

**Bay Area Air Quality Management District**

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**Permit Evaluation  
and  
Statement of Basis  
for  
RENEWAL of**

**MAJOR FACILITY REVIEW PERMIT**

for  
**Cardinal Cogen, Inc.**  
**Facility #A1629**

**Facility Address:**  
Campus and Jordan Way  
Palo Alto, CA 94305

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Application: 21629

October 5, 2012

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**A. Background**

This facility is subject to the Operating Permit requirements of Title V of the federal Clean Air Act, Part 70 of Title 40 of the Code of Federal Regulations (CFR), and BAAQMD Regulation 2, Rule 6, Major Facility Review because it is a major facility as defined by BAAQMD Regulation 2-6-212. It is a major facility because it has the “potential to emit” (as defined by BAAQMD Regulation 2-6-218) more than 100 tons per year of a regulated air pollutant. The pollutants that exceed the 100 tons per year threshold are NOx and CO.

Major Facility Operating permits (Title V permits) must meet specifications contained in 40 CFR Part 70 as contained in BAAQMD Regulation 2, Rule 6. The permits must contain all “applicable requirements” (as defined in BAAQMD Regulation 2-6-202), monitoring requirements, recordkeeping requirements, and reporting requirements. The permit holders must submit reports of all monitoring at least every six months and compliance certifications at least every year.

Pursuant to Regulation 2, Rule 6, section 416, the District has reviewed the terms and conditions of this Major Facility Review permit and determined that they are still valid and correct. This review included an analysis of applicability determinations for all sources, including those that have been modified or permitted since the issuance of the initial Major Facility Review Permit. The review also included an assessment of all monitoring in the permit for sufficiency to determine compliance.

In the Bay Area, state and District requirements are also applicable requirements and are included in the permit. These requirements can be federally enforceable or non-federally enforceable. All applicable requirements are contained in Sections I through VI of the permit.

Each facility in the Bay Area is assigned a facility identifier that consists of a letter and a 4-digit number. This identifier is also considered to be the identifier for the permit. The identifier for this facility is A1629.

This facility received its initial Title V permit in 1998. The first permit renewal was issued August 24, 2005. This application is for a second permit renewal. Although the current permit expired on August 23, 2010, it continues in force until the District takes final action on the permit renewal. The proposed permit shows all changes to the permit in ~~strikeout~~/underline format.

**B. Facility Description**

Cardinal Cogen is a cogeneration facility that produces steam, chilled water, and electricity that it sells to Stanford University, Stanford Medical Center and PG&E. The total electrical output of the facility is 49 MW and consists of 4 water-tube boilers, one gas turbine, one heat recovery steam generator with duct burners, one black start diesel engine and two diesel emergency generators.

There has been no significant change in emissions since the last permit renewal in 2005. The following table summarizes Total Stationary Source Emissions from the Renewal Applications.

Pollutant	Renewal Application 6648 (2002) tons/year	Renewal Application 21629 (2010) tons/year
CO	100.0	92.2
NOx	117.8	111
PM10	26.9	25.6
VOC	68.0	58.9
SO2	1.2	1.1
Benzene	N/A	0.0748
Formaldehyde	N/A	0.502
Diesel PM	N/A	0.0073

### C. Permit Content

The legal and factual basis for the permit follows. The permit sections are described in the order presented in the permit.

#### I. Standard Conditions

This section contains administrative requirements and conditions that apply to all facilities. If the Title IV (Acid Rain) requirements for certain fossil-fuel fired electrical generating facilities or the accidental release (40 CFR § 68) programs apply, the section will contain a standard condition pertaining to these programs. Many of these conditions derive from 40 CFR § 70.6, Permit Content, which dictates certain standard conditions that must be placed in the permit. The language that the District has developed for many of these requirements has been adopted into the BAAQMD Manual of Procedures, Volume II, Part 3, Section 4, and therefore must appear in the permit.

The standard conditions also contain references to BAAQMD Regulation 1 and Regulation 2. These are the District's General Provisions and Permitting rules.

#### Changes to permit:

The dates of adoption and approval of rules in Standard Condition 1.A Administrative Requirements have been updated.

The following language was added to Standard Condition I.B.1: This is the "application shield" pursuant to BAAQMD Regulation 2-6-407.

#### II. Equipment

This section of the permit lists all permitted or significant sources. Each source is identified by an S and a number (e.g., S24).

Permitted sources are those sources that require a BAAQMD operating permit pursuant to BAAQMD Rule 2-1-302.

Significant sources are those sources that have a potential to emit of more than 2 tons per year of a “regulated air pollutant” (as defined in BAAQMD Rule 2-6-222) or 400 pounds per year of a “hazardous air pollutant” (as defined in BAAQMD Rule 2-6-210).

All abatement (control) devices that control permitted or significant sources are listed. Each abatement device whose primary function is to reduce emissions is identified by an A and a number (e.g., A-24). If a source is also an abatement device, such as when an engine controls VOC emissions, it will be listed in the abatement device table but will have an “S” number. An abatement device may also be a source (such as a thermal oxidizer that burns fuel) of secondary emissions. If the primary function of a device is to control emissions, it is considered an abatement (or “A”) device. If the primary function of a device is a non-control function, the device is considered to be a source (or “S”). There are no abatement devices at this facility.

The equipment section is considered to be part of the facility description. It contains information that is necessary for applicability determinations, such as fuel types, contents or sizes of tanks, etc. This information is part of the factual basis of the permit.

Each of the permitted sources has previously been issued a permit to operate pursuant to the requirements of BAAQMD Regulation 2, Permits. These permits are issued in accordance with state law and the District’s regulations. The capacities in the permitted sources table are the maximum allowable capacities for each source, pursuant to Standard Condition I.J and Regulation 2-1-403.

There are no differences between the equipment list in the permit and the equipment list in the renewed Title V permit application.

Changes to permit:

1. The model number for S-6 Gas Turbine was changed from the generic MS-6001 to PG6531B as specified in the owner/operator and GE evaluation of the turbine history. The turbine capacity was updated as well, and the ISO rating was included for applicability clarification.
2. The capacities for S-9 and S-10 engines were corrected.

**III. Generally Applicable Requirements**

This section of the permit lists requirements that generally apply to all sources at a facility including insignificant sources and portable equipment that may not require a District permit. If a generally applicable requirement applies specifically to a source that is permitted or significant, the standard will also appear in Section IV and the monitoring for that requirement will appear in Sections IV and VII of the permit. Parts of this section apply to all facilities (e.g., particulate, architectural coating, odorous substance, and sandblasting standards). In addition, standards that apply to insignificant or unpermitted sources at a facility (e.g., refrigeration units that use more than 50 pounds of an ozone-depleting compound) are placed in this section.

Unpermitted sources are exempt from normal District permits pursuant to an exemption in BAAQMD Regulation 2, Rule 1. They may, however, be specifically described in a Title V permit if they are considered “significant sources” as defined in BAAQMD Rule 2-6-239.

Changes to permit:

1. Table III has been updated by adding the following rules and standards to conform to current practice:
  - BAAQMD Regulation 2, Rule 2, Permits, New Source Review
  - SIP Regulation 2, Rule 2, Permits, New Source Review
  - BAAQMD Regulation 2, Rule 4, Permits, Emissions Banking
  - SIP Regulation 2, Rule 4, Permits, Emissions Banking
  - BAAQMD Regulation 2, Rule 5, New Source Review of Toxic Air Contaminants
  - BAAQMD Regulation 2, Rule 6, Permits, Major Facility Review
  - SIP Regulation 2, Rule 6, Permits, Major Facility Review
  - BAAQMD Regulation 3, Fees
  - SIP Regulation 3, Fees
  - BAAQMD Regulation 6, Particulate Matter and Visible Emissions has been designated as SIP Regulation 6, since the rule has been renamed and renumbered as Regulation 6, Rule 1, Particulate Matter, General Provisions
  - SIP Regulation 8, Rule 2, Miscellaneous Operations
  - SIP Regulation 8, Rule 51, Adhesive and Sealant Products
  - BAAQMD Regulation 9, Rule 1, Inorganic Gaseous Pollutants - Sulfur Dioxide
  - California Health and Safety Code Section 93116 et seq., Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Rated at 50 Horsepower and Greater
  - 40 CFR Part 63, Subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines
  - 40 CFR Part 82, Subpart E, Protection of Stratospheric Ozone
2. The dates of adoption or approval of the rules and their “federal enforceability” status in Table III have also been updated.
3. Removed BAAQMD Regulation 8, Rule 40 and Rule 47 from the permit since the facility does not have any contaminated soil treatment operations.

**IV. Source-Specific Applicable Requirements**

This section of the permit lists the applicable requirements that apply to permitted or significant sources. These applicable requirements are contained in tables that pertain to one or more sources that have the same requirements. The order of the requirements is:

- District Rules
- SIP Rules (if any) are listed following the corresponding District rules. SIP rules are District rules that have been approved by EPA for inclusion in the California State Implementation Plan. SIP rules are “federally enforceable” and a “Y” (yes) indication will appear in the “Federally Enforceable” column. If the SIP rule is the current District rule, separate citation of the SIP rule is not necessary and the “Federally Enforceable” column will have a “Y” for “yes”. If the SIP rule is not the current District rule, the SIP rule or the necessary portion of

the SIP rule is cited separately after the District rule. The SIP portion will be federally enforceable; the non-SIP version will not be federally enforceable, unless EPA has approved it through another program.

- Other District requirements, such as the Manual of Procedures, as appropriate.
- Federal requirements (other than SIP provisions)
- BAAQMD permit conditions. The text of BAAQMD permit conditions is found in Section VI of the permit.
- Federal permit conditions. The text of Federal permit conditions, if any, is found in Section VI of the permit.

Section IV of the permit contains citations to all of the applicable requirements. The text of the requirements is found in the regulations, which are readily available on the District or EPA websites, or in the permit conditions, which are found in Section VI of the permit. All monitoring requirements are cited in Section IV. Section VII is a cross-reference between the limits and monitoring requirements. A discussion of monitoring is included in Section C.VII of this permit evaluation/statement of basis.

### Complex applicability determinations

#### Applicability of District and Federal Regulations to Boilers S-1, S-2, S-3 and S-4

##### A. District Regulations

The following boilers are operated at this facility:

Source	Description	Peak Capacity MMBtu/hr	Firing Rate Limit MMBtu/hr	Initial Date of Operation	Date of Modification
S-1	Bigelow Sterling FHC 30	> 100	99	1957	1994
S-2	Bigelow Sterling FHC 30	> 100	99	1957	1994
S-3	Bigelow Sterling FHC 30	> 100	99	1957	1994
S-4	Bigelow Sterling FHC 30	> 100	99	1965	1993

There are source records that indicate that one or more of Boilers S-1, S-2, S-3 and S-4 have the capacity to fire over 99MMBtu/hr. Currently permit conditions limit firing rates for all 4 boilers as a group, but there are no firing rate limits for each individual boiler. A permit condition revision will be included in this renewed permit that ensures S-1, S-2, S-3 and S-4 boilers are limited to 99MM BTU/hr.

The four boilers were the primary steam providers for Stanford University campus and hospital. They were initially designed as solid fuel boilers. Later they were modified to fire on natural gas, with backup liquid fuel provisions during natural gas curtailment events, and remained as the primary steam provider until the Cogen Project was commissioned in 1988. Once the Cogen

project was in operation, the four boilers were placed in cold standby service, operation to commence when the Cogen facility was out of service or operating at partial load. The change to backup operation generated on-site emissions credits that were used when permitting the Cogen facility. In 1993 and 1994, the boiler operation was changed from backup units to peaking units (only one boiler was expected to be required for peaking, but the permit was structured such that any one of the four boilers could be used for this peaking service).

S-1, S-2 and S-3 boilers were grandfathered sources first operated in 1957. In 1994, via Application 13962, S-1, S-2 and S-3 boilers were modified from backup operation to peaking operation and retrofitted with low-NO<sub>x</sub> burners and flue gas recirculation to comply with the BACT limit of 25ppm NO<sub>x</sub> @3%O<sub>2</sub>. The BACT for CO was determined to be 200ppm @3%O<sub>2</sub>. No emissions offsets were required (see S-4 below). In Application 13962, S-1, S-2 and S-3 boilers were determined to be in compliance with Regulation 9, Rule 7, Regulation 6 [now Regulation 6, Rule 1], and NSPS Subpart Dc.

S-4 boiler was a grandfathered sources first operated in 1965. In 1993, via Application 10471, S-4 boiler was modified from backup operation to peaking operation and retrofitted with low-NO<sub>x</sub> burners and flue gas recirculation to comply with the BACT limit of 25ppm NO<sub>x</sub> @3%O<sub>2</sub>. The BACT for CO was determined to be 200ppm @3%O<sub>2</sub>. Emissions offsets were required for the emissions increases associated with the change to peaking operation (since only one boiler was expected to be required for peaking operation, these offsets were allowed to cover the offsets for the flexibility to use S-1, S-2 and S-3 for peaking operation). In Application 10471, S-4 boiler was determined to be in compliance with Regulation 9, Rule 7, Regulation 6 [now Regulation 6, Rule 1], and NSPS Subpart Dc.

Boilers S-1, S-2, S-3 and S-4 are subject to Regulation 9, Rule 7. Regulation 9-7-307 is the Final Emission Standard. For boilers with a capacity over 75MMBtu/hr, the applicable emission standard is Regulation 9-7-307.6, which limits NO<sub>x</sub> and CO emissions to 5ppmvd and 400 ppmvd, both at 3% O<sub>2</sub>, respectively. Regulation 9-7-112 is a limited exemption for Regulation 9-7-307 based on low fuel usage. Boilers S-1, S-2, S-3 and S-4 are exempt from the emissions standard 9-7-307, pursuant to Regulation 9-7-112.2, as long as fuel usage is less than 10% of the annual maximum heat capacity. Cardinal Cogen has agreed to the following new permit condition that details the requirements of this limited exemption.

