

EMISSION REDUCTION CREDIT ENGINEERING EVALUATION

Reviewed by: _____
Title: APCO
Date: _____

Applicant: **Lake Shore Mojave**

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Application No.: **0418001/101/401/
501** Project #: 130924

Location: 14486 Borax Road, Boron 93516 QS/T/R: SW23/T11N/R08W

Project Title: NO_x, PM₁₀ and VOC Emission Reduction Credits (ERC) for the shut down of a gas fired turbine engine.

App. Rec.: 09/24/2013 Deemed Complete: 03/07/2014
180 Days: 06/03/2014 Submittal Date: 03/11/2014

Evaluation By: Cherita Young

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I. **PROPOSAL:**

Lake Shore Mojave has requested to bank NO_x, VOC and PM₁₀ Emission Reduction Credits (ERCs) for the shutdown of one natural gas fired turbine (40 MW). Shutdown of the facility occurred on August 5, 2013. Bankable ERCs are required to be in excess of Eastern Kern APCD prohibitory Rule 425 (see Attachment A). Emission Reduction Credits (ERC) requested by the applicant have to comply with District Rule 210.3, including the definition of Actual Emission Reduction (AER) in Rule 210.1 which requires calculations to be completed in accordance with the procedures in Rule 210.1. The following emission reductions have been found to qualify for banking:

EMISSION REDUCTION CREDITS

	NOx	PM10	VOC
lb/mo:	21,184	531	657
lb/yr:	254,211	6,380	7,880

*Based on Averages from the last three years.

II. APPLICABLE RULES and REGULATIONS:

- A. Rule 210.1 - New and Modified Stationary Source Review (Amended 07/11/96)
 - 1) Provides calculation methods for Historical Actual Emissions (HAE) and Actual Emission Reductions (AER).
 - 2) Provides calculation methods for calculating Stationary Source Potential to Emit (SSPE) for NOx and VOC.

- B. Rule 210.3 – Emission Reductions Banking (Amended 5/2/96)
 - 1) Facilitate use of emission reductions by industry as tradeoffs or offsets for new or modified stationary sources of air contaminants, including transfer of ownership of such credits, and
 - 2. Provide the District with a means by which it can verify that such emissions reductions are surplus, permanent, quantifiable and enforceable.

C. Rule 425 - Cogeneration Gas Turbine Engines (Oxides of Nitrogen) (Adopted 8/16/93)

Emissions for a gas turbine engine rated over 10 MW driving a cogeneration operation shall not exceed the following:

For Westinghouse 251B10 gas turbine with Authority to Construct issued before 1/1/83 using dry low-NOx combustors to meet January 1, 1997 limits:

$$NOx(ppmv) = 20 ppmv \times \left(\frac{EFF}{25} \right), \text{ Gas fired}$$

$$NOx(ppmv) = 45 ppmv \times \left(\frac{EFF}{25} \right), \text{ Oil fired}$$

Percent EFF (efficiency) shall be the higher of EFF₁ or EFF₂ below.

An EFF less than 25 shall be assigned a value of 25.

