

**Engineering Evaluation
Pacific Gas and Electric Company
Application #22441
Plant #26**

BACKGROUND

Pacific Gas and Electric Company (PG&E) has submitted an application to bank Interchangeable Emission Reduction Credits (IERCs) at the Potrero Power Plant in San Francisco pursuant to Regulation 2, Rule 9 (Interchangeable Emission Reduction Credits), adopted on April 7, 1999.

This facility has one boiler (S-1) subject to the Advanced Technology Alternative Emission Control Plan (ATAECP "system-wide emissions bubble") of Regulation 9-11, Section 309. Under the ATAECF, the individual boilers are not required to comply with a specific emission limit, but their emissions and fuel use contribute to a system-wide average. The current system-wide average NO_x limit (2000) is 0.105 lb/MMBtu; this limit will ratchet down over the years to 0.057 (2002), 0.037 (2004) and 0.018 (2005) lb/MMBtu. There are a total of 15 utility boilers at four facilities subject to Regulation 9-11. At the time the IERCs were generated, the Potrero and Hunters Point power plants were considered one facility under Regulation 2-9-211 since they are located within three miles and were under common ownership until April 16, 1999. Three of these facilities including this Potrero Power Plant were sold and transferred to the Southern Energy Delta on April 16, 1999.

The applicant has applied to bank IERCs from the following source:

S-1 Boiler No. 3-1 Electric Generation, Riley Stoker Corporation, gas and oil fired, 2150 MMBTU/hr heat input.

The reductions in NO_x emissions are due to the addition of new controls and the innovative use of lower emitting combustion practices. These include:

1. Increased FGR rate for increased combustion air mass with a lower overall oxygen level. This acts as a diluent to lower the peak flame temperature which in turn lowers the actual thermal NO_x emissions. The FGR rate increased from 7-8% to 10-11%. The fan blades were modified to create more static pressure to induce an increase in flue gas volume. The fan motor and the ductwork were not modified.
2. Addition of dampers and partitions to windboxes to achieve better distribution of combustion air into the burners and the overfire air (OFA) ports.
3. Modified OFA system by adding additional OFA ports for better staging and off-stoichiometric firing.
4. Cold flow modeling was used to assure proper combustion balance and to avoid furnace stratification due to the above modifications.
5. Modified superheat section of the boiler to compensate for the higher FGR rate (less radiation, but more convective heat transfer).
6. Improved operating procedures and training of Operations and Maintenance personnel.

EMISSIONS CALCULATIONS

I. Baseline and Initial Generation Periods

The initial IERC generation period proposed starts on January 1, 1997 and ends on April 16, 1999. Per Regulation 2-9-602, the baseline period is the five-year period immediately preceding the initial credit generation period. Therefore the baseline period for this application is January 1, 1992 through December 31, 1996. Furthermore the initial credit generation period shall not be more than 30 months prior to the submittal of the first complete IERC banking application (Regulation 2-9-204). This IERC banking application was deemed complete on June 7, 1999. The initial IERC generation period chosen by PG&E complies with this requirement.

IERC generation period: January 1, 1997 through April 16, 1999

IERC baseline period: January 1, 1992 through December 31, 1996

II. Baseline Throughput

As per Regulation 2-9-602.2, the baseline throughput is the lesser of actual throughput or permitted throughput during the baseline period. Since there was no permit condition limiting the throughput of fuel during this period, the actual throughput of fuel reported by PG&E is used as the baseline throughput. The fuel throughput for the baseline period is summarized as follows:

<i>Calendar Year</i>	<i>Natural Gas Input</i>	<i>Oil Input</i>	<i>Total Input</i>
1992	10,294,803 MMBtu/yr	167,994 MMBtu/yr	10,462,797 MMBtu/yr
1993	10,866,177	516,956	11,383,133
1994	12,051,067	204,319	12,255,386
1995	8,168,192	0	8,168,192
1996	9,279,449	0	9,279,449
Total	50,659,688	889,269	51,548,957

The gas and oil throughput data above are summarized from EPA datagroups of the CEM (Continuous Emission Monitor) computers, which use hourly averages based on 15 minute averages. The raw CEM data can be accessed at the EPA website. The raw CEM data can be accessed at the EPA website. See Appendix A for data summaries. The CEMs are regularly source tested to verify compliance with District Regulation 1-522.6 that requires accuracy within 5% of CEM full scale or 10% of applicable emission standard (see Appendix B). The average fuel throughput for the baseline period is calculated to be **10,309,791 MMBtu/yr**.