1. Beginning 1/1/12, the owner/operator shall operate the S-1 Boiler such that the heat input shall not exceed 867,240 therms in any consecutive 12-month period unless the boiler complies with the requirements of Part 7 below. (Basis: Regulation 9-7-112.2)
2. Beginning 1/1/12, the owner/operator shall operate the S-2 Boiler such that the heat input shall not exceed 867,240 therms in any consecutive 12-month period unless the boiler complies with the requirements of Part 7 below. (Basis: Regulation 9-7-112.2)
3. Beginning 1/1/12, the owner/operator shall operate the S-3 Boiler such that the heat input shall not exceed 867,240 therms in any consecutive 12-month period unless the boiler complies with the requirements of Part 7 below. (Basis: Regulation 9-7-112.2)



4. Beginning 1/1/12, the owner/operator shall operate the S-4 Boiler such that the heat input shall not exceed 867,240 therms in any consecutive 12-month period unless the boiler complies with the requirements of Part 7 below. (Basis: Regulation 9-7-112.2)
5. The owner/operator shall operate a non-resettable totalizing fuel meter or other APCO-approved monitoring method that demonstrates that Boilers S-1, S-2, S-3 and S-4 are operated at or below the heat input level limited by Parts 1, 2, 3 and 4. (Basis: Regulation 9-7-504.1)
6. The owner/operator shall maintain records of the fuel use data and the higher heating value of the fuel for each consecutive 12-month period. These records shall be retained for a period of 5 years from the date the record is made, and shall be made accessible to District staff upon request. (Basis: Regulation 9-7-504.2)
7. If the boiler heat input limits of Part 1, 2, 3 or 4 are exceeded, the owner/operator shall comply with the following emission limits (corrected to 3% Oxygen) within 24 months of the heat input exceedance:  
NOx: 5 ppmv  
CO: 400 ppmv  
(Basis: Regulations 9-7-112, 9-7-307.6)
8. If the owner/operator fails to maintain records to allow verification of fuel usage, then the owner/operator shall have the burden of proof to establish eligibility for the low fuel usage exemption described in these Parts 1 through 7.  
(Basis: Regulations 9-7-112, 9-7-307.6, 9-7-504)

## **B. NSPS**

Boilers S-1, S-2, S-3 and S-4 are potentially subject to NSPS Subpart Dc Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units because they have a capacity between 10MMBtu/hr and 100MMBtu/hr and were modified after June 9, 1989. However, for the purposes of NSPS, the definition of a modified source contained in 60.14 is used. EPA has used an hourly potential emissions basis for determining if emissions are increased (Re: US Environmental Protection Agency Applicability Determination Index Control Numbers 9700031, 9700157 and 9800056). Since the hourly firing rate of each boiler was 99MMBtu/hr while in cold standby service and the hourly firing rate of each boiler was 99MMBtu/hr while in peaker service, there is no increase in emissions. Therefore, even though the change to peaker service was a modification according to Regulation 2-1-234, for NSPS applicability the change to peaker service is not a modification pursuant to 40 CFR 60.14(a). Therefore, the boilers are not subject to Subpart Dc.

## **C. NESHAPs and MACT**

This facility is not a major source of HAPS. Therefore, it is an area source of HAPS. Boilers S-1, S-2, S-3 and S-4 are potentially subject 40 CFR 63, Subpart JJJJJ, National Emission

Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources. However, Boilers S-1, S-2, S-3 and S-4 are exempt from Subpart JJJJJ, pursuant to 63.11195(e), because they are gas-fired boilers as defined in 63.11237.

### **Applicability of District and Federal Regulations to Combined Cycle Gas Turbine S-6**

S-6 is a combined cycle gas turbine that drives an electrical generator and generates steam with a Heat Recovery Steam Generator (HSRG). A portion of the steam generated fulfills the requirements of Stanford University and the Stanford Medical Center, and the remaining drives a steam turbine electrical generator for additional electrical power generation (hence the term "Cogeneration"). The electrical power that is not used by Stanford is exported to the PG&E grid. The original design of the Cogeneration system provided more than half of the electrical power to PG&E. S-6 is limited to PUC quality Natural Gas fuel by permit condition.

S-6 Gas Turbine was initially permitted in 1983 with the initial Authority to Construct being granted in June, 1983 via Application 28741. The initial Permit to Operate for S-6 was granted August 15, 1988 via Application 30455. The initial Permit to Operate was for a "Gas Turbine, GE Frame 6 with steam injection, 462MMBtu/hr". The emission calculations in Application 28741 were based on 462MMBtu/hr (HHV). Application 30455 amended Application 28741 without any increase in the firing capacity and no change in emissions.

Gas Turbines are precision manufactured severe duty rotating equipment. Consequently, Gas Turbines need proscribed equipment inspections and when these so indicate, require comprehensive periodic overhauls to maintain reliability. In addition, Gas Turbine technology has advanced over the operation of S-6. Therefore, Gas Turbine overhauls are seldom, if ever, a replacement-in-kind maintenance event. When GE provides the necessary materials for a Gas Turbine overhaul, the parts often are provided with the latest alloy advancements and advanced machining tolerances. GE refers to these advances as "Uprates" that are promoted to increase output and reduce heat rate. In the GE White Paper "Uprate Options for the MS6001 Heavy-Duty Gas Turbine" (GER-4217B dated June 2010), authors Timothy Ginter and Olivier Crabos identify major Frame 6 Uprates in 1995, 1997 and 1999, primarily employing advances in materials to allow higher operating temperatures.

S-6 Gas Turbine is designed for 24000 hours of operation between recommended inspection and maintenance activities. This duration is predicated on the gas turbine being operated at "Base Load" conditions. Gas turbines can operate above base load conditions, but this operation will reduce the duration between recommended inspection and maintenance activities. Gas turbine manufacturers rate a turbine at "Peak Load" operation, where the turbine fires higher such that the driven equipment produces more output. However, peak loads are not recommended for extended periods and for S-6, one hour of peak load operation is considered to have the equivalent effect of 6 hours of base load operation with regards to hot gas path maintenance planning. For this reason, base load operation is considered to be the continuous rating used to determine the Power Output Rating for the gas turbine as defined in Regulation 9-9-214.

One of the functions in a gas turbine is to compress the inlet air to the pressures required for the combustors that burn the fuel. The combustors generate the energy that drives the combustion

gas turbine, which provides the power for both the air compressor and the power for the gas turbine service. On cold days, when the inlet combustion air is denser, there is more oxygen mass available for the combustion, and the gas turbine is capable of firing at higher heat input rates. When S-6 was initially installed in the 80's, Frame 6 Gas Turbine performance was limited by operating temperatures, largely by the metallurgy in the hot gas path. As a consequence, even on cold days, the increased heat input was limited due to the metallurgy in the hot gas path. However, as upgraded metallurgy was installed in the hot gas path, the operating temperature limitations diminished, and increases in input heat rates became more significant.

In the early days of the life of S-6 Gas Turbine, permit applications were addressed by not allowing any increases in input heat rate. This strategy was justifiable to ensure BACT was not triggered. 1984 Application 30455 was the first S-6 application that incorporated gas turbine design improvements. In the engineering evaluation for this application, emphasis was made that updating the Authority to Construct to reflect these design improvements was to occur without an increase in the firing capacity of the gas turbine. In 1995 Application 25191 that retro-fitted S-6 with dry low-NOx combustors to comply with the Requirements of Regulation 9, Rule 9, the rated heat input given in the S-6 source description was not increased to ensure that BACT was not triggered. All emission calculations, including those for granting emission credits, were based on the maximum firing rate. The Permit to Operate granted 6/26/1997 via Application 25191, was for the following equipment:

S-6, Gas Turbine, General Electric MS-6001, 464 MMBTU/hour maximum firing rate, equipped with a General Electric DLN Combustor System

As a point of clarification, it should be noted that correspondence in the Application 25191 file indicated the originally permitted 462MMBtu/hr was a typographical error and the correct maximum firing rate is 464MMBtu/hr (reference: July 21, 1995 letter from William H. Buchan, Program Area Manager, Geraghty and Miller, Inc, on behalf of Cardinal Cogen, to Barry G. Young, Supervising Air Quality Engineer, BAAQMD). The 464MMBtu/hr is consistent with the maximum firing rate and the maximum fuel usage specification included in the 2/6/95 Source Data Form C completed by Geraghty and Miller and submitted for Application 25191.

In preparation for the renewal of this Title V permit, extensive research was completed to determine what gas turbine was initially installed, what the design criteria was for the original gas turbine, and if and when the gas turbine was altered or modified. District records contained owner/operator correspondence that indicated conflicting information. On May 3, 2012, the results of the GE evaluation was transmitted to the District. The results of the May 1, 2012 GE Cycle Deck turbine performance simulator are shown in the following tables.

Case #	1	2	3	4	5	6	7
Model	6531B	6531B	6531B	6531B	6531B	6531B	6531B
RPM	5106	5106	5106	5106	5106	5106	5106
Conversions, Modifications and Uprates	None				Dry Low NOx Combustors 1.0, IGV 86 deg, 6541 HGP hardware		
Condition	ISO	ISO	30 F and 78% RH	30 F and 78% RH	ISO	ISO	30 F and 78% RH
Operating Mode	Baseload	Peak	Baseload	Peak	Baseload	Peak	Baseload

Additional Operating Notes	NOx control	NOx control	NOx control	NOx control		Power Augmentation	
Steam Injection Rate, % airflow	2%	2%	2%	2%	0%	2%	0%
Ambient Temperature, F	59	59	30	30	59	59	30
Ambient Relative Humidity, %	60%	60%	78%	78%	60%	60%	78%
Firing Rate (LHV), MMBTU/hr	444.9	451.2	480.0	494.8	440.9	465.8	476.0
Firing Rate (HHV), MMBTU/hr	493.7	500.7	532.7	549.1	489.3	517.0	528.2

The findings and conclusions from this evaluation are as follows:

1. The worst case ambient operating temperature was increased from 22F to 30F, because GE and Cardinal confirmed that 30F is the lowest ambient at which the turbine can be operated due to concerns about icing (previous design criteria used the 22F);
2. The correct turbine model number from the 1987 installation is PG6531B;
3. The DLN uprate caused the GE Cycle Deck nomenclature to change from Model PG6531B to Model PG6541 due to hot gas path (“HGP”) hardware changes;
4. Previous Cycle Deck runs incorrectly assumed that there was an uprate to the turbine gearbox as part of the 1995 Dry Low NOx Combustors project Application 25191 that changed the turbine shaft speed, but Cardinal and GE have since confirmed that no gear box uprate was performed and the shaft speed remains at the original design level (5106 RPM);
5. The maximum turbine peak firing rate at 30F based on the original PG6531B turbine design is 549.1 MMBtu/hr (Case #4);
6. This 549.1 MMBtu/hr firing rate should be listed in the permit as the maximum firing rate because the current turbine will not exceed this original design firing level and Cardinal has no data showing an exceedance of this original design maximum firing rate;
7. This 549 MMBtu/hr firing rate is comparable to the 555 MMBtu/hr reported previously for this turbine, and Cardinal does not know the precise origin of the 555 MMBtu/hr value but the most likely explanation is different ambient condition assumptions or different steam injection rates;
8. The Dry Low NOx Combustors uprate project actually resulted in a decreased turbine firing rate for comparable operating scenarios since the steam for NOx control was not necessary after the Dry Low NOx Combustors project (Compare Cases 1 and 5, for example, where turbine firing at base load and ISO conditions decreased from 493.7 to 489.3 MMBtu/hr after the Dry Low NOx Combustors upgrade);
9. Regarding Rule 9-9 applicability, Cases 1 and 5 also demonstrate that the turbine was originally rated at less than 500 MMBtu/hr at base load continuous operation and ISO conditions, without power augmentation, and that the current turbine configuration is also rated at less than 500 MMBtu/hr under those same conditions;
10. Since the Dry Low NOx Combustors upgrade, steam is now used for power augmentation during peak firing operating scenarios, typically during the summer months when ambient temperatures are higher;

11. These peak firing, power augmentation operating scenarios do not exceed 549.1 MMBtu/hr;
12. All work on the turbine other than the Dry Low NO<sub>x</sub> Combustors upgrade qualifies as routine maintenance, repair, or replacement as evidenced by Cardinal accepting the original plant firing limit of 549.1 MMBtu/hr.
13. It is unclear where the original gas turbine firing rate specification of 462MMBTU/hr (later 464MMBTU/hr) originated, but it appears to have been based on the lower heating value (LHV) of the fuel gas.

The full 5/1/2012 GE evaluation, including the details of the assumptions and conditions of the analysis, is included in Appendix B.

#### ***A. District Regulations***

S-6 is subject to Regulation 9, Rule 9, Nitrogen Oxides from Stationary Gas Turbines. The NO<sub>x</sub> emission standard for S-6 is contained in Regulation 9-9-301.2 and is based on fuel type and Heat Input Rating. For Gas Turbines with Turbine Heat Input Rating greater than 250 but less than 500MMBtu/hr firing natural gas, the NO<sub>x</sub> emissions are less than either 0.43 lbs/MW<sub>hr</sub> or 9 ppmv corrected to 15% O<sub>2</sub>, dry basis.

S-6 complies with the 9 ppmv NO<sub>x</sub> standard without modification. Therefore, the compliance schedule detailed in Regulation 9-9-402 does not apply.

Regulation 9-9-206 defines the Heat Input Rating as follows:

**9-9-206 Heat Input Rating:** The heat input requirement (based on fuel HHV) of a gas turbine at its International Standards Organization (ISO) 3977 nameplate rated power output at standard conditions of 1 atmosphere, 15° Centigrade, and 60% atmospheric humidity.

Cardinal Cogen has demonstrated with the recent GE analysis that the ISO rating for S-6 is below 500MMBtu/hr. This determination is based on the ISO rating of S-6 being below 500MMBtu/hr.

#### ***B. NSPS***

S-6 is subject to 40 CFR 60 Subpart GG because S-6 has a heat input at peak load greater than 10MMBtu/hr (LHV) and was constructed after October 3, 1977. Furthermore, S-6 was constructed for the purpose of supplying more than one-third of its potential electric output to PG&E, therefore S-6 is considered a Electric Utility Stationary Gas Turbine as defined in 40 CFR 60.331.

Subpart GG has emission standards for NO<sub>x</sub> and SO<sub>2</sub>. The NO<sub>x</sub> standard for Electric Utility Stationary Gas Turbines is 60.332(a)(1) as determined by 60.332(b). The SO<sub>2</sub> standard is contained in either 60.333(a) 0.015% by volume at 15% O<sub>2</sub> dry basis or the fuel sulfur content shall not exceed 0.8 % by weight (8000 ppmw).

#### ***C. NESHAPs and MACT***

S-6 is not subject to 40 CFR 63 Subpart YYYYY, National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines, pursuant to 63.6080, because this facility is not a Major Source of HAPS.

### **Applicability of District and Federal Regulations to Gas Turbine Duct Burner S-8**

S-8 Duct Burner has a rated capacity of 124MMBtu/hr, and is designed to provide additional capacity to the Gas Turbine Heat Recovery Steam Generator, an integral part of S-6 Combined Cycle Gas Turbine. S-8 was installed via Application 14748 in 1995 and replaced original Duct Burner S-7. S-8 is limited to PUC Quality Natural Gas fuel by permit condition.