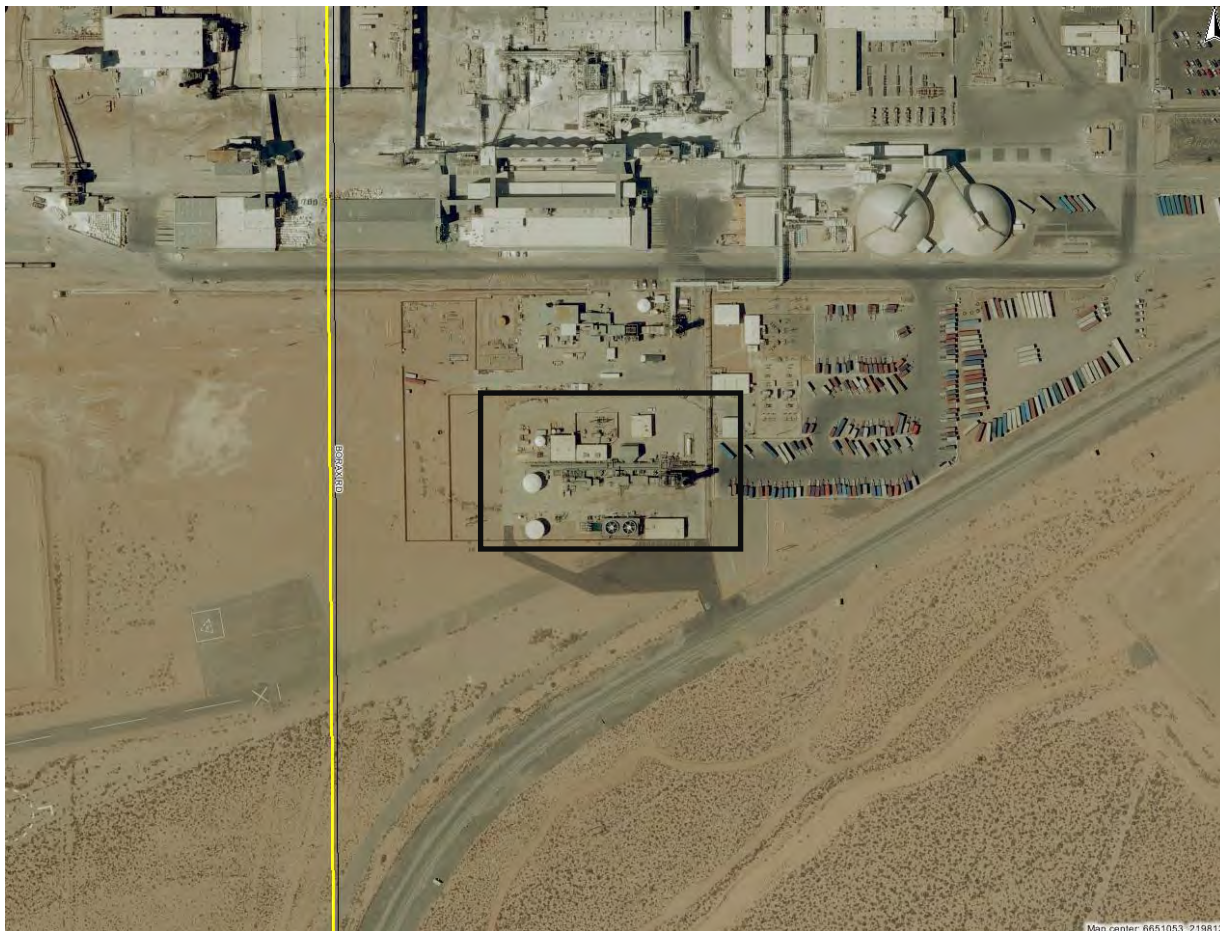
EFF₁ = 3412 Btu/kW-hr x 100% / Actual Heat Rate at HHV, Btu/kW-hr

EFF₂ = EFF_{mfr} x LHV/HHV; Where EFF_{mfr} is the manufacturer's continuous rated percent thermal efficiency of the gas turbine engine

III. EQUIPMENT LISTING (PERMIT NO. 0418001C):

- A. 519.53 MM Btu/hr Westinghouse Model CW251 B-10 input natural gas or fuel oil-fired 40 MW gas turbine with inlet air filter and evaporative cooler;
- B. Turbine combustor steam injection system for NO_x control;
- C. Unfired heat recovery steam generator;
- D. Selective catalytic reduction (SCR) NO_x control system utilizing ammonia;
- E. 15 MW steam turbine generator; and
- F. Mist eliminator in gas turbine/generator and steam turbine/generator lube oil reservoir vapor extractor vent.

IV. EQUIPMENT LOCATION):



Location: 14486 Borax Road, Boron 93516

V. METHOD OF GENERATING REDUCTIONS:

The reductions are generated through the shutdown of the power generating plant, Lake Shore Mojave. The shutdown of the plant will result in reductions in NOx, PM₁₀ and VOC.