III. Baseline Emissions and Emission Rate

A. Emission Rate

The NO_x emissions from boiler S-1 were measured by a CEM. As mentioned above, raw CEM data can be accessed at the EPA website. The average annual emission rates calculated from EPA datagroups are summarized below. Emissions and fuel data can be found in Appendix A.

<i>Calendar Year</i>	<i>Gas Emissions</i>	<i>Gas Emission Factor</i>	<i>Oil Emissions</i>	<i>Oil Emission Factor</i>
1992	863.93 ton/yr	0.1678 lb/MMBtu	28.93 ton/yr	0.3444 lb/MMBtu
1993	913.18	0.1681	87.27	0.3376
1994	971.15	0.1612	30.41	0.2977
1995	614	0.1503	0	NA
1996	734	0.1582	0	NA
Totals	4096.26		146.61	

The Emission rate for the baseline period is calculated as follows:

$$ER = [(4096.26 + 146.61 \text{ ton}) * (2000 \text{ lb/ton})] / (51,548,957 \text{ MMBtu}) = 0.1646 \text{ lb/MMBtu}$$

However, under the ATAECF, oil firing is not allowed (Regulation 9-11-309). Hence the emissions from oil firing must be adjusted to the levels that would have occurred if gas had been fired instead of oil by using the applicable gas emission factor:

$$\begin{aligned} 1992: & 0.1678 \text{ lb/MMBtu} \times 167,994 \text{ MMBtu} = 28,189 \text{ lb/yr} = 14.09 \text{ ton} \\ 1993: & 0.1612 \text{ lb/MMBtu} \times 516,956 \text{ MMBtu} = 83,333 \text{ lb/yr} = 41.67 \text{ ton} \\ 1994: & 0.1503 \text{ lb/MMBtu} \times 204,319 \text{ MMBtu} = 30,709 \text{ lb/yr} = \frac{15.35 \text{ ton}}{71.11 \text{ ton}} \end{aligned}$$

$$ER = [(4096.26 + 71.11 \text{ ton}) * (2000 \text{ lb/ton})] / (51,548,957 \text{ MMBtu}) = \mathbf{0.162 \text{ lb/MMBtu}}$$

The emission rate from firing natural gas is compared to District source test results (used to confirmed accuracy of CEMs) during the baseline period in the table below:

Date of Source Test	Results (ppmvd @ 3% O2)	Results (lb/MMBtu)
6/23/93	118	0.1405
1/25/94	118	0.1405
5/19/94	140	0.1667
2/1/95	111	0.1321
9/6/95	112	0.1333
3/7/96	149	0.1774
10/25/96	129	0.1536

The mean source test emission rate is 0.1492 lb/MMBtu with a standard deviation of 0.0174 (0.1318 to 0.1666 lb/MMBtu). Hence, the emission rate of 0.162 lb/MMBtu is consistent with District source tests results.

B. Baseline Adjusted Emission Rate

The baseline emission rate is required to be adjusted to Reasonably Available Control Technology (RACT) or Best Available Retrofit Technology (BARCT) in effect for S-1 during the credit generation periods as per District Regulation 2-9-603.1.1. Regulation 9-11-309.1 ATAECF requires all boilers in the electric power generating system to comply with the following system-wide NO_x emission rate limits during the respective credit generation periods: (1) 1997: 0.188 lb/MMBtu; (2) 1998: 0.160 lb/MMBtu, and (3) 1999: 0.115 lb/MMBtu. Therefore, except for the 1997 period (because the actual baseline emission rate is lower), baseline emission rates will be adjusted downward to these BARCT emissions rates. Baseline adjusted emission rates are thus:

$$\begin{aligned} CGP_1 &= \mathbf{0.162 \text{ lb/MMBtu}} \\ CGP_2 &= \mathbf{0.160 \text{ lb/MMBtu}} \\ CGP_3 &= \mathbf{0.115 \text{ lb/MMBtu}} \end{aligned}$$