#### **A. District Regulations**

S-8 is not subject to Regulation 9, Rule 7, Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional and Commercial Boilers, Steam Generators and Process Heaters, pursuant to Regulation 9-7-110.5:

- 9-7-110 Exemptions:** The requirements of this rule shall not apply to the following:
- 110.5 Waste heat recovery boilers that are used to recover sensible heat from the exhaust of combustion turbines or reciprocating internal combustion engines;

Since S-8 is in the exhaust section of S-6 Gas Turbine, it is subject to the optional energy-based (lb/MWhr) emission standards of Regulation 9, Rule 9, Nitrogen Oxides from Stationary Gas Turbines. However, S-8 is not subject to the concentration-based NOx emission limits in Reg 9-9 because, pursuant to Regulation 1-107, Combination of Emissions, because there are “adequate and reliable means to establish the nature, extent and quantity of emission from each source.” This is accomplished through the installation of a NOx CEMS after the S-6 turbine but before the S-8 Duct Burners. The requirements of S-6 are shown in Table IV-B. The only requirement for S-8 in Regulation 9, Rule 9 is the optional energy-based (lb/MWhr) NOx Emission Standard in Regulation 9-9-301.2 and the associated Regulation 9-9-501 that requires monitoring and recording of S-8 fuel consumption if the facility chooses to meet the optional lb/MWhr standard. S-8 is subject to Regulation 6, Rule 1, Particulate Matter; General Requirements, and Regulation 9, Rule 1, Inorganic Gaseous Pollutants - Sulfur Dioxide.

#### **B. NSPS**

S-8 is subject to 40 CFR 60, Subpart Db, Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units, because it was constructed after June 19, 1984 and S-8 has a heat input capacity above 100MMBtu/hr. S-8 is not subject to 40 CFR 60 Subpart GG, Standards of Performance for Stationary Gas Turbines. S-8 is not subject to 40 CFR 60, Subpart KKKK, Standards of Performance for Stationary Combustion Turbines, because it was not constructed, modified, or reconstructed after to February 18, 2005.

The Subpart Db sulfur standard S-8 is contained in 60.42b. However, the only standard for natural gas firing is 60.42b(k)(1) but this standard does not apply to S-8 because construction, reconstruction or modification did not occur after February 28, 2005. The Subpart Db particulate matter standard is contained in 60.43b. However, there is no particulate matter standard in 60.43b for natural gas fuel. The Subpart Db NOx standard is contained in 60.44b. 60.44b(a)(4) specifies the NOx limit for duct burners at 0.20 lb NOx per MMBtu expressed as NO2. 60.44b(h) and (i) states that this NOx standard applies at all times, including periods of startup, shutdown and malfunction, based on a 30-day rolling average. 60.44b(j) allows a 3-hr average basis for performance tests for natural gas fuel.

### **C. NESHAPs and MACT**

This facility is not a major source of HAPS. Therefore, it is an area source of HAPS. S-8 Duct Burner is potentially subject 40 CFR 63, Subpart JJJJJ, National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources. However, S-8 is exempt from Subpart JJJJJ, pursuant to 63.11195(e), because S-8 is a gas-fired boiler as defined in 63.11237.

#### **Applicability of State and Federal Regulations to Engines S-9, S-10 and S-11.**

This facility operates 3 sources that are Diesel engines. In addition to the District regulations applicable to these sources (Regulation 6, Rule 1 -- Particulate Matter, General Requirements, Regulation 9, Rule 1 - Inorganic Gaseous Pollutants - Sulfur Dioxide, and Regulation 9, Rule 8 - Inorganic Gaseous Pollutants, NOx and CO from Stationary IC Engines), the following state and federal regulations are potentially applicable to any stationary compression ignition engine at this facility:

- California Air Resource Board (CARB) Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines -- CCR, Title 17, Section 93115.
- NSPS for Stationary Compression Ignition Internal Combustion Engines, 40 CFR 60 Subpart III.
- NESHAPS for Stationary Reciprocating Internal Combustion Engines, 40 CFR 63 Subpart ZZZZ

These engines are referred to in several ways: IC engines or ICE (Internal Combustion, which also includes spark ignited engines), CI engines (Compression Ignition - Diesel fuel specific), and RICE (Reciprocating Internal Combustion Engines, also includes spark ignition engines). The applicability of these regulations and the requirements for each engine depend on the type of facility (major source or area source), the year the source was placed in service, the model year of the engine, the power rating of the engine and the displacement of the engine. The following table summarizes the pertinent data for the engines at this facility based on the District records. All of the engines were initially exempt from permitting when placed in service. Since the initial

operation, owner/operators of engines with power ratings equal to or greater than 50 HP, that were brought on site before September 1, 2001, lost their exemption from permitting. These engines are referred to Loss of Exemption (LOE) engines.

**Cardinal Cogen A1629 Diesel Engine Summary**

<b>Source</b>	<b>HP</b>	<b>Year Placed in Service</b>	<b>Displacement cu in</b>	<b>Engine Model Year</b>
9	750	1987	852	1987
10	1818	1997	2646	1997
11	349	1998	524	1998

**A. ATCM.**

Since the issuance of the initial Title V permit, the California Air Resource Board (CARB) adopted and amended an Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines (<http://www.arb.ca.gov/diesel/documents/FinalReg2011.pdf>). The non-federally enforceable requirements of the ATCM apply to all engines greater than 50 bhp and have been included in this Title V renewal permit. The emission standards applicable to the engines at this facility depend on whether the engine is a prime or emergency standby engine, whether the engine drives fire pump (a pump that provides emergency firewater), and whether the source is a new or in-use engine.

Pursuant to § 93115.4(30), S-9 Turbine Starter does not qualify as an Emergency Use engine and per § 93115.4(58) is therefore a Prime engine. S-10 and S-11 are Emergency Standby engines. None of the engines at this facility are fire pumps. Therefore, the applicable standards for S-9 are contained in § 93115.7 ATCM for Stationary CI Engines – Stationary Prime Diesel-Fueled CI

Engine (>50 bhp) Emission Standards and the applicable standards for S-10 and S-11 are contained in § 93115.6 ATCM for Stationary CI Engines – Emergency Standby Diesel-Fueled CI Engine (>50 bhp) Operating Requirements and Emission Standards.

A new engine is defined in § 93115.4(50) as one that was installed after January 1, 2005. Therefore, all engines at this facility are in-use engines. The applicable standards for the in-use engines are contained in § 93115.7(b) for S-9 and in § 93115.6(b) for S-10 and S-11. S-9 may qualify for the exemption from § 93115.7(b)(1) allowed by § 93115.3(j), Request for Exemption for Low-Use Prime Engines Outside of School Boundaries. Cardinal Cogen has submitted Application 24546 to obtain the written approval for this exemption and this application was approved July 24, 2012.

The S-9 requirements for prime engines are included in § 93115.7(b). For Diesel PM emissions, S-9 is exempt from § 93115.7(b)(1) pursuant to in § 93115.3(j) once the written approval was granted 7/24/2012. Until that time, here are three options for engines that are not certified.

- (A) Option 1: Reduce the diesel PM emission rate by at least 85 percent, by weight, from the baseline level, in accordance with the appropriate compliance schedule specified in sections 93115.11 and



93115.12;

(B) Option 2: Emit diesel PM at a rate less than or equal to 0.01 g/bhp-hr in accordance with the appropriate compliance schedule as specified in sections 93115.11 and 93115.12;

(C) Option 3: Reduce the diesel PM emission rate by at least 30% from the baseline level, by no later than January 1, 2006, and emit diesel PM at a rate of 0.01 g/bhp-hr or less by no later than July 1, 2011.

For other pollutants, the standards are contained in § 93115.7(b)(2):

(A) Meet the applicable HC, NO<sub>x</sub>, NMHC+NO<sub>x</sub>, and CO standards for off-road engines of the same model year and maximum rated power as specified in the Off-Road Compression Ignition Engine Standards (title 13, CCR, section 2423). If no standards have been established for an off-road engine of the same model year and maximum rated power as the in-use stationary prime diesel-fueled CI engine, then the in-use stationary prime diesel-fueled CI engine shall meet the Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power, irrespective of the new stationary emergency standby diesel-fueled CI engine's model year; or

(B) Not increase CO emission rates by more than 10% above baseline; and  
Not increase HC or NO<sub>x</sub> emission rates by more than 10% above baseline, or  
Not increase the sum of NMHC and NO<sub>x</sub> emission rates above baseline.

The § 93115.7(b)(1) requirements above will not apply to S-9 effective 7/24/2012 when the permit application for the § 93115.3(j) exemption was approved.

The requirements for S-10 and S-11 in-use emergency standby engines at this facility are included in § 93115.6(b). In-use engine emission standards limit the engine operation depending on the Diesel PM emissions. Table 2 of the ATCM summarizes the requirements of § 93115.6(b)(3):

Table 2: Summary of the Emission Standards and Operating Requirements for In-Use Stationary Emergency Standby Diesel-Fueled CI Engines > 50 BHP (See section 93115.6(b)(3))				
Diesel PM				Other Pollutants
Diesel PM Standards (g/bhp-hr)	Maximum Allowable Annual Hours of Operation for Engines Meeting Diesel PM Standards			HC, NOx, NMHC+NOx, and CO Standards (g/bhp-hr)
	Emergency Use	Non-Emergency Use		
		Emission Testing to show compliance <sup>1</sup>	Maintenance & Testing (hours/year)	
>0.40 <sup>2</sup>	Not Limited by ATCM <sup>2</sup>	Not Limited by ATCM <sup>2</sup>	20	Not limited by ATCM <sup>2</sup>
>0.15 and ≤0.40	Not Limited by ATCM <sup>2</sup>	Not Limited by ATCM <sup>2</sup>	21 to 30	For engines with emission control strategies not verified through the verification procedure: Off-Road CI Engine Certification Standards for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard, or Tier 1 standards. <sup>3</sup>
>0.01 and ≤0.15	Not Limited by ATCM <sup>2</sup>	Not Limited by ATCM <sup>2</sup>	31 to 50 (Upon approval by the District)	
≤0.01	Not Limited by ATCM <sup>2</sup>	Not Limited by ATCM <sup>2</sup>	51 to 100 (Upon approval by the District)	

1. Emission testing limited to testing to show compliance with section 93115.6(b)(3).
2. May be subject to emission or operational restrictions as defined in current applicable district rules, regulations, or policies.
3. The option to comply with the Tier 1 standards is available only if no off-road engine certification standards have been established for an off-road engine of the same model year and maximum rated power as the new stationary emergency standby diesel-fueled CI engine.

The in-use engines at this facility comply with these standards because each engine is subject to a permit condition that limits non-emergency operation.

## B. NSPS.

40 CFR 60 Subpart IIII applies to all owners/operators of CI ICE that commenced construction after July 11, 2005 where the engine was manufactured after April 1, 2005 and are not fire pump engines [60.4200(a)(2)(i)] or are manufactured as certified NFPA fire pump engines after July 1, 2006 [60.4200(a)(2)(ii)].

All of the engines at this facility commenced construction before 2005, therefore, NSPS Subpart IIII does not apply.

### C. NESHAPS

40CFR63 Subpart ZZZZ applies to any RICE (Reciprocating Internal Combustion Engines ) in a major or area source of HAP emissions. According to the emission calculations submitted for this Title V permit renewal, this facility is not a major source of HAPS, so according to § 63.6585(c), this facility is an area source of HAPS. For an area source, existing engines are those that commenced construction before June 12, 2006 [§ 63.6590(a)(1)(iii)] and new engines are those that commenced construction after June 12, 2006 [§ 63.6590(a)(2)(iii)].

All engines at this facility are existing engines.

All existing emergency engines are potentially not subject to the requirements of Subpart ZZZZ pursuant to §63.6590(b)(3)(vii):

§ 63.6590 What parts of my plant does this subpart cover?

(b) Stationary RICE subject to limited requirements.

(3) The following stationary RICE do not have to meet the requirements of this subpart and of subpart A of this part, including initial notification requirements:

(vii) Existing commercial emergency stationary RICE located at an area source of HAP emissions; or

However, the EPA August 9, 2010 Memorandum entitled "Guidance Regarding Definition of Residential, Commercial, and Institutional Emergency Stationary RICE in the NESHAP for Stationary RICE" does not list the engines at this facility as commercial. Therefore, pursuant to 63.6595(a), the applicable emission limitations are effective October 19, 2013.

According to the definitions in 63.6675, S-9 is a "black start" engine and S-10 and S-11 are "Emergency Stationary RICE":

§ 63.6675 What definitions apply to this subpart?

Terms used in this subpart are defined in the Clean Air Act (CAA); in 40 CFR 63.2, the General Provisions of this part; and in this section as follows:

*Black start engine* means an engine whose only purpose is to start up a combustion turbine.

*Emergency stationary RICE* means any stationary internal combustion engine whose operation is limited to emergency situations and required testing and maintenance. Examples include stationary RICE used to produce power for critical networks or equipment (including power supplied to portions of a facility) when electric power from the local utility (or the normal power source, if the facility runs on its own power production) is interrupted, or stationary RICE used to pump water in the case of fire or flood, etc. Stationary RICE used for peak shaving are not considered emergency stationary RICE. Stationary RICE used to supply power to an electric grid or that supply non-emergency power as part of a financial arrangement with another entity are not considered to be emergency engines, except as permitted under §63.6640(f). All emergency stationary RICE must comply with the requirements specified in §63.6640(f) in order to be considered emergency stationary RICE. If the engine does not

comply with the requirements specified in §63.6640(f), then it is not considered to be an emergency stationary RICE under this subpart.

The emission limitations and operating limitations for S-9, S-10 and S-11 are detailed in 63.6603(a):

§ 63.6603 What emission limitations and operating limitations must I meet if I own or operate an existing stationary RICE located at an area source of HAP emissions? Compliance with the numerical emission limitations established in this subpart is based on the results of testing the average of three 1-hour runs using the testing requirements and procedures in §63.6620 and Table 4 to this subpart.

(a) If you own or operate an existing stationary RICE located at an area source of HAP emissions, you must comply with the requirements in Table 2d to this subpart and the operating limitations in Table 1b and Table 2b to this subpart that apply to you.

For S-9, S-10 and S-11, the requirements are indicated in ZZZZ Table 2d Part 4:

Table 2d Part 4. Emergency stationary CI RICE and black start stationary CI RICE.

- a. Change oil and filter every 500 hours of operation or annually, whichever comes first;
- b. Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first; and
- c. Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.

63.6625(i) allows the oil change frequency required by Part 4a to be based on an oil analysis program.

Furthermore, as indicated in the definition of Emergency Stationary RICE shown above, S-10, 1818 HP, and S-11, 349 HP are subject to the requirements of 63.6640(f). S-10 and S-11 are subject to 63.6640(f)(1):

(f) Requirements for emergency stationary RICE.

