Rule 69.3.1 emission control requirements will not have noticeable economic impacts on the affected facility.

7. CONCLUSIONS

Proposed Rule 69.3.1 will apply to 32 turbines in San Diego County. The majority of turbines (27) are already in compliance with all proposed rule requirements. Two turbines which would require modifications to comply with the rule are expected to be taken out of service and will not be replaced. The remaining three turbines at one facility that otherwise would require installation of add-on controls are planned to be replaced with larger turbines. Several control options available to these turbines to meet the rule requirements have been evaluated; none of them are likely to cause significant economic impacts. The cost-effectiveness of these control options is in a range between $2.2 and $5.9 per pound of NOx reduced, which is below the estimated cost-effectiveness of other currently adopted District rules regulating NOx emissions. Depending on the control option chosen by the facility, the expected NOx emission reduction from the one affected facility could range from 22.5 to 135 tons per year.

TABLE 4. SUMMARY OF THE CONTROL OPTIONS FOR PROPOSED REPLACEMENT TURBINES SUBJECT TO RULE 69.3.1

Turbine Description	Add-on Control Technology	Applicable Rule 69.3.1 limit, ppmv		NOx emission reductions, tons/year [1]	Total Capital Costs, $M	Total Annual Costs, $M/yr	Cost-effectiveness, $/lb NOx reduced
		Gas	Oil				
New 10.3 MW with DLN and add-on control	SCR	10.8	30	130	4.4	1.6	6.1
New 10.3 MW with WI and add-on control	SCR	9	25	135	5.3	1.8	6.6
New 10.3 MW with DLN derated to 9.9 MW	none	25	65	22.5	no additional costs	0.1	2.2
New 10.3 MW with DLN[2]	none	18	42	56	no additional cost	no additional cost	n/a

[1] Emission reductions are calculated compared to the District's 1997 Emission Inventory for this facility.

[2] This option assumes that the turbines will be able to comply with 18 ppm limit when operating on gaseous fuel.

REFERENCES

1. Letter from Bill Powers, Powers Engineering, to Ralph Ordonez, May 21, 1998.

2. "Kelco Sails in New Seas," San Diego Union, April 26, 1994, San Diego, California.

3. Monsanto Annual Report, 1997, p. 38.

4. Letter from Bill Powers, Powers Engineering, to Mike Lake, San Diego Air Pollution Control District, August 3, 1998.