C. Baseline Adjusted Emissions

Baseline adjusted emissions are calculated by multiplying the Baseline Adjusted Rate by the average fuel throughput for the baseline period pursuant to Regulation 2-9-603.1.2.

$$\begin{aligned} A_1 &= (0.162 \text{ lb/MMBtu})(10,309,791 \text{ MMBtu/yr})(1 \text{ ton} / 2000 \text{ lb}) &= \mathbf{835.1 \text{ tons}} \\ A_2 &= (0.160 \text{ lb/MMBtu})(10,309,791 \text{ MMBtu/yr})(1 \text{ ton} / 2000 \text{ lb}) &= \mathbf{824.8 \text{ tons}} \\ A_3 &= (0.115 \text{ lb/MMBtu})(10,309,791 \text{ MMBtu/yr})(1 \text{ ton} / 2000 \text{ lb})(90/365)^* &= \mathbf{146.2 \text{ tons}} \\ &\bullet \text{ adjusted for one quarter} \end{aligned}$$

D. ATAECF Compliance During Credit Generation Period

The S-1 boiler at the Potrero facility along with the boilers at the Hunters Point, Contra Costa and Pittsburg Power Plants are subject to the ATAECF for the years 1997, 1998 and until April 16, 1999. The Potrero, Contra Costa, and Pittsburg plants were transferred to Southern Energy Delta on April 16, 1999. The table below indicates PG&E was in compliance with the ATAECF with or without the Potrero boiler during the credit generation period.

Year	ATAECF Requirement	System-Wide (SW) Emissions	SW Emissions w/o Potrero Units
1997	0.188 lb/MMBtu	0.093 lb/MMBtu	0.089 lb/MMBtu
1998	0.160	0.087	0.085
1999*	0.115	0.067	0.063

* through 4/16/99

IV. Credit Generation Period (CGP) Actual Emissions

The CGP actual emissions are calculated with the same methodology as for baseline emissions using CEM data. There are three CGP periods consisting of (1) 1997 calendar year, (2) 1998 calendar year and (3) January 1 to April 16, 1999.

CGP	Total Heat Input	Emission Factor	NOx Emissions
1 (B ₁)	7,319,027 MMBtu/yr	0.133 lb/MMBtu	486.6 ton/yr
2 (B ₂)	11,391,214	0.104	591.1
3 (B ₃)	2,352,054	0.090	105.8

V. Comparison of CEM and District Databank Emissions Data

The table below compares emissions and emission rates from CEM data and the District's Databank (DB):

Year	CEM Gas Factor (lb/MMBtu)	DB Gas Factor (lb/MMBtu)	CEM Oil Factor (lb/MMBtu)	DB Oil Factor (lb/MMBtu)	CEM NOx emissions (ton/yr)	DB NOx emissions (ton/yr)
1992	0.168	0.200	0.3444	0.241	892.86	1006.74
1993	0.168	0.200	0.3376	0.241	1000.45	1114.58
1994	0.161	0.200	0.2977	0.241	1001.56	1183.35
1995	0.150	0.200			614.00	1183.35
1996	0.158	0.159			734.00	715.20
1997	0.089	0.159			486.60	563.49
1998	0.085	0.159			591.10	889.56

Note that the District Databank emission factor for natural gas combustion at S-1 has been modified only twice: (1) in or prior to 1992, and (2) in 1996. While the DB factor compares reasonably well with the CEM factor from 1992 through 1996, it has not been changed frequently enough to reflect the low NO_x modifications (see Background Section) performed on the boiler beginning in 1996. See Appendix C for data and calculations from which the results above are derived. Thus, the CEM data are deemed more reliable and accurate and therefore used in the calculation of the available IERC's at this facility.