(1) If you own or operate an existing emergency stationary RICE with a site rating of less than or equal to 500 brake HP located at a major source of HAP emissions, a new or reconstructed emergency stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions that was installed on or after June 12, 2006, or an existing emergency stationary RICE located at an area source of HAP emissions, you must operate the emergency stationary RICE according to the requirements in paragraphs (f)(1)(i) through (iii) of this section. Any operation other than emergency operation, maintenance and testing, and operation in non-emergency situations for 50 hours per year, as described in paragraphs (f)(1)(i) through (iii) of this section, is prohibited. If you do not operate the engine according to the requirements in paragraphs (f)(1)(i) through (iii) of this section, the engine will not be considered an emergency engine under this subpart and will need to meet all requirements for non-emergency engines.

- (i) There is no time limit on the use of emergency stationary RICE in emergency situations.
- (ii) You may operate your emergency stationary RICE for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by Federal, State or local government, the manufacturer, the vendor, or the insurance company associated with the engine. Maintenance checks and readiness testing of such units is limited to 100 hours per year. The owner or operator may petition the Administrator for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the owner or operator maintains records indicating that Federal, State, or local standards require maintenance and testing of emergency RICE beyond 100 hours per year.
- (iii) You may operate your emergency stationary RICE up to 50 hours per year in non-emergency situations, but those 50 hours are counted towards the 100 hours per year provided for maintenance and testing. The 50 hours per year for non-emergency situations cannot be used for peak shaving or to generate income for a facility to supply power to an electric grid or otherwise supply power as part of a financial arrangement with another entity; except that owners and operators may operate the emergency engine for a maximum of 15 hours per year as part of a demand response program if the regional transmission organization or equivalent balancing authority and transmission operator has determined there are emergency conditions that could lead to a potential electrical blackout, such as unusually low frequency, equipment overload, capacity or energy deficiency, or unacceptable voltage level. The engine may not be operated for more than 30 minutes prior to the time when the emergency condition is expected to occur, and the engine operation must be terminated immediately after the facility is notified that the emergency condition is no longer imminent. The 15 hours per year of demand response operation are counted as part of the 50 hours of operation per year provided for non-emergency situations. The supply of emergency power to another entity or entities pursuant to financial arrangement is not limited by this paragraph (f)(1)(iii), as long as the power provided by the financial arrangement is limited to emergency power.

The following table summarizes the applicable requirements for the engines at this facility.

**Cardinal Cogen A1629 Diesel Engine Regulatory Summary**

Source	BAAQMD Reg 6 Rule 1 Reg 9 Rule 1 Reg 9 Rule 8	ATCM	NSPS 40CFR60 Subpart III	NESHAPS 40CFR63 Subpart ZZZZ	Existing Permit Condition and Non-Emergency Hours Limit
9	Yes	Yes, In-Use Prime	No	Yes	21844-2 200hrs
10	Yes	Yes, In-Use Emergency	No	Yes	19698-2 100hrs

Source	BAAQMD Reg 6 Rule 1 Reg 9 Rule 1 Reg 9 Rule 8	ATCM	NSPS 40CFR60 Subpart III	NESHAPS 40CFR63 Subpart ZZZZ	Existing Permit Condition and Non-Emergency Hours Limit
11	Yes	Yes, In-Use Emergency	No	Yes	19698-2 100hrs

The following table summarizes the actual emissions and compliance for the engines at this facility.

**Cardinal Cogen A1629 Diesel Engine Compliance Summary**

Standards, g/hp-hr						
Pollutant	NOx	Organic	NMHC + NOx	CO	PM	Comments Reference
Tier 1 600>=HP<=750	6.90	1.0	N/A	8.5	0.40	
Tier 4 Interim 600>=HP<=750	0.30	0.14	N/A	N/A	0.01	
Tier 4 Final 600>=HP<=750	0.30	0.14	N/A	N/A	0.01	
BACT (effective 12/22/2010)	95% of NMHC + NOx *	5% of NMHC + NOx *	3.0 (4.8 for HP > 750)	2.6 (3.7 for HP < 175)	0.15	

**Cardinal Cogen A1629 Diesel Engine Compliance Summary**

Pollutant	NOx	Organic	NMHC + NOx	CO	PM	Comments Reference
<b>Source</b>	<b>Actual Emissions, g/hp-hr</b>					
9	22.43	0.36	22.79	1.56	0.35	LOE
10	9.90	0.15	10.05	2.81	0.42	LOE
11	5.34	0.20	5.54	1.34	0.22	LOE

Based on the evaluation above, the following changes will be incorporated into the permit:

S-9, Turbine Starter Engine, 750 HP: Based on the final disposition of Application 24546, impose Condition 25295 that limits operation to 20 hours annually.

S-10, Emergency Generator, 1818 HP: Impose Condition 22820 that limits non-emergency operation to 20 hours annually (subject to approval of new emissions data in an upcoming permit application).

S-11, Emergency Generator, 349 HP: Impose Condition 22830 that limits non-emergency operation to 30 hours annually.

The renewed permit includes Condition 22820, Condition 22830 and Condition 25295 as an applicable requirement for these In-use engines.

**Compliance Assurance Monitoring (CAM) 40 CFR 64.**

The Compliance Assurance Monitoring (CAM) regulation in 40 CFR 64 was developed to provide assurance that facilities comply with applicable emissions limitations by adequately monitoring control devices. The CAM rule was effective on November 21, 1997. However, most facilities are not affected by CAM requirements until they submit applications for Title V permit renewal.

CAM applies to a source of criteria pollutant or hazardous air pollutant (HAP) emissions if all the following requirements are met:

- The source is located at a major source for which a Title V permit is required; and
- The source is subject to a federally enforceable emission limitation or standard for a criteria pollutant or HAP; and
- The source uses a control device to comply with the federally enforceable emission limitation or standard; and
- The source has potential pre-control emissions of the regulated pollutant that are equal to or greater than the major source threshold for the pollutant (in BAAQMD, the major source thresholds are 100 tons per year for each criteria pollutant, 10 tons per year for a single HAP, and 25 tons per year for two or more HAPs); and
- The source is not otherwise exempt from CAM.

For this facility, CAM does not apply because there are no control devices used to comply with any limit or standard.

**Acid Rain 40 CFR 72-78.**

Acid Rain section 72.6(b)(5) exempts a “qualifying facility” with a “qualifying power purchase commitment” from the Acid Rain regulations.

Per section 72.2, Qualifying facility (QF) means a “qualifying small power production facility” within the meaning of section 3(17)(C) of the Federal Power Act (FPA) or a “qualifying cogeneration facility” within the meaning of section 3(18)(B) of the Federal Power Act.

**FPA Section 3(18)**

(A) "cogeneration facility" means a facility which produces--

- (i) electric energy, and
- (ii) steam or forms of useful energy (such as heat) which are used for industrial, commercial, heating, or cooling purposes;

(B) 'qualifying cogeneration facility' means a cogeneration facility that the Commission determines, by rule, meets such requirements (including requirements respecting minimum size, fuel use, and fuel efficiency) as the Commission may, by rule, prescribe;

Cardinal is a “qualifying cogeneration facility” under the FERC rules and therefore is exempt from Acid Rain as a “qualifying facility”. Cardinal Cogen’s Power Purchase Agreement with Pacific Gas & Electric Company that confirms this status is dated October 12, 1984.

Changes to permit:

1. Added BAAQMD Regulation 6, Rule 1 Particulate Matter General Requirements and changed BAAQMD Regulation 6 to SIP Regulation 6 to all tables.
2. Added BAAQMD Regulation 9, Rule 7 Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters and changed the existing BAAQMD Regulation 9, Rule 7 to SIP Regulation 9, Rule 7 in Table IV-A for S-1, S-2, S-3 and S-4.
3. Added 40 CFR 63 Subpart JJJJJ to Table IV-A for S-1, S-2, S-3 and S-4.
4. Added Condition 25233, and clarified and/or corrected text for Condition 2878 and the PSD Condition in Table IV-A for S-1, S-2, S-3 and S-4.
5. In Table IV-B for S-6, updated BAAQMD Regulation 9, Rule 9, added SIP Regulation 9, Rule 9.
6. In Table IV-B for S-6, updated 40 CFR 60, Subpart GG.
7. Added Condition 14501, and clarified and/or corrected text for Condition 2878 and the PSD Condition in Table IV-B for S-6.
8. In Table IV-C for S-8, added Regulation, 9-7-110.5 and 9-9-301.2 consistent with the applicability determination above.
9. In Table IV-C for S-8, updated NSPS Subpart Db and added 40 CFR 63 Subpart JJJJJ
10. Added Condition 14501, and clarified and/or corrected text for Condition 2878 and the PSD Condition in Table IV-C for S-8.
11. In Table IV-D for S-9 Engine, added Regulation 9, Rule 8, Inorganic Gaseous Pollutants, NO<sub>x</sub> and CO from Stationary IC Engines, CCR Title 17, Section 93115, ATCM for Stationary Compression Ignition Engines, 40 CFR 60 Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, 40 CFR 63 Subpart ZZZZ, NESHAPS for Stationary Reciprocating Internal Combustion Engines, for Condition 21844, updated basis in Part 2, corrected Part 4 and added Parts 5 and 6, and added Condition 25295.
12. In Table IV-E for S-10 and S-11 Engines, added Regulation 9, Rule 8, Inorganic Gaseous Pollutants, NO<sub>x</sub> and CO from Stationary IC Engines, CCR Title 17, Section 93115, ATCM for Stationary Compression Ignition Engines, 40 CFR 60 Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, 40 CFR 63 Subpart ZZZZ, NESHAPS for Stationary Reciprocating Internal Combustion Engines, for Condition 19698, corrected Parts 4 and 5 and added Parts 6 and 7, and added Condition 22820 for S-10 and Condition 22830 for S-11.

**V. Schedule of Compliance**

A schedule of compliance is required in all Title V permits pursuant to BAAQMD Regulation 2-6-409.10 which provides that a major facility review permit shall contain the following information and provisions:

“409.10 A schedule of compliance containing the following elements:



- 10.1 A statement that the facility shall continue to comply with all applicable requirements with which it is currently in compliance;
- 10.2 A statement that the facility shall meet all applicable requirements on a timely basis as requirements become effective during the permit term; and
- 10.3 If the facility is out of compliance with an applicable requirement at the time of issuance, revision, or reopening, the schedule of compliance shall contain a plan by which the facility will achieve compliance. The plan shall contain deadlines for each item in the plan. The schedule of compliance shall also contain a requirement for submission of progress reports by the facility at least every six months. The progress reports shall contain the dates by which each item in the plan was achieved and an explanation of why any dates in the schedule of compliance were not or will not be met, and any preventive or corrective measures adopted.”

The BAAQMD Compliance and Enforcement Division has conducted a review of compliance over the past seven year and has no records of compliance problems at this facility during the period. The compliance report is contained in Appendix D of this permit evaluation and statement of basis.

Changes to permit:

There were no changes to the permit.

**VI. Permit Conditions**

During the Title V permit development, the District has reviewed the existing permit conditions, deleted the obsolete conditions, and, as appropriate, revised the conditions for clarity and enforceability. Each permit condition is identified with a unique numerical identifier, up to five digits.

When necessary to meet Title V requirements, additional monitoring, recordkeeping, or reporting requirements have been added to the permit.

All changes to existing permit conditions are clearly shown in “strike-out/underline” format in the proposed permit. When the permit is issued, all “strike-out” language will be deleted and all “underline” language will be retained, subject to consideration of comments received.

The existing permit conditions are derived from previously issued District Authorities to Construct (A/C) or Permits to Operate (P/O). Permit conditions may also be imposed or revised as part of the annual review of the facility by the District pursuant to California Health and Safety Code (H&SC) § 42301(e), through a variance pursuant to H&SC § 42350 *et seq.*, an order of abatement pursuant to H&SC § 42450 *et seq.*, or as an administrative revision initiated by District staff. After issuance of the Title V permit, permit conditions will be revised using the procedures in Regulation 2, Rule 6, Major Facility Review.

Conditions that are obsolete or that have no regulatory basis have been deleted from the permit.

Conditions have also been deleted (or updated) due to the following:

- Redundancy in recordkeeping requirements.
- Redundancy in other conditions, regulations and rules.

- The condition has been superseded by other regulations and rules.
- The equipment has been taken out of service or is exempt.
- The event has already occurred (i.e. initial or start-up source tests).

The regulatory basis is listed following each condition. The regulatory basis may be a rule or regulation. The District is also using the following terms for regulatory basis:

- **BACT:** This term is used for a condition imposed by the Air Pollution Control Officer (APCO) to ensure compliance with the Best Available Control Technology in Regulation 2-2-301.
- **Cumulative Increase:** This term is used for a condition imposed by the APCO that limits a source's operation to the operation described in the permit application pursuant to BAAQMD Regulation 2-1-403.
- **Offsets:** This term is used for a condition imposed by the APCO to ensure compliance with the use of offsets for the permitting of a source or with the banking of emissions from a source pursuant to Regulation 2, Rules 2 and 4.
- **PSD:** This term is used for a condition imposed by the APCO to ensure compliance with a Prevention of Significant Deterioration permit issued pursuant to Regulation 2, Rule 2.

Changes to permit:

1. In Condition 2878, Part 1, added maximum firing rate for each boiler.
2. Revised Condition 19698, Part 2 to reflect the current Regulation 9-8-330.3.
3. Revised Condition 21844, Part 2 to reflect the current Regulation 9-8-111.3.
4. Added Condition 22820 for S-10.
5. Added Condition 22830 for S-11.
6. Added Condition 25233 for Boilers S-1, S-2, S-3 and S-4.
7. Added Condition 25295 for Engine S-9.

**VII. Applicable Limits and Compliance Monitoring Requirements**

This section of the permit is a summary of numerical limits and related monitoring requirements for each source. The summary includes a citation for each monitoring requirement, frequency of monitoring, and type of monitoring. The applicable requirements for monitoring are completely contained in Sections IV, Source-Specific Applicable Requirements, and VI, Permit Conditions, of the permit.

The District has reviewed all monitoring and has determined the existing monitoring is adequate.

The tables below contain only the limits for which there is no monitoring or inadequate monitoring in the applicable requirements. The District has examined the monitoring for other limits and has determined that monitoring is adequate to provide a reasonable assurance of compliance.

Monitoring decisions are typically the result of a balancing of several different factors including: 1) the likelihood of a violation given the characteristics of normal operation, 2) degree of

variability in the operation and in the control device, if there is one, 3) the potential severity of impact of an undetected violation, 4) the technical feasibility and probative value of indicator monitoring, 5) the economic feasibility of indicator monitoring, and 6) whether there is some other factor, such as a different regulatory restriction applicable to the same operation, that also provides some assurance of compliance with the limit in question.

These factors are the same as those historically applied by the District in developing monitoring for applicable requirements. It follows that, although Title V calls for a re-examination of all monitoring, there is a presumption that these factors have been appropriately balanced and incorporated in the District's prior rule development and/or permit issuance. It is possible that, where a rule or permit requirement has historically had no monitoring associated with it, no monitoring may still be appropriate in the Title V permit if, for instance, there is little likelihood of a violation. Compliance behavior and associated costs of compliance are determined in part by the frequency and nature of associated monitoring requirements. As a result, the District will generally revise the nature or frequency of monitoring requirements only when it can support a conclusion that existing monitoring is inadequate.