VI. ERC CALCULATIONS:

A. Assumptions and Emission Factors:

1. Actual Emission Reductions were based on annual fuel use data, source test data for the same or closest year.
2. Used emission factors represented in lb/hour and lb/MMscf.
3. Heat recovery for subject gas turbine engine is sent to a steam turbine for power generation.
4. Rule 425 limit based on the following equation:

$$R425_{Limit} = 20 ppmv \times \left(\frac{EFF}{25} \right)$$

Where EFF is demonstrated percent thermal efficiency of the gas turbine engine only, calculated from the actual heat input (using HHV) without consideration of any downstream energy recovery. EFF is the greater of EFF₁ and EFF₂ below.

$$EFF_1 = \frac{3412 \text{ Btu} / \text{kW} \cdot \text{hr}}{\text{Heat} \cdot \text{Input} \text{ Btu} / \text{kW} \cdot \text{hr}} \times 100\%$$

and

$$EFF_2 = EFF_{Mfr} \times \frac{LHV}{HHV}$$

where:

EFF_{Mfr} = Manufacturer's quoted efficiency
 LHV = Lower heating value of natural gas.
 HHV = Higher heating value of natural gas.

5. Actual Emission Reductions (AER) from Rule 210.1:
 $AER = HAE$

B. Baseline Period Determination and Data:

Baseline period for this project (in accordance with Rule 210.1, Subsection II.F.2) is three consecutive within the past 5 years (July 2008 to August 2013). For this project the baseline period shall be from July 2010 to August 2013.

Data acquired during the baseline period was used to calculate emissions reductions. Applicant submitted fuel use data from the cogeneration operation from July 2010 to August 2013.

FUEL USE DATA (MMscf):				
2010 (8/1-12/31)	2011	2012	2013 (1/1-7/31)	Total
1523.157	3380.764	3481.863	736.337	9122

Higher Heating Value (HHV): 1028

Lower Heating Value (LHV): 1007

C. NOx Rule 425 Limit Calculations:

Heat Input Calculations Example:

9,122 Mscf. * 1028 Btu/scf = 9,377,416 MMBtu

9,377,416 MMBtu / 21,685 hours = 432.44 MMBtu/hr

MMBtu / 3 years	Hours / 3 years	Heat Input MMBtu/hr
9,377,416	21,685	432.44

Rule 425 emission levels are calculated using formulas in Subsection VI.A.4 above. Conversion of ppmv limits to lb/MMBtu limits was completed using the following formula:

$$lb / MMBtu = \frac{[(ppmv) \times (F @ 60^\circ F) \times (MW)]}{(20.9 - \%O_2)} \times 0.55 \times 10^{-7} .$$

Where:

MW = molecular weight of NOx (46);

Fuel F-Factor @ 60°F = 8494 dscf/MMBtu;

%O₂ = 15%;

ppmv = R425limit (varying)

Calculation of EFF1:

$$Heat \cdot Input = \frac{432.44 \frac{MMBtu}{hr}}{40MW} = \frac{432,440,000 \frac{Btu}{hr}}{40,000kW} = 10,811 \frac{Btu}{kW \cdot hr}$$

$$EFF_1 = \frac{3412 \frac{Btu}{kW \cdot hr}}{10,811 \frac{Btu}{kW \cdot hr}} \times 100\% = 31.56\%$$

Calculation of Rule 425 limit:

$$Rule425_{limit} = 20 ppmv \times \left(\frac{31.56}{25} \right) = 25.25 ppmv$$

Conversion of ppmv to lb/MMBtu:

$$lb / MMBtu = \frac{(25.25 \times 8494 \times 46)}{(20.9 - 15\%)} \times 0.55 \times 10^{-7} = 0.092$$

$$EFF_2 = EFF_{mfr} \times \frac{1007}{1028} = 26.01$$

RULE 425 EMISSION LIMITS

EFF1	EFF2	Rule 425 (ppmv)	Rule 425 (lb/MMbtu)	Heat Input (btu/kW-hr)
31.56%	26.01	25.25	0.092	10,811

EFF₁ is always greater than EFF₂; therefore, EFF₁ was used in calculation of Rule 425 emission limits.