VI. Credit Generation Period Non-Curtailment Emissions

The CGP non-curtailment emissions are derived by multiplying the average baseline throughput by the actual emissions rate pursuant to Regulation 2-9-603.1.4.

$$\begin{aligned} C_1 &= (10,309,791 \text{ MMBtu/yr})(0.133 \text{ lb/MMBtu})(1 \text{ ton}/2000 \text{ lb}) &= \mathbf{685.6 \text{ ton/yr}} \\ C_2 &= (10,309,791 \text{ MMBtu/yr})(0.104 \text{ lb/MMBtu})(1 \text{ ton}/2000 \text{ lb}) &= \mathbf{535.1 \text{ ton/yr}} \\ C_3 &= (10,309,791 \text{ MMBtu/yr})(0.090 \text{ lb/MMBtu})(1 \text{ ton}/2000 \text{ lb})(90/365)^* &= \mathbf{114.4 \text{ ton/yr}} \end{aligned}$$

** based on first quarter results*

VII. IERC

The Interchangeable Emission Reduction Credits (IERC) are calculated by subtracting the greater of B (CGP actual emissions) and C (CGP non-curtailment emissions) from A (baseline emissions) in accordance with Regulation 2-9-603.1.5.

Period 1 (1997): C is greater than B; thus the IERCs for this period are:

$$\text{IERC}_1 = 835.1 - 685.6 = \mathbf{149.5 \text{ tons}}$$

Period 2 (1998): B is greater than C; thus the IERCs for this period are:

$$\text{IERC}_2 = 824.8 - 591.1 = \mathbf{233.7 \text{ tons}}$$

Period 3 (1999): C is greater than B; thus the IERCs for this period are:

$$\text{IERC}_3 = 146.2 - 114.4 = \mathbf{31.8 \text{ tons}}$$

TOXICS RISK SCREENING ANALYSIS

There is no net increase in emissions of toxic compounds that will result from this IERC banking application. Therefore, a Toxics Risk Screening Analysis is not required.

STATEMENT OF COMPLIANCE

This application for IERCs is in compliance with Regulation 2, Rule 9, Interchangeable Emissions Reduction Credits. Emissions reductions at Source S-1 complies with the criteria in Regulation 2-9-301.1.1 as (1) S-1 boiler is a stationary source in the District Emission Inventory; (2) emission reductions are real, permanent, quantifiable, enforceable, surplus and are calculated from actual data and records. Emission reductions are achieved by implementation of low NO_x techniques and installation of low NO_x devices as described in the Background section of this evaluation. The NO_x emissions are monitored by CEMs that are checked regularly by the District Source Test Section; (3) S-1 is still operating and fully functional.

The initial IERC generation period, January 1, 1997 through April 16, 1999, is not more than 30 months prior to the submittal of the first complete banking application (deemed complete on June 7, 1999) and is therefore in compliance Regulation 2-9-204.

The baseline period, January 1, 1992 through December 31, 1996, is the five-year period immediately preceding the initial credit generation period. Therefore the baseline period for this application is in compliance with Regulation 2-9-602,

Regulation 2-9-603.1.1 requires the baseline emission rate to be adjusted to comply with the most stringent of (BARCT) Best Available Retrofit Control Technology and (RACT) Reasonably Available Control Technology. The BARCT/RACT determination for this application is the system

average emission rates required by Advanced Technology Alternative Emission Control Plan of Regulation 9-11.

Regulation 2-1-312.10 categorically exempts from CEQA review applications to bank emission reductions pursuant to Regulation 2, Rule 4 and Regulation 2, Rule 9 because such applications have no potential for causing a significant environmental impact.

RECOMMENDATIONS

It is recommended that the following IERC Certificates be issued to Pacific Gas and Electric Company for:

Location: Potrero Power Plant
1201 Illinois Street
San Francisco, CA 94107

Baseline Period: January 1, 1992 through December 31, 1996

Certificate #1: effective date: January 1, 1998, expiration date: December 31, 2002

Credit Generation Period January 1, 1997 to December 31, 1997
IERC₁ = 145.9 tons NO_x

Certificate #2: effective date: January 1, 1999, expiration date: December 31, 2003

Credit Generation Period January 1, 1998 to December 31, 1998
IERC₂ = 233.7 tons NO_x

Certificate #3: effective date: April 17, 1999, expiration date: April 16, 2004

Credit Generation Period January 1, 1999 to April 16, 1999
IERC₃ = 31.8 tons NO_x

by: _____ Date: _____
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