NOX Sources

S# & Description	Emission Limit Citation	Federally Enforceable Emission Limit	Monitoring
None			

**NOx Discussion:**

The annual NOx source test requirement in Condition 2878 provides adequate monitoring for Boilers S-1, S-2, S-3 and S-4. S-6 Gas Turbine and S-8 Duct Burner are monitored with NOx CEMs. Engines S-9, S-10 and S-11 are Loss of Exemption low use engines with permit conditions that limit hours of operation. There are no NOx limits for these engines so monitoring is not required.

CO Sources

S# & Description	Emission Limit Citation	Federally Enforceable Emission Limit	Monitoring
None			

**CO Discussion:**

The annual CO source test requirement in Condition 2878 provides adequate monitoring for Boilers S-1, S-2, S-3 and S-4. S-6 Gas Turbine and S-8 Duct Burner are monitored with a CO CEM. Engines S-9, S-10 and S-11 are Loss of Exemption low use engines with permit conditions that limit hours of operation. There are no CO limits for these engines so monitoring is not required.

**SO<sub>2</sub> Sources**

<b># &amp; Description</b>	<b>Emission Limit Citation</b>	<b>Federally Enforceable Emission Limit</b>	<b>Monitoring</b>
S-1, S-2, S-3 and S-4 Boilers, S-6 Gas Turbine, S-8 HRSG Duct Burner, S-9 Turbine Starter Diesel Engine, S-10 & S-11 Standby Generator Diesel Engines	BAAQMD 9-1-301	Ground level concentrations of SO <sub>2</sub> shall not exceed: 0.5 ppm for 3 consecutive minutes AND 0.25 ppm averaged over 60 consecutive minutes AND 0.05 ppm averaged over 24 hours	None
S-1, S-2, S-3 and S-4 Boilers, S-6 Gas Turbine, S-8 HRSG Duct Burner, S-9 Turbine Starter Diesel Engine, S-10 & S-11 Standby Generator Diesel Engines	BAAQMD 9-1-302	300 ppm (dry)	None

**SO<sub>2</sub> Discussion:**

**BAAQMD Regulation 9-1-301, 302**

All facility combustion sources are subject to the SO<sub>2</sub> emission limitations in District Regulation 9, Rule 1 (ground-level concentration and emission point concentration). In EPA's June 24, 1999 agreement with CAPCOA and ARB, "Periodic Monitoring Recommendations for Generally Applicable Requirements in SIP", EPA has agreed that natural-gas-fired combustion sources do not need additional monitoring to verify compliance with Regulation 9, Rule 1, since violations of the regulation are unlikely. Therefore, no monitoring is necessary for these requirements for S-6 Gas Turbine and S-8 HRSG duct burner since they are fired exclusively on natural gas. Similarly, no monitoring is necessary for Boilers S-1, S-2, S-3 and S-4 since they are primarily in back-up service, and when they are in peaking service they are fired exclusively on natural gas.

S-9 Turbine Starter Diesel Engine and S-10 and S-11 Standby Generator Diesel Engines are expected to comply with Regulation 9-1-301 and 302 since the sulfur content of diesel fuel fired at the engines is limited by the ATCM not to exceed 0.0015% by weight. The sulfur content will be monitored by vendor fuel certification.

Per the CAPCOA/ARB/EPA Agreement of 6/24/99 entitled "Periodic Monitoring Recommendations For Generally Applicable Requirements in SIP", compliance with the diesel fuel sulfur content limit in BAAQMD Regulation 9-1-304 will be assured by certification of the sulfur content by the fuel supplier for each fuel delivery.

PM Sources

<b>S# &amp; Description</b>	<b>Emission Limit Citation</b>	<b>Federally Enforceable Emission Limit</b>	<b>Monitoring</b>
S-1, S-2, S-3 and S-4 Boilers, S-6 Gas Turbine, S-8 HRSG Duct Burner	BAAQMD Regulation 6-1-301 SIP 6-301	Ringelmann 1.0	None
S-9 Turbine Starter Diesel Engine, S-10 & S-11 Standby Generator Diesel Engines	BAAQMD Regulation 6-1-303.1 SIP 6-303.1	Ringelmann 2.0	None
S-6 Gas Turbine, S-9 Turbine Starter Diesel Engine, S-10 & S-11 Standby Generator Diesel Engines	BAAQMD Regulation 6-1-310 SIP 6-310	0.15 gr/dscf	None
S-1, S-2, S-3 and S-4 Boilers, S-8 HRSG Duct Burner, S-9 Turbine Starter Diesel Engine, S-10 & S-11 Standby Generator Diesel Engines	BAAQMD Regulation 6-1-310.3 SIP 6-310.3	0.15 gr/dscf at 6% O <sub>2</sub>	None

**PM Discussion:**

BAAQMD Regulation 6 “Particulate Matter and Visible Emissions”

Visible Emissions

BAAQMD Regulation 6-1-301 limits visible emissions to no darker than 1.0 on the Ringelmann Chart (except for periods or aggregate periods less than 3 minutes in any hour). Visible emissions are normally not associated with combustion of gaseous fuels, such as natural gas. Sources S-1, S-2, S-3 and S-4 Boilers (during peaker service operation), S-6 Gas Turbine, S-8 HRSG Duct Burner burn natural gas exclusively, therefore, per the EPA's June 24, 1999 agreement with CAPCOA and ARB titled “Summary of Periodic Monitoring Recommendations for Generally Applicable Requirements in SIP”, no monitoring is required to assure compliance with this limit for these sources. Moreover, the standby generators and starter engine operate infrequently, so additional monitoring is not warranted.

Because S-9 Turbine Starter Diesel Engine, and S-10 and S-11 Standby Generator Diesel Engines will be fired exclusively on diesel fuel with a maximum sulfur content of 0.0015% by weight, visible emissions are not expected. Therefore, S-9, S-10 and S-11 are expected to continue to comply with Regulation 6-1-303.1.

**Particulate Weight Limitation**

BAAQMD Regulation 6-1-310 limits filterable particulate (FP) emissions from any source to 0.15 grains per dry standard cubic foot (gr/dscf) of exhaust volume. Section 310.3 limits filterable particulate emissions from “heat transfer operations” to 0.15 gr/dscf @ 6% O<sub>2</sub>. These are the “grain loading” standards.

Exceedances of the grain loading standards are normally not associated with combustion of gaseous fuels, such as natural gas. Sources S-1, S-2, S-3 and S-4 Boilers (during peaker service operation), S-6 Gas Turbine, S-8 HRSG Duct Burner burn natural gas exclusively, therefore, per the EPA's July 2001 agreement with CAPCOA and ARB entitled "CAPCOA/CARB/EPA Region IX Recommended Periodic Monitoring for Generally Applicable Grain Loading Standards in the SIP: Combustion Sources: Summary of Periodic Monitoring Recommendations for Generally Applicable Requirements in SIP", no monitoring is required to assure compliance with this limit for these sources.

Because S-9 Turbine Starter Diesel Engine, and S-10 and S-11 Standby Generator Diesel Engines will be fired exclusively on diesel fuel with a maximum sulfur content of 0.0015% by weight, Grain loading standards are not expected to be exceeded. Therefore, S-9, S-10 and S-11 are expected to continue to comply with Regulation 6-1-310.3.

**POC Sources**

<b>S# &amp; Description</b>	<b>Emission Limit Citation</b>	<b>Federally Enforceable Emission Limit</b>	<b>Monitoring</b>
None			

**POC Discussion:**

There are no POC emissions standards or emission limits for the equipment operated at this facility.

**Changes to permit:**

1. Added BAAQMD Regulation 6, Rule 1 Particulate Matter General Requirements and changed BAAQMD Regulation 6 to SIP Regulation 6 to all tables.
2. Added BAAQMD Regulation 9, Rule 7 Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters and changed the existing BAAQMD Regulation 9, Rule 7 to SIP Regulation 9, Rule 7 in Table VII-A for S-1, S-2, S-3 and S-4.
3. In Table VII-A for Boilers S-1, S-2, S-3 and S-4, added NOx and CO source test required by Condition 2878.
4. In Table VII-A for Boilers S-1, S-2, S-3 and S-4, added hours of operation and fuel usage monitoring citation from Condition 2878 and BAAQMD 9-7-113.1.

5. In Table VII-A for Boilers S-1, S-2, S-3 and S-4, added fuel sulfur content and opacity monitoring requirements of NSPS.
6. In Table VII-A for Boilers S-1, S-2, S-3 and S-4, added fuel usage limit and monitoring required by Condition 25233.
7. In Table VII-B for S-6 Gas Turbine, updated BAAQMD Regulation 9, Rule 9, added SIP Regulation 9, Rule 9.
8. Deleted.
9. In Table VII-C for S-8 Duct Burner, added Regulation 9, Rule 9 limits and monitoring.
10. In Table VII-D for S-9 Engine, added hours of operation limit and monitoring required by Condition 25295 and added 40 CFR 63 Subpart ZZZZ requirements.
11. In Table VII-E for S-10 and S-11 Engines, added hours of operation limit and monitoring required by Conditions 22820 and 22830.
12. In Table VII-E for S-10 and S-11 Engines, added 40 CFR 63 Subpart ZZZZ requirements.

### **VIII. Test Methods**

This section of the permit lists test methods that are associated with standards in District or other rules. It is included only for reference. In most cases, the test methods in the rules are source test methods that can be used to determine compliance but are not required on an ongoing basis. They are not “applicable requirements” as defined by Regulation 2-6-202.

If a rule or permit condition requires ongoing testing, the requirement will also appear in Section IV of the permit.

### **IX. Permit Shield:**

The District rules allow two types of permit shields. The permit shield types are defined as follows: (1) A provision in a major facility review permit explaining that specific federally enforceable regulations and standards do not apply to a source or group of sources, or (2) A provision in a major facility review permit explaining that specific federally enforceable applicable requirements for monitoring, recordkeeping and/or reporting are subsumed because other applicable requirements for monitoring, recordkeeping, and reporting in the permit will assure compliance with all emission limits.

The second type of permit shield is allowed by EPA’s “White Paper 2 for Improved Implementation of the Part 70 Operating Permits Program.” The District uses the second type of permit shield for all streamlining of monitoring, recordkeeping, and reporting requirements in Title V permits. The District’s program does not allow other types of streamlining in Title V permits.

This facility has the first type of permit shield.

Following is the detail of the permit shields that were requested by the applicant.

**Table IX-A-1**  
**S-1, S-2, S-3, S-4, Boilers**

<b>Citation</b>	<b>Title or Description</b>
NSPS Subpart D	Standards of Performance for Fossil-Fuel-Fired Steam Generators for Which Construction Is Commenced After August 17, 1971 (Boiler capacities below 250 MM BTU/hr)
NSPS Subpart Da	Standards of Performance for Electric Utility Steam Generating Units for Which Construction Is Commenced After September 18, 1978 (Boilers not built for the purposes of generating electricity)
NSPS Subpart Db	Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units (Boiler capacities below 100 MM BTU)
NSPS Subpart Dc	Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units (Boilers built before 6/9/1989 and not modified or reconstructed since 6/9/1989)
40 CFR 63, subpart DDDDD	National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters (Facility is not a major source of HAP emissions)
40 CFR Part 64	Compliance Assurance Monitoring (Sources do not utilize abatement devices)
40 CFR Part 72	Acid Rain Permit Program (Qualifying power production facility)
BAAQMD 1-520	Opacity, NO <sub>x</sub> , and CO <sub>2</sub> or O <sub>2</sub> Monitoring for steam generators over 250 MM BTU/hr (Boiler capacities below 250 MM BTU/hr)
BAAQMD 6-302	Opacity Limitation (District has not required monitoring)
BAAQMD 9-1-501	Area Monitoring Requirements (District has not required monitoring)
BAAQMD 9-1-502	Emission Monitoring Requirements (District has not required monitoring)

**Table IX-A-2**  
**S-6, Gas Turbine**

<b>Citation</b>	<b>Title or Description</b>
40 CFR 63, subpart YYYY	National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (Facility is not a major source of HAP emissions)
40 CFR Part 64	Compliance Assurance Monitoring (Source does not utilize an abatement device)
40 CFR Part 72	Acid Rain Permit Program (Qualifying power production facility)
BAAQMD 1-520.1	Opacity Monitoring for steam generators over 250 MM BTU/hr (Requirement does not apply to turbines)



**Table IX-A-2  
 S-6, Gas Turbine**

Citation	Title or Description
BAAQMD 6-302	Opacity Limitation (District has not required monitoring)
BAAQMD 9-1-501	Area Monitoring Requirements (District has not required monitoring)
BAAQMD 9-1-502	Emission Monitoring Requirements (District has not required monitoring)

**Table IX-A-3  
 S-8, Duct Burner**

Citation	Title or Description
40 CFR 60 Subpart GG	Standards of Performance for Stationary Gas Turbines (Source is subject to Subpart Db)
40 CFR Part 64	Compliance Assurance Monitoring (Source does not utilize an abatement device)
40 CFR Part 72	Acid Rain Permit Program (Qualifying power production facility)
BAAQMD 1-520.1	Opacity, NO <sub>x</sub> , and CO <sub>2</sub> or O <sub>2</sub> Monitoring for steam generators over 250 MM BTU/hr (Boiler capacities below 250 MM BTU/hr)
BAAQMD 6-302	Opacity Limitation (District has not required monitoring)
BAAQMD 9-1-501	Area Monitoring Requirements (District has not required monitoring)
BAAQMD 9-1-502	Emission Monitoring Requirements (Duct burner does not burn liquid or solid fuels)

Changes to permit:

- 40 CFR 60 Subpart GG was added to Table IX-A-3 for S-8 Duct Burner, consistent with the S-8 applicability determination in Section C.IV if this Statement of Basis.
- 40 CFR 63 Subpart ZZZZ was removed from Table IX-A-4 for S-9, S-10 and S-11 Engines, consistent with the applicability determination in Section C.IV if this Statement of Basis

**X. Revision History**

Changes to permit:

The section was updated.

**XI. Glossary**

Changes to permit:

The section was updated.

**D. Alternate Operating Scenarios:**

No alternate operating scenario has been requested for this facility.

**E. Compliance Status:**

An office memorandum dated October 2, 2012 from the Director of Compliance and Enforcement, to the Director of Engineering, presents a review of the compliance record of Cardinal Cogen, Inc. (Site #: A1629). The Compliance and Enforcement Division staff has reviewed the records for Cardinal Cogen, Inc. for the period between August 23, 2005 through September 19, 2012. This review was initiated as part of the District evaluation of an application by Cardinal Cogen, Inc. for a Title V permit. During the period subject to review, activities known to the District include:

- There were two Notices of Violation issued during this review period.
- The District did not receive any alleged complaints.
- The facility is not operating under a Variance or an Order of Abatement from the District Board.
- There were three monitor excesses or equipment breakdowns reported or documented by District staff.