NOx Emission Factors (lb/hr) (gathered from annual source test data):

year	lb/hr
2010	10.9
2011	11.41
2012	12.14
2013	12.78

PM₁₀ Emission Factor: 2.1 lb/MMscf

VOC Emission Factor: 2.59 lb/MMscf

- Emission factors for PM₁₀ and VOC were gathered from South Coast Annual Emission Report 2012 for a similar gas turbine from the Carson Cogeneration Company

D. Actual Emission Reductions:

Because this is a shutdown of the facility the Actual Emissions Reductions (AER) is equal to the Historical Actual Emissions (HAE)

$$AER = HAE = AHO * NER$$

Where;

AHO = Annual Hours of Operation (hours/year)

NER = NOx Emission Rate (lb/hour)

NOx YEARLY ACTUAL EMISSION REDUCTIONS

Year	hours/year	NOx Emission Rate (lb/hr)	AER lb/ year	
2010	3469	10.9	37,812.10	
2011	8052	11.41	91,873.32	
2012	8391	12.14	101,866.74	
2013	1773	12.78	22,658.94	
	total		254,211.10	lb
			127.11	tons
		average	42.37	ton/yr

Average Annual Fuel Use (MMscf) – 3040.67

PM₁₀ Actual Emission Reduction

$$2.1 \frac{lb}{MMscf} \times 3040.67 MMscf \times \frac{1 ton}{2000 lb} = 3.19 \frac{ton}{year}$$

VOC Actual Emission Reduction

$$2.59 \frac{lb}{MMscf} \times 3040.67 MMscf \times \frac{1 ton}{2000 lb} = 3.94 \frac{ton}{year}$$

Emission Reduction (ton/year)

NOx	PM ₁₀	VOC
42.37	3.19	3.94

VII. CONCLUSIONS:

- A. Rule 210.1:
Baseline Period, Historical Actual Emissions (HAE) and Actual Emission Reductions (AER) were calculated in accordance with Rule 210.1, Subsections II.F; IV.A; and IV.C. Emission reductions comply with requirements of Rule 210.1.

- B. Rule 210.3:
The emission reduction credits were examined to determine if the credits comply with the requirement of Rule 210.3. The following was determined:
 1. Real: The plant is no longer in operation, therefore the actual emission reduction is real.

 2. Surplus: Reductions are generated by the closure of the plant, there are no emissions currently being created.

 3. Permanent: Reductions are required to be enforceable by permit conditions. Therefore, upon issuance of the ERC, the Permit to Operate (PTO) is longer valid because the plant is no longer in operation.

 4. Quantifiable: Actual fuel use data and data from source tests were used to quantify historical actual emissions. Historical actual emissions were used to determine the actual emission reductions. Therefore, actual emission reductions were quantifiable.

 5. Enforceable: The plant is no longer in operation and PTO will be cancelled. This company is no longer allowed to operate at this site, unless another permit is obtained.

- C. Rule 425:
Emission limits for gas turbine engine shall comply with requirements of Rule 425. Proposed emission limit for gas turbine engine is 19 ppmv. Given proposed emission limit is maintained, gas turbine engine shall comply with requirements of Rule 425.

VIII. RECOMMENDATION:

Upon completion of mandatory 30 day public notice period, issue Emission Reduction Credit Certificate:

ERC No.	Location	For Unit (PTO)
0418001/101/401/501	14486 Borax Road, Boron SW23/T11N/R08W	1004077H

ATTACHMENT A

Draft ERC



EMISSION REDUCTION CREDIT CERTIFICATE EASTERN KERN AIR POLLUTION CONTROL DISTRICT

Administrative Office: 2700 "M" Street Suite 302, Bakersfield, CA 93301
 Phone: (661) 862-5250 • Fax: (661) 862-5251 • ekapcd@co.kern.ca.us
 Tehachapi Field Office: Phone: (661) 823-9264 • Fax: (661) 823-0167

ISSUE DATE: APRIL XX, 2014	APPLICATION NO.: 0418001/401
EXPIRATION: APRIL XX, 2016	DATE: SEPTEMBER 24, 2013

EMISSIONS REDUCTION CERTIFICATE IS HEREBY GRANTED TO:

LAKE SHORE MOJAVE

If this AUTHORITY TO CONSTRUCT is reissued to a new owner, any emissions increase assigned to this equipment during the initial New Source Review Process remains with initial bearer of this document.