The owner certified that all equipment was operating in compliance on February 19, 2010. No on-going non-compliance issues have been identified to date.

The October 2, 2012 Compliance Report is attached to this Statement of Basis in Appendix D.

**F. Differences between the Application and the Proposed Permit:**

The Title V permit application was originally submitted on February 23, 2010. This version is the basis for constructing the proposed Title V permit. Revisions were made to the application 21629 as a result of changes at the facility that were made pursuant to Permit Application 24546. Changes to the permit are made consistent with the applicability determinations in Section C.IV above.

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Permit Evaluation and Statement of Basis, Renewed Permit. Site # A1629,  
Cardinal Cogen, Inc., Campus and Jordan Way, Palo Alto, California 94305

**Appendix A, Engineering Evaluations**

APPENDIX A  
ENGINEERING EVALUATIONS

## **Application 11916, Gas Turbine S-6 Maximum Firing Rate**

### **Cardinal Cogen; Plant #1629 Campus Drive and Jordan Way, Stanford CA 94305**

#### **BACKGROUND**

Cardinal Cogen is applying to increase the maximum rated hourly heat input given in the source description for their S-6 Gas Turbine. When the turbine was retro-fitted with dry low-NOx (DLN) combustors in 1996 under application 25191 to comply with Regulation 9, Rule 9, the rated heat input given in the source description was not increased to ensure that BACT was not triggered. S-6 is currently not subject to any permit conditions limiting its hourly heat input rate. The rated heat input is currently set at 464 MM BTU per hour as listed in the source description. This heat input rate is a nominal value that was first instituted when a revised authority to construct was issued on 12/27/84.

On cold days when the combustion air is denser, the gas turbine is capable of firing at a heat input rate in excess of 464 MM BTU/hr. Prior to the retrofit of the gas turbine with dry-low-NOx combustors in 1996, the gas turbine was also capable of firing at heat input rates in excess of 464 MM BTU/hr according to the facilities gas usage records. Because this nominal rated heat input is cited as the capacity of S-6 in Table II-A of Cardinal Cogen's Title V operating permit, it is the maximum allowable capacity for the gas turbine pursuant to standard condition I.J. and Regulation 2-1-301. To ensure that they do not exceed this capacity, Cardinal Cogen is requesting that the maximum rated heat input (capacity) for the S-6 Gas Turbine be set at 555 MM BTU/hr. This request is being evaluated with respect to the BACT requirement of NSR.

According to gas usage records submitted by Cardinal, the gas turbine was capable of firing at a peak heat input rate of 571.4 MM BTU/hour prior to the retrofit with dry-low-NOx combustors. Therefore, the institution of a revised heat input rate of 555 MM BTU/hr will not result or allow any increase in the actual capacity of the gas turbine and will not result in any emission increases.

#### **Permitting History**

The original authority to construct for the gas turbine was issued on June 8, 1983 under application 28741. The authority did not specify the heat input rating for the turbine, but specified a nominal output rating of 38.65-MW for the gas turbine and 4.5-MW for the steam turbine. The application included estimated operating parameters for the facility that showed a heat input rate of 462 MM BTU/hr for the gas turbine. Because the project resulted in a net increase in CO emissions in excess of 250 lb/day, the offset provision of NSR for CO emissions was triggered. However, the applicant demonstrated through modeling that the project would not interfere with the attainment or maintenance of any applicable standard for CO and offsets were not required.

Subsequently, a revised authority to construct was issued on December 27, 1984 under application 30455 that increased the total facility output from 43.15-MW to 47-MW. The increase in output was obtained through improvements in plant efficiency and did not result in any increase in the maximum firing rate of the gas turbine or duct burners. This application specified a heat input rate for the gas turbine of 464.4 MM BTU/hour at 59°F as a nominal design value in an energy balance diagram. The revised authority to construct listed a firing rate of 462 MM BTU/hr but did not explicitly state that it was a maximum value.

The authority to construct for the installation of the DLN combustors was issued on March 13, 1996 under application number 25191. This authority explicitly specified a maximum firing rate of 464 MM

BTU/hr for the gas turbine. The DLN combustor was started up on 2/28/97 and the permit to operate was issued on June 26, 1997.

## CRITERIA-POLLUTANT EMISSION SUMMARY

### Annual Average Project Emissions Increase:

Pollutant	lb/day	ton/yr
POC	0	0
NO <sub>x</sub>	0	0
SO <sub>2</sub>	0	0
CO	0	0
PM <sub>10</sub>	0	0
NPOC	0	0

### Emission Calculations

The existing permit condition 2878 that was established at the time of the retrofit of the gas turbine with DLN combustors includes a limit on the NO<sub>x</sub> emission concentration from the gas turbine. Part 3(b) of condition #2878 states:

- “b. The NO<sub>x</sub> concentration in the Gas Turbine shall not exceed 14.6 ppmvd at 15% oxygen averaged over any consecutive three hour period, or 16.9 ppmvd at 15% oxygen averaged over any 24-hour period while firing at less than 80% baseload. (Note: 14.6 ppm and 16.9 ppm are 13 ppm and 15 ppm respectively, corrected for energy efficiency.) (basis: 9-9-301.2, 9-9-401, Banking)”

To ensure that the proposed increase in heat input rate will not result in an increase in daily NO<sub>x</sub> emissions or potential to emit NO<sub>x</sub> and will not trigger BACT, these NO<sub>x</sub> limits will be reduced proportionally.

Converting the concentration limits to emission factors:

$$(14.6 \text{ ppmv})(20.95 - 0)/(20.95 - 15) = 51.4 \text{ ppmv NO}_x \text{ @ } 0\% \text{ O}_2$$

$$(51.4/10^6)(1 \text{ lb mol}/385.3 \text{ dscf})(46.01 \text{ lb NO}_2/\text{lb mol})(8600 \text{ dscf/MM BTU}) \\ = 0.053 \text{ lb/MM BTU}$$

$$(16.9 \text{ ppmv})(20.95 - 0)/(20.95 - 15) = 59.5 \text{ ppmv NO}_x \text{ @ } 0\% \text{ O}_2$$

$$(59.5/10^6)(1 \text{ lb mol}/385.3 \text{ dscf})(46.01 \text{ lb NO}_2/\text{lb mol})(8600 \text{ dscf/MM BTU}) \\ = 0.061 \text{ lb/MM BTU}$$

Current daily maximum NO<sub>x</sub> emission rates:

$$(0.053 \text{ lb/MM BTU})(464 \text{ MM BTU/hr}) = \mathbf{24.6 \text{ lb NO}_x/\text{hr}}$$

$$(0.061 \text{ lb/MM BTU})(464 \text{ MM BTU/hr}) = \mathbf{28.3 \text{ lb NO}_x/\text{hr}}$$

The allowable NO<sub>x</sub> emission factor corresponding to the revised heat input rate of 555 MM BTU/hr is calculated as follows:

$$(24.6 \text{ lb NO}_x/\text{hr})/(555 \text{ MM BTU/hr}) = 0.044 \text{ lb/MM BTU}$$

$$(28.3 \text{ lb NO}_x/\text{hr})/(555 \text{ MM BTU/hr}) = 0.051 \text{ lb/MM BTU}$$

Converting these emission factors to an emission concentration yields:

$$(0.044 \text{ lb/MM BTU})(10^6)(385.3 \text{ dscf/1 lb mol})(\text{lb mol}/46.01 \text{ lb NO}_2)(\text{MM BTU}/8600 \text{ dscf}) \\ = 42.84 \text{ ppmv NO}_x \text{ @ 0\% O}_2$$

$$(0.051 \text{ lb/MM BTU})(10^6)(385.3 \text{ dscf/1 lb mol})(\text{lb mol}/46.01 \text{ lb NO}_2)(\text{MM BTU}/8600 \text{ dscf}) \\ = 49.66 \text{ ppmv NO}_x \text{ @ 0\% O}_2$$

Converting to 15% O<sub>2</sub>:

$$(42.84 \text{ ppmv})(20.95 - 15)/(20.95) = 12.17 \text{ ppmv @ 15\% O}_2$$

$$(49.66 \text{ ppmv})(20.95 - 15)/(20.95) = 14.11 \text{ ppmv @ 15\% O}_2$$

Accordingly, part 3(b) of condition 2878 will be revised as follows:

“b. The NO<sub>x</sub> concentration in the Gas Turbine shall not exceed ~~14.6~~ 12.17 ppmvd at 15% oxygen averaged over any consecutive three hour period, or ~~16.9~~ 14.11 ppmvd at 15% oxygen averaged over any 24-hour period while firing at less than 80% baseload. (Note: ~~14.6~~ 12.17 ppm and ~~16.9~~ 14.11 ppm are 13 ppm and 15 ppm respectively, corrected for energy efficiency and to reflect the revised maximum heat input rate of 555 MM BTU/hr for the gas turbine.) (basis: 9-9-301.2, 9-9-401, Banking)”

There are no permit condition limits on CO emission concentrations, or hourly or daily mass CO emissions. There is an annual limit on CO mass emissions of 150 tons per year. This limit will remain in place and is not affected by the proposed change in heat input rate.

## BACT ANALYSIS

Pursuant to Regulation 1-115, any increase in emissions resulting from the modification of a source to meet emission standards (such as a combustor retro-fit per Regulation 9, Rule 9) is not subject to the BACT and offset provisions of NSR. Therefore, the increase in CO emissions resulting from the installation of the DLN combustors at the gas turbine was not subject to NSR, provided that the DLN combustors did not have a capacity larger than the existing combustors.

Because the authority to construct for the retro-fitting of the gas turbine was processed in 1996, this analysis is based upon the NSR regulation in effect at that time. Under that version of NSR, the replacement of the existing combustor with a new combustor with a maximum heat input rate that is less than or equal to the maximum heat input rate of the existing combustor is not considered a change in the method of operation per Regulation 2-2-223.1 and therefore is not considered to be a modification. Therefore, such a change is not subject to NSR or its BACT provisions.

The June 15, 1994 version of Regulation 2-2-223.1 states:

“Unless previously limited by a permit condition the following shall not be considered changes in method of operation:

223.1 An increase in the production rate if such increase does not exceed the operating design capacity or the actual demonstrated capacity of the facility as approved by the APCO.”

Pursuant to Regulation 1-115, any increase in emissions resulting from the modification of a source to meet emission standards (such as a retrofit per Regulation 9, Rule 9) is not subject to the BACT and offset provisions of NSR. Therefore, the increase in CO emissions resulting from the installation of the DLN combustors at the gas turbine was not subject to NSR.

Based upon natural gas usage records from December 18, 1995, the existing combustor achieved a maximum hourly heat input rate of 9,383 scfm. According to records from P.G.&E., the heat content of the natural gas was 1,015 BTU/scf. The corresponding maximum heat input rate is therefore:

$$(9,383 \text{ scf/min})(1,015 \text{ BTU/scf})(60 \text{ min/hr}) = 571.4 \text{ MM BTU/hr}$$

Therefore, the requested revised maximum heat input rate of 555 MM BTU/hr for the DLN combustor does not exceed the demonstrated capacity of the previous combustor. The requested increase in rated heat input from 464 MM BTU/hr to 555 MM BTU/hr is therefore not considered to be a modification and is not subject to the BACT provision of NSR.

## **FACILITY CUMULATIVE INCREASE**

(since April 5, 1991)

There will be no increase in annual emissions as a result of the proposed increases in rated heat input for the gas turbine. The existing annual emission limits and annual gas usage limits will remain in effect.

## **TOXIC RISK SCREENING ANALYSIS**

The TRMP does not apply since the proposed increase in maximum rated heat input rate for the gas turbine will not affect annual TAC emission rates.

## **OFFSET ANALYSIS**

Because the proposed increase in maximum rated heat input for the Gas Turbine will not result in any increase in annual emissions, the offset provision of NSR does apply.

## **Major Facility Review (Title V) Analysis**

The maximum capacity listed for S-6 Gas Turbine in Table II-A of the renewal Title V permit will be changed from 464 MM BTU/hr to 555 MM BTU/hr. The source-specific applicable requirements (part IV) table and applicable requirements & compliance monitoring (part VII)

table for S-6 will be changed to reflect the reductions in the NOx concentration limits specified in part 3(b) of condition 2878.

**FEE SUMMARY**

Source	Fee Schedule	Filing Fee	Initial Fee	Late Fee	Permit to Operate Fee*	Source Sub-Total
S-6 Gas Turbine	B	\$259.00	\$0.00	\$0.00	\$1,632.00	\$1,891.00
<b>Grand Total</b>						<b>\$1,891.00</b>
<b>Amount Paid</b>						<b>\$1,891.00</b>

\*per Regulation 3, schedule B, the increase in permit to operate fees due to the increase in heat input rating from 464 MM BTU/hr to 555 MM BTU/hr; calculated as follows:

$$(555 - 464 \text{ MM BTU/hr})(\$17.93/\text{MM BTU}) = \$1,631.63$$

This rounds up to \$1,632.00

**STATEMENT OF COMPLIANCE**

**S-6 Gas Turbine** is expected to continue to comply with Regulation 9, Rule 9, section 301.2. According to CEM records, NOx emissions from S-6 Gas Turbine typically does not exceed 6.5 ppmv @ 15% O<sub>2</sub>.

This project is **categorically exempt** from District CEQA Regulation 2-1-311 pursuant to Regulation 2-1-312.11 (Permit applications for a new/modified source(s) or for process changes which will satisfy the "No Net Emission Increase" provisions of Regulation 2, Rule 2, and for which there is no possibility that the project may have any significant environmental effect in connection with any environmental media or resources other than air quality) and therefore is not subject to CEQA review.

The Cardinal Cogen facility is **not** located within 1000 feet of the outer boundary of a K-12 school and is therefore not subject to the public notification requirements of Regulation 2-1-412.

A Toxics Risk Screening Analysis is not required since the proposed increase in maximum heat input rating will not result in any increase in TAC emissions. TBACT does not apply to this project.