ACTUAL HISTORICAL ERC:

Pollutant: Oxides of Nitrogen (NO_x)

Amount: 42.37 tons per year

Rough Draft

(See attached sheets for equipment description and conditions)

S SW23	T 11N	R 08W	Location: 14486 Borax Road, Boron, California
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This Emission Reduction Credit (ERC) can only be used in accordance with Eastern Kern Air Pollution Control District New Source Review Rule (NSR) and Federal Requirements.

Validation Signature:

Glen E. Stephens, P.E.
Air Pollution Control Officer



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LAKE SHORE MOJAVE

If this AUTHORITY TO CONSTRUCT is reissued to a new owner, any emissions increase assigned to this equipment during the initial New Source Review Process remains with initial bearer of this document.

ACTUAL HISTORICAL ERC:

Pollutant: Particulate Matter

Amount: 3.19 tons per year

Rough Draft

(See attached sheets for equipment description and conditions)

S SW23	T 11N	R 08W	Location: 14486 Borax Road, Boron, California
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ACTUAL HISTORICAL ERC:

Pollutant: Volatile Organic Compounds (VOC)

Amount: 3.93 tons per year

Rough Draft

(See attached sheets for equipment description and conditions)

S SW23	T 11N	R 08W	Location: 14486 Borax Road, Boron, California
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Validation Signature:

 Glen E. Stephens, P.E.
 Air Pollution Control Officer

ATTACHMENT B

Emission Data

**Mojave Cogeneration Company, L.P.
 Boron Cogeneration Facility
 40.0 MW Turbine**

**Project 272-6806
 January 29, 2010**

Mojave Cogeneration CEM Summary

Run	Time	% O2	NOx @ 15% O2	NOx lb/hr	CO lb/hr
1	08:35 - 09:36	14.99	5.0	9.9	1.4
2	09:47 - 10:48	15.00	6.2	12.0	1.3
3	11:02 - 12:03	14.95	5.9	11.8	1.4
4	12:14 - 12:44	15.03	6.0	11.9	1.3
5	12:54 - 13:24	14.87	6.3	12.9	1.3
6	13:34 - 14:04	14.82	6.2	12.7	1.4
7	14:10 - 14:40	15.35	5.1	8.9	1.2
8	15:10 - 15:40	15.54	5.7	9.1	1.1
9	15:49 - 16:19	15.53	5.7	9.2	1.1
Average		15.12	5.8	10.9	1.3

AEROS ENVIRONMENTAL, INC.
Summary Of Results

EIF Mojave, LLC
 Boron Cogeneration Facility
 40.0 MW Turbine

Project 272-7187
 January 19, 2011
 PTO No. 0418001C

Pollutant	ppm	ppm @ 15% O ₂	lb/hr	lb/day	Permit Limits	
NOx	5.67	6.01	11.42	274.01	8.33 ppm @ 15% O ₂ 15.00 lb/hr 814 lb/day 49.99 tons/yr	
	5.40	5.72	11.11	266.63		
	5.61	5.97	11.70	280.78		
	<i>Mean runs 1-3</i>	5.56	5.90	11.41		273.81
CO	1.27	1.35	1.56	37.45	23.0 lb/hr 552 lb/day 99.99 tons/yr	
	1.21	1.29	1.52	36.47		
	1.15	1.23	1.46	35.09		
	<i>Mean runs 1-3</i>	1.21	1.29	1.51		36.34
NH ₃	5.06	5.37			20 ppm @ 15% O ₂	
	6.89	7.27				
	7.54	8.02				
	<i>Mean runs 1-3</i>	6.49	6.89			
RATA and RAA Results						
Instrument	Aeros	Mojave	Diff	% RM	% AS	RATA & RAA Limits
O ₂ % Vol	15.35	15.18	0.16			1% Diff
NOx @ 15% O ₂	6.03	5.5	0.48	9.02	6.53	20% RM or 10% AS
NOx lb/hr	11.75	10.2	1.52	14.71	11.52	20% RM or 10% AS
CO lb/hr	1.49	1.3	0.19		0.93	10% RM or 5% AS
NH ₃ ppm	6.49	6.9	0.41	6.32		15% RAA or 7.5% AS

AEROS ENVIRONMENTAL, INC.

Summary Of Results

Lake Shore Mojave, LLC
Cogeneration Facility
40.0 MW Turbine

Project 272-7703
January 18, 2012
PTO No. 0418001C

Pollutant	ppm	ppm @ 15% O ₂	lb/hr	lb/day	Permit Limits	
NOx	5.44	5.62	11.23	269.52	8.33 ppm @ 15% O ₂ 15.00 lb/hr 814 lb/day 49.99 tons/yr	
	5.91	6.15	12.39	297.41		
	6.10	6.36	12.81	307.50		
	<i>Mean runs 1-3</i>	5.82	6.04	12.14		291.48
CO	0.62	0.64	0.78	18.75	23.0 lb/hr 552 lb/day 99.99 tons/yr	
	0.67	0.70	0.86	20.52		
	0.68	0.71	0.87	20.77		
	<i>Mean runs 1-3</i>	0.66	0.68	0.83		20.01
NH ₃	5.71	5.91			20 ppm @ 15% O ₂	
	5.99	6.20				
	7.43	7.76				
	<i>Mean runs 1-3</i>	6.38	6.62			
RATA and RAA Results						
Instrument	Aeros	Mojave	Diff	% RM	% AS	RATA & RAA Limits
O ₂ % Vol	15.21	15.11	0.10			1% Diff
NOx @ 15% O ₂	5.96	5.6	0.33	6.32	4.52	20% RM or 10% AS
NOx lb/hr	11.86	11.1	0.72	9.26	7.32	20% RM or 10% AS
CO lb/hr	0.80	0.9	0.14		1.25	10% RM or 5% AS
NH ₃ @ 15% O ₂	6.62	3.9	2.72	41.1	13.6	15% RAA or 7.5% AS

AEROS ENVIRONMENTAL, INC.

Summary Of Results

**Lake Shore Mojave, LLC
Cogeneration Facility
40.0 MW Turbine**

**Project 272-8133
February 7, 2013
PTO No. 0418001C**

Pollutant	ppm	ppm @ 15% O ₂	lb/hr	lb/day	Permit Limits	
NOx	6.81	7.07	13.79	330.99	8.33 ppm @ 15% O ₂ 15.00 lb/hr 814 lb/day 49.99 tons/yr	
	5.75	5.92	11.74	281.88		
	6.26	6.42	12.79	307.01		
	<i>Mean runs 1-3</i>	6.28	6.47	12.78		306.63
CO	0.55	0.57	0.68	16.31	23.0 lb/hr 552 lb/day 99.99 tons/yr	
	0.58	0.59	0.72	17.21		
	0.61	0.63	0.76	18.28		
	<i>Mean runs 1-3</i>	0.58	0.60	0.72		17.26
NH ₃	5.93	6.16			20 ppm	
	6.63	6.82				
	6.42	6.59				
	<i>Mean runs 1-3</i>	6.33	6.52			
	ppm		gr/100scf	lb/hr		
Fuel Sulfur	As H ₂ S in Fuel Gas		As SO ₂ in Stack Exhaust	As SO ₂ in Stack Exhaust	0.75 gr/100 scf	
	<1		<0.06	<0.073		
RATA and RAA Results						
Instrument	Aeros	Mojave	Diff	% RM	% AS	RATA & RAA Limits
O ₂ % Vol	15.16	15.07	0.09			1% Diff
NOx @ 15% O ₂	6.26	5.6	0.63	12.38	9.31	20% RM or 10% AS
NOx lb/hr	12.38	10.7	1.68	15.84	13.08	20% RM or 10% AS
CO @ 15% O ₂	0.61	0.6	0.01	5.06	N/A	10% RM or 5% AS
CO lb/hr	0.73	0.7	0.03	8.13	0.26	10% RM or 5% AS
NH ₃ , ppm	6.33	4.4	1.96	31.0	9.8	15% RAA or 7.5% AS