**PERMIT CONDITIONS**

*As discussed above, permit condition 2878, part 3(b) will be revised to ensure that there will be no increase in NOx emissions as a result of the increase in maximum rated heat input for the gas turbine. Part 3(b) will read as follows:*

- “b. The NOx concentration in the Gas Turbine shall not exceed ~~14.6~~ 12.17 ppmvd at 15% oxygen averaged over any consecutive three hour period, or ~~16.9~~ 14.11 ppmvd at 15%



oxygen averaged over any 24-hour period while firing at less than 80% baseload. (Note: ~~14.6~~ 12.17 ppm and ~~16.9~~ 14.11 ppm are 13 ppm and 15 ppm respectively, corrected for energy efficiency and to reflect the revised maximum heat input rate of 555 MM BTU/hr for the gas turbine.) (basis: 9-9-301.2, 9-9-401, Banking)”

## RECOMMENDATION

Issue a **revised Permit to Operate with revised permit conditions** (#2878) for the following source:

- S-6 Gas Turbine, General Electric MS-6001, 555 MM BTU/hour maximum firing rate, equipped with a General Electric DLN Combustor System**

## EXEMPT SOURCES

None

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**Senior Air Quality Engineer**

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**Date**

**Application 24546, Black Start Engine S-9 ATCM Exemption Request**

**Engineering Evaluation  
Cardinal Cogen, Inc.  
Plant #15128-A#24546  
288 Campus Drive, Building 14-105  
Palo Alto, CA 94305**

**Background:**

Cardinal Cogen, Inc. is applying for a change in a condition for the following equipment:

***S-9 Prime Starter Engine: Diesel Engine Make: Detroit Diesel; Model: 7123-7300; Rated Horsepower: 750 HP; Model Year: 1987.***

The above engine was installed in 1987. The facility applied for an emergency standby diesel engine generator set permit in July, 2002 under application #4663. Since the engine was installed in 1987, it was permitted as a LOE (Loss of Exemption Engine) engine.

Cardinal Cogen, Inc. has applied to change the engine status from an emergency standby diesel engine generator set to a low-use prime engine solely used to start a combustion gas turbine engine. Pursuant to ATCM section 93115.3 (j) Exemption for Low-Use Prime Engine Outside of School Boundaries, the above engine will be awarded only 20 hours per year.

To satisfy the ATCM requirements engine has to meet the following conditions.

1. The engine should be a prime engine.
2. The engine should be located more than 500 feet from a school at all times.
3. The engine should operate no more than 20 hours cumulatively per year.

Cardinal Cogen, Inc. wishes to use this engine as a limited use engine in accordance with BAAQMD Regulation 9-8-111, Limited Exemption for Low Usage. Section 93115.7 of the CARB Air Toxics Control Measure for Stationary Compression Ignition Engines requires control of diesel particulate to 0.01 g/bhp-hr for stationary prime diesel-fueled engines except for engines defined as Low-use Prime Engines. The above will be limited to 20 hours per year. Therefore, the diesel particulate limit of 0.01 g/bhp-hr will not apply to this engine.

The engine is considered to be prime for the purposes of the ATCM because use of the engine will be discretionary and will not be limited to emergencies.

For the purposes of BAAQMD Regulation 9, Rule 8, the engine is not subject to the requirements of Sections 301, 302, 303, 304, and 305, if the engine operates no more than 100 hours/year. This engine will operate only 20 hours per year, therefore this engine will not be subject to the limits of 180 ppm NOx and 440 ppm CO at 15% oxygen, dry, in Section 9-8-304.1.

The District issued Notice of Violation #A51063 on May 16, 2012 because the engine was not in compliance with CARB's Airborne Toxic Control Measure for Stationary Compression Ignition Engines (ATCM). The ATCM requires emergency engines to run only for emergency purposes as defined in Section 93115.4(a)(25). The engine is used as a "black-start" engine to start the

facility's turbine, which is considered to be a discretionary use. Section 93115.3(j) does provide a limited exemption from the emission limits in Section 93115.7(b)(1) for such engines, but the approval has to be in writing and the approval must specify the following conditions:

- “(1) the engine is a prime engine;
- (2) the engine is located more than 500 feet from a school at all times;
- (3) the engine operates no more than 20 hours cumulatively per year. The district APCO may use a different number of hours for applying this exemption if the diesel-fueled CI engine is used solely to start a combustion gas turbine engine, provided the number of hours used for this exemption is justified by the district, on a case-by-case basis, with consideration of factors including, at a minimum, the operational requirements of a facility using a combustion gas turbine engine and the impacts of the emissions from the engine at any receptor location.”

New Condition 25295 will contain these requirements in writing. After the change in conditions has been approved, the facility will no longer be in violation of the ATCM as long as the engine does not run more than 20 hours in any consecutive 12-month period, beginning with the date of issuance of the change in conditions.

**Emission Summary:**

Emissions from S-9 do not need to be calculated since S-9 is a loss of exemption engine and is not defined as a new or modified source pursuant to Regulation 2-1-232 and 2-1-234.

**Cumulative Increase:**

The engine status will be changed from emergency standby diesel engine set to prime engine with the 20 hours per year limit on operation. The emergency engines do not have limits on emergency usage. Therefore, there will be a reduction in emissions due to limited hours or operation. Emissions from S-9 do not count towards the facility's cumulative increase since S-9 is a loss of exemption engine and is not defined as a new or modified source pursuant to Regulation 2-1-232 and 2-1-234.

**Best Available Control Technology:**

This engine, while technically prime, will likely operate less than an emergency generator, since it is not allowed unlimited usage for emergencies. This engine will have a firm limit of 20 hours of operation per year. As an emergency engine, this engine had a limit of 100 hours per year for maintenance and testing, but no limit on the use for emergencies.

Since the engine operation will be reduced from 100 hours per year to 20 hours per year, emissions will be reduced. Therefore, BACT will not be required.

**Offsets**

Offsets must be provided for any new or modified source at a facility that emits more or is permitted to emit more than 10 tons/yr of POC or NOx. This engine will have a firm limit of 20 hours of operation per year. As emergency engine, this engine had a limit of 100 hours per year for maintenance and testing, but no limit on the use for emergencies. The emissions from this engine are reduced. Therefore, offsets are not required.

**Toxic Risk Screen Analysis:**

The emissions of diesel particulate will decrease and therefore, this application is not subject to Regulation 2, Rule 5, New Source Review for Toxic Air Contaminants.

## **STATEMENT OF COMPLIANCE**

### **BAAQMD Requirements**

#### Regulation 6, Rule 1, Particulate Matter, General Requirements

S9 is subject to the limitations of Regulation 6-1-303, Ringelmann No. 2 Limitation, because this engine has a displacement of less than 25 liters. The total displacement is 13.96 liters per Application 24546. The standard states that “a person shall not emit for a period or periods aggregating more than three minutes in any hour, a visible emission that is as dark or darker than No. 2 on the Ringelmann Chart, or of such opacity as to obscure an observer’s view to an equivalent or greater degree, nor shall said emission, as perceived by an opacity sensing device in good working order, where such device is required by District Regulations, be equal to or greater than 40% opacity”. This engine is not expected to produce visible emissions or fallout in violation of this regulation.

The engine is also subject to the particulate weight limitation in Section 6-1-310 of 0.15 gr/dscf. This engine is expected to comply with the standard.

#### Regulation 9, Rule 1, Sulfur Dioxide

S9 is subject to the SO<sub>2</sub> limitations of Regulation 9-1-301 (Limitations on Ground Level Concentrations of Sulfur Dioxide), Regulation 9-1-302 (Limitations Sulfur Dioxide Emissions) and 9-1-304 (Burning of Solid and Liquid Sulfur Dioxide Fuel). From Regulation 9-1-301, the ground level concentrations of SO<sub>2</sub> will not exceed 0.5 ppm continuously for 3 consecutive minutes or 0.25 ppm averaged over 60 consecutive minutes, or 0.05 ppm averaged over 24 hours. Per Regulation 9, Rule 1, Section 302, a person shall not emit from any source a gas stream containing sulfur dioxide in excess of 300 ppm (dry). And Regulation 9, Rule 1, Section 304, states that a person shall not burn any liquid fuel having sulfur content in excess of 0.5% by weight. Compliance with Regulation 9, Rule 1 is expected since diesel fuel with a 0.0015% by weight sulfur is mandated for use in California.

#### Regulation 9, Rule 8, NO<sub>x</sub> and CO from Stationary Internal Combustion Engines

S9 will not be considered to be an emergency generator and therefore will not be subject to the following sections of the rule:

- 9-8-230, Emergency Standby Engine
- 9-8-231, Emergency Use
- 9-8-237, Unforeseeable
- 9-8-330, Emergency Standby Engines, Hours of Operation,
- 9-8-530, Emergency Standby and Low Usage Engines, Monitoring and Recordkeeping

The engine will be considered to be a low-usage engine in accordance with Section 9-8-111, Limited Exemption for Low Usage, and therefore will not be subject to the following sections of the rule:

- 9-8-304, Emission Limits – Compression-Ignited Engines
- 9-8-503, Quarterly Demonstration of Compliance

The engines will be subject to the following section:

- 9-8-502.1, Recordkeeping

#### Regulation 2, Rule 6, Major Facility Review

This change in conditions is an administrative amendment for the purposes of Regulation 2, Rule 6, Major Facility Review, because the requirements for limits on emergency engines in BAAQMD Regulation 9, Rule 8, NO<sub>x</sub> and CO from Stationary Internal Combustion Engines, and stationary diesel engines in the California Airborne Toxic Control Measure for Stationary Compression Ignition Engines are not federally enforceable. The definition of administrative amendment in BAAQMD Regulation 2-6-201 includes non-federally enforceable requirements.

#### **State Requirements**

##### CEQA

This application is considered to be ministerial under the District's Regulation 2-1-311 and therefore is not subject to CEQA review. The engineering review for this project requires only the application of standard permit conditions and standard emission factors in accordance with Permit Handbook Chapter 2.3.

This facility is not within 1000 feet of a K-12 school, and therefore is not subject to the public notification requirements of Regulation 2-1-412.

#### **Airborne Toxic Control Measure for Stationary Compression Ignition Engines (ATCM)**

The ATCM requirements are based on the exemption for low-use prime engine outside school boundaries per Section 93115.3(j), Request for Exemption for Low-Use Prime Engine Outside of School Boundaries.

The engine is considered to be a prime engine for the purposes of the ATCM because Section 93115.4(a)(58) defines any engine that is not an emergency engine as a prime engine.

In-use stationary prime engines are required to meet the requirements in Section 93115.7(b), but this engine was built in 1987, and is permitted as a Low-Use Prime Engine. Therefore, this engine is not required to meet the following ATCM standards in Section 93115.7(b):

PM	0.01 g/bhp-hr
----	---------------

The applicant will comply with the fuel requirements in Section 93115.5.

#### **NESHAP**

- 40 CFR Part 63.6603(a) – Operating requirements for black-start CI engines at area sources:
  - Change oil and filter every 500 hours of operation or annually, whichever comes first;
  - Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first; and
  - Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.

- Minimize the engine's time spent at idle during startup and minimize the engine's startup time to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes.
- 40 CFR Parts 63.6605(b) and 63.6625(e) – O&M requirements for black-start CI engines at area sources.
  - This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer or the permittee's own maintenance plan.
  - The permittee's maintenance plan must provide to the extent practicable for the maintenance and operation of the engine in a manner consistent with good air pollution control practice for minimizing emissions.
  - Determination of whether such operation and maintenance procedures are being used will be based on information available to the District which may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source.
- 40 CFR Part 63.6655 – Recordkeeping for black-start CI engines at area sources.
  - Keep records of each notification you submitted to comply with Subpart ZZZZ, each occurrence/duration/response of a malfunction, and required maintenance.

*PSD does not apply.*

### **Permit Condition**

COND #25295

1. S9, Engine, is considered to be a low-use prime engine as defined by ATCM Section 93115.3(a)(58). The owner/operator shall not operate S9, Engine, for more than 20 hours in any consecutive 12-month period for any purpose, beginning with the date of issuance of the change in conditions pursuant to Application #24546. [Basis: 9-8-111, ATCM 93115.3(j)]
2. The owner/operator shall comply with the fuel requirements in the CARB Stationary Diesel Engine ATCM Section 93115.5. [Basis: "Stationary Diesel Engine ATCM" section 93115.5]
3. The owner/operator shall ensure that the engine is located more than 500 feet from a school at all times. [Basis: ATCM 931153(j)].
4. The owner/operator shall comply with the following operating requirements for black-start CI engines at area sources:
  - a. Change oil and filter every 500 hours of operation or annually, whichever comes first;
  - b. Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first; and
  - c. Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.
  - d. Minimize the engine's time spent at idle during startup and minimize the engine's startup time to a period needed for appropriate and safe loading of the engine, not to

exceed 30 minutes.

[Basis: 40 CFR Part 63.6603(a)]

5. The owner/operator shall operate each stationary engine only when a non-resettable totalizing meter (with a minimum display capability of 9,999 hours) that measures the hours of operation for the engine is installed, operated and properly maintained. [Basis: 9-8-530]
6. Records: The owner/operator shall maintain the following monthly records in a District-approved log for at least 60 months from the date of entry. Log entries shall be retained on-site, either at a central location or at the engine's location, and made immediately available to the District staff upon request.
  - a. Hours of operation
  - b. Fuel usage[Basis: Cumulative Increase, 9-8-111, ATCM 93115.3(j)]

### **Recommendation**

Issue a change in conditions for:

**S-9 Prime Starter Engine: Diesel Engine Make: Detroit Diesel; Model: 7123-7300; Rated Horsepower: 750 HP; Model year 1987.**

By: Brenda Cabral for  
Madhav Patil  
Air Quality Engineer

Date: 7/24/2012

**Appendix B, GE S-6 Gas Turbine Evaluation**

APPENDIX B

S-6 Gas Turbine Evaluation  
GE Energy  
May 1, 2012



**GE Energy**

George Mathai  
Performance Engineer  
May 1, 2012



**SITE LOCATION**

Site Name	Cardinal Cogen
Serial Number	295187
Turbine Model	PG6541
Date	5/1/2012

**Installed Upgrade Components (for reference only)**

- DLN 1.0
- Steam injection for power augmentation
- MKV
- GTD-222 Stage 2 nozzle (non-press)
- GTD-222 Stage 3 nozzle
- Stage 2 shroud
- Stage 3 shroud
- HPP brush seal
- Stage 2 bucket
- Stage 3 bucket
- Stage 1 shroud
- S2N brush seal
- Stage 1 bucket
- Stage 1 nozzle
- Extendorized parts – combustion liner, flow sleeves, nozzle tips
- Counter bore plugs in CDC inner barrels
- High flow GTD C450 IGVs
- IGV angle increase 84 to 86
- Inner barrel brush seal
- Transition piece
- Firing temperature increase (+42F)

## GE Energy

George Mathai  
 Performance Engineer  
 May 1, 2012

The following performance cases were run using GE Cycle Deck.

**Table 1: Cycle Deck Nameplate Cases**

Case #	1	2	3	4	5	6	7
Model	6531B	6531B	6531B	6531B	6531B	6531B	6531B
RPM	5106	5106	5106	5106	5106	5106	5106
CM&U	None	None	None	None	DLN 1.0, IGV 86 deg, 6541 HGP hardware	DLN 1.0, IGV 86 deg, 6541 HGP hardware	DLN 1.0, IGV 86 deg, 6541 HGP hardware
Condition	ISO	ISO	30 F and 78% RH	30 F and 78% RH	ISO	ISO	30 F and 78% RH
Op Mode	Baseload	Peak	Baseload	Peak	Baseload	Peak	Baseload
Additional	NOx control	NOx control	NOx control	NOx control		Power Aug	

This unit was originally a model 6531B when installed in 1987. Uprates of HGP hardware revised it to be model 6541 per GE Cycle Deck nomenclature. The only difference between 6531B and 6541 are the following HGP hardware:

- S2N – GTD222
- S2S honeycomb seal
- S3S honeycomb seal
- S2B cutter teeth
- S3B cutter teeth

The following rated conditions were used for the analysis.

**Table 2: Rated Condition**

Parameter	Units	Value
Compressor Inlet Temperature	deg F	per Table 1
Compressor Inlet Relative Humidity	%	per Table 1
Barometric Pressure	psia	14.65
Shaft Speed	rpm	5106
Generator Power Factor		0.8

**GE Energy**

**George Mathai**  
**Performance Engineer**  
 May 1, 2012

Parameter	Units	Value
IGV Angle	deg	per Table 1
Inlet Pressure Drop	inH2O	5.0
Exhaust Pressure Drop	inH2O	14.0
Fuel Temperature	deg F	80
Steam Injection Flow for Power Augmentation (when applicable)	ratio	2% of airflow
NOx target for Steam Injection (when applicable on Std combustor)	ppm @ 15% O2	42
Steam Injection Pressure (when applicable)	psia	300
Steam Injection Temperature (when applicable)	deg F	500
Peak Fire Temperature Bias (when applicable)	deg F	40
Fuel Composition (Natural Gas)		
• Nitrogen (N <sub>2</sub> )	% mol	0.74
• Carbon Dioxide (CO <sub>2</sub> )	% mol	0.83
• Methane (CH <sub>4</sub> )	% mol	95.91
• Ethane (C <sub>2</sub> H <sub>6</sub> )	% mol	2.31
• Propane (C <sub>3</sub> H <sub>8</sub> )	% mol	0.16
• N-Butane (C <sub>4</sub> H <sub>12</sub> )	% mol	0.03
• Iso-Butane (C <sub>4</sub> H <sub>12</sub> )	% mol	0.02
Fuel Lower Heating Value	Btu/lb	20725
Fuel Higher Heating Value	Btu/lb	23000

**GE Energy**

George Mathai  
 Performance Engineer  
 May 1, 2012

**Table 3: Cycle Deck Nameplate Results**

Case #		1	2	3	4	5	6	7
Load Condition		BASE	PEAK	BASE	PEAK	BASE	PEAK	BASE
Steam Injection Rate	<i>% airflow</i>	2%	2%	2%	2%	0%	2%	0%
Ambient Temperature	<i>deg F</i>	59	59	30	30	59	59	30
Ambient Relative Humidity	<i>%</i>	60%	60%	78%	78%	60%	60%	78%
Heat Cons. (LHV)	<i>Mbtu/hr</i>	444.9	451.2	480.0	494.8	440.9	465.8	476.0
Heat Cons. (HHV)	<i>Mbtu/hr</i>	493.7	500.7	532.7	549.1	489.3	517.0	528.2

Notes:

1. All calculations are at new and clean condition
2. These are estimates only, no guarantees are stated or implied
3. This does not take into account the generator load limit or any other site specific electrical or fuel supply restrictions

**Appendix C, Glossary**

APPENDIX C  
GLOSSARY

**ACT**

Federal Clean Air Act

**APCO**

Air Pollution Control Officer

**ARB**

Air Resources Board

**BAAQMD**

Bay Area Air Quality Management District

**BACT**

Best Available Control Technology

**Basis**

The underlying authority which allows the District to impose requirements.

**CAA**

The federal Clean Air Act

**CAAQS**

California Ambient Air Quality Standards

**CAM**

Compliance Assurance Monitoring per 40 CFR Part 64

**CAPCOA**

California Air Pollution Control Officers Association

**CEM**

Continuous Emission Monitor

**CEQA**

California Environmental Quality Act

**CFR**

The Code of Federal Regulations. 40 CFR contains the implementing regulations for federal environmental statutes such as the Clean Air Act. Parts 50-99 of 40 CFR contain the requirements for air pollution programs.

**CO**

Carbon Monoxide

**Cumulative Increase**

The sum of permitted emissions from each new or modified source since a specified date pursuant to BAAQMD Rule 2-1-403, Permit Conditions (as amended by the District Board on 7/17/91) and SIP Rule 2-1-403, Permit Conditions (as approved by EPA on 6/23/95). Cumulative increase is used to determine whether threshold-based requirements are triggered.

**District**

The Bay Area Air Quality Management District

**EPA**

The federal Environmental Protection Agency.

**Excluded**

Not subject to any District regulations.

**Federally Enforceable, FE**

All limitations and conditions which are enforceable by the Administrator of the EPA including those requirements developed pursuant to 40 CFR Part 51, subpart I (NSR), Part 52.21 (PSD), Part 60 (NSPS), Part 61 (NESHAPs), Part 63 (MACT), and Part 72 (Permits Regulation, Acid Rain), including limitations and conditions contained in operating permits issued under an EPA-approved program that has been incorporated into the SIP.

**FP**

Filterable Particulate as measured by BAAQMD Method ST-15, Particulate.

**GLC**

Ground Level Concentration

**HAP**

Hazardous Air Pollutant. Any pollutant listed pursuant to Section 112(b) of the Act. Also refers to the program mandated by Title I, Section 112, of the Act and implemented by 40 CFR Part 63.

**Major Facility**

A facility with potential emissions of: (1) at least 100 tons per year of regulated air pollutants, (2) at least 10 tons per year of any single hazardous air pollutant, and/or (3) at least 25 tons per year of any combination of hazardous air pollutants, or such lesser quantity of hazardous air pollutants as determined by the EPA administrator.

**MFR**

Major Facility Review. The District's term for the federal operating permit program mandated by Title V of the Federal Clean Air Act and implemented by District Regulation 2, Rule 6.

**MOP**

The District's Manual of Procedures.

**NAAQS**

National Ambient Air Quality Standards

**NESHAPS**

National Emission Standards for Hazardous Air Pollutants. See in 40 CFR Parts 61 and 63.

**NMHC**

Non-methane Hydrocarbons (Same as NMOC)

**NMOC**

Non-methane Organic Compounds (Same as NMHC)

**NO<sub>x</sub>**

Oxides of nitrogen.

**NSPS**

Standards of Performance for New Stationary Sources. Federal standards for emissions from new stationary sources. Mandated by Title I, Section 111 of the Federal Clean Air Act, and implemented by 40 CFR Part 60 and District Regulation 10.

**NSR**

New Source Review. A federal program for pre-construction review and permitting of new and modified sources of pollutants for which criteria have been established in accordance with Section 108 of the Federal Clean Air Act. Mandated by Title I of the Federal Clean Air Act and implemented by 40 CFR Parts 51 and 52 and District Regulation 2, Rule 2. (Note: There are additional NSR requirements mandated by the California Clean Air Act.)

**Offset Requirement**

A New Source Review requirement to provide federally enforceable emission offsets for the emissions from a new or modified source. Applies to emissions of POC, NOx, PM10, and SO2.

**Phase II Acid Rain Facility**

A facility that generates electricity for sale through fossil-fuel combustion and is not exempted by 40 CFR 72 from Titles IV and V of the Clean Air Act.

**POC**

Precursor Organic Compounds

**PM**

Particulate Matter

**PM10**

Particulate matter with aerodynamic equivalent diameter of less than or equal to 10 microns

**PSD**

Prevention of Significant Deterioration. A federal program for permitting new and modified sources of those air pollutants for which the District is classified "attainment" of the National Air Ambient Quality Standards. Mandated by Title I of the Act and implemented by both 40 CFR Part 52 and District Regulation 2, Rule 2.

**PTE**

Potential to Emit as defined by BAAQMD Regulation 2-6-218

**SIP**

State Implementation Plan. State and District programs and regulations approved by EPA and developed in order to attain the National Air Ambient Quality Standards. Mandated by Title I of the Act.

**SO2**

Sulfur dioxide

**THC**

Total Hydrocarbons (NMHC + Methane)

**Title V**



Title V of the federal Clean Air Act. Requires a federally enforceable operating permit program for major and certain other facilities.

**TOC**

Total Organic Compounds (NMOC + Methane, Same as THC)

**TPH**

Total Petroleum Hydrocarbons

**TSP**

Total Suspended Particulate

**VOC**

Volatile Organic Compounds

**Units of Measure:**

bhp	=	brake-horsepower
btu	=	British Thermal Unit
cu. ft.	=	cubic foot
cfm	=	cubic feet per minute
dscf	=	dry standard cubic foot
dscfm	=	dry standard cubic foot per minute
g	=	gram
gal	=	gallon
gpm	=	gallons per minute
gr	=	grain
hp	=	horsepower
hr	=	hour
lb	=	pound
in	=	inch
max	=	maximum
m <sup>2</sup>	=	square meter
min	=	minute
mm	=	million
MMbtu	=	million btu
MMcf	=	million cubic feet
ppmv	=	parts per million, by volume
ppmw	=	parts per million, by weight
psia	=	pounds per square inch, absolute
psig	=	pounds per square inch, gauge
scfm	=	standard cubic feet per minute
tpy	=	tons per year
yr	=	year

Permit Evaluation and Statement of Basis, Renewed Permit. Site # A1629,  
Cardinal Cogen, Inc., Campus and Jordan Way, Palo Alto, California 94305

**Appendix D, BAAQMD Compliance Report**

APPENDIX D  
BAAQMD COMPLIANCE REPORT

**COMPLIANCE & ENFORCEMENT DIVISION**

**Inter-Office Memorandum**

**October 2, 2012**

TO: JIM KARAS – ACTING DIRECTOR OF ENGINEERING

FROM: WAYNE KINO – ACTING DIRECTOR OF ENFORCEMENT

SUBJECT: REVIEW OF COMPLIANCE RECORD OF:

**CARDINAL COGEN, INC.; SITE #A1629**

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**Background**

This review was initiated as part of the District evaluation of an application by CARDINAL COGEN, INC. for a Title V Permit Renewal. It is standard practice of the Compliance and Enforcement Division to undertake a compliance record review in advance of a renewal of a Title V Permit. The purpose of this review is to assure that any non-compliance problems identified during the prior five-year permit term have been adequately addressed, or, if non-compliance persists, that a schedule of compliance is properly incorporated into the Title V permit compliance schedule. In addition, the review checks for patterns of recurring violation that may be addressed by additional permit terms. Finally, the review is intended to recommend, if necessary, any additional permit conditions and limitations to improve compliance.

CARDINAL COGEN, INC. is a power cogeneration facility that provides cooling, heating and power to the Stanford University campus and Stanford Hospital. The facility operates four boilers, a gas turbine, a turbine starter diesel engine and multiple emergency generators.

**Compliance Review**

Compliance records were reviewed for the time period from August 23, 2005 through September 19, 2012. The results of this review are summarized as follows.

**1. Violation History**

Staff reviewed CARDINAL COGEN, INC. Annual Compliance Certifications and found no ongoing non-compliance and no recurring pattern of violations.

Staff also reviewed the District compliance records for the review period. During this period CARDINAL COGEN, INC. activities known to the District include:

Permit Evaluation and Statement of Basis, Renewed Permit. Site # A1629,  
Cardinal Cogen, Inc., Campus and Jordan Way, Palo Alto, California 94305

REVIEW OF COMPLIANCE RECORD OF:  
**Cardinal Cogen, Inc. – SITE # A1629**  
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District-issued Notices of Violation.

NOV#	Regulation	Date Occur	# of Days	Comments	Disposition
A48955	1-522.6	4/24/07	1	Failure to Maintain NO <sub>x</sub> monitor	Resolved Legal 7/21/08
A51063	Title 17 CCR, Section 93115.7(b)(1)	10/8/07	10/8/07 to 7/24/12	Failure to meet diesel particulate matter emission standard	*In compliance 7/24/12. NOV pending legal resolution.

\*CARDINAL COGEN, INC. submitted a request and received approval for an exemption to Title 17 CCR, Section 93115.7(b)(1) from the District. A permit condition was added to their Permit to Operate to allow the diesel engine to operate 20 hours per year as allowed by the exemption in Title 17 CCR, Section 93115.3(j). This violation could have been prevented provided Cardinal Cogen submitted a request for the above exemption in October, 2007.

CARDINAL COGEN, INC. submitted a Title V deviation report to the District on August 16, 2012. The deviation was for an indicated NO<sub>x</sub> CEM excess at the gas turbine (S #6) from August 11, 2011 to September 20, 2011. The deviation was discovered during an internal audit. The audit revealed that CARDINAL COGEN staff were applying the wrong NO<sub>x</sub> standard in Regulation 9, Rule 9 instead of the permit condition limit #2878. The deviation is currently being reviewed by the Technical Services Division to verify if the deviation warrants enforcement action.

**2. Complaint History**

The District did not receive any air pollution complaints alleging CARDINAL COGEN, INC. as the source.

**3. Reportable Compliance Activity**

Reportable Compliance Activity (RCA), also known as "Episode" reporting, is the reporting of compliance activities involving a facility as outlined in District Regulations and State Law. Reporting covers breakdown requests, indicated monitor excesses, pressure relief device releases, inoperative monitor reports and flare monitoring.

Within the review period, the District received three notifications for RCA's. The three RCA's were for inoperative monitors. There were no NOV's as a result of these RCA's.

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The District received three notifications for RCA's.

Episode	Date Occur	# of Days	Comments	Disposition
05C59	11/5/07	1	Continuous Emission Monitors (CEMs) failed calibration	No violation documented
05L51	3/23/09	1	Continuous Emission Monitors (CEMs) not reading steady	No violation documented
05T78	5/16/10	1	Continuous Emission Monitors (CEMs) temperature error	No violation documented

#### **4. Enforcement Agreements, Variances, or Abatement Orders**

There were no enforcement agreements, variances, or abatement orders for CARDINAL COGEN, INC. within the review period.

#### **Conclusion**

Following its review of all available facility and District compliance records from August 23, 2005 through September 19, 2012, the District's Compliance and Enforcement Division has determined that CARDINAL COGEN, INC. was in intermittent compliance from the date of the last permit renewal, on August 23, 2005, through the present. However, CARDINAL COGEN, INC. has demonstrated no evidence of ongoing noncompliance and no recurring pattern of violations that would warrant consideration of a Title V permit compliance schedule for this facility.

Based on this review and analysis of all the violations for the review period, the District has concluded that no schedule of compliance or change in permit terms is necessary beyond what is already contained in the facility's current Title V permit.

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