El Paso Pipeline Group
Plant Services Department
1001 Louisiana Street
Houston, TX 77002
(713) 420-2344

February 15, 2011

Pima County Department of Environmental Quality;
Attn: Ms. Teresa Sobolewski, Air Program Manager; 33 N. Stone, Suite 730, Tucson, AZ 85701

Tracking # 1Z7701651395473273

US EPA Region IX
Director, Air Division (Attn: AIR-1)
75 Hawthorn Street
San Francisco, CA 94105

Tracking # 1Z7701651398718682

RE: El Paso Natural Gas Vail Station Test Report (Permit No. 425)

The Plant Services Department of El Paso Pipeline Group would like to submit the attached emission test report. Testing was performed on three (3) General Electric M3002-RA Natural Gas Fired Gas Turbines located at the El Paso Natural Gas (EPNG) Vail Compressor Station, Pima County, Arizona.

The purpose of the test as stated in the protocol is to satisfy the requirements of Permit Nos.425. There were no deviations from the submitted test protocol. Testing was completed on February 2, 2011.

If you have any questions or comments please feel free to contact me as indicated below.

Thank You,

Jared North
El Paso Pipeline Group
Office: (713) 420-5436
Cell: (713) 819-8124
jared.north@elpaso.com

"As required by the Pima County Air Quality Control Code PCC 17.12.180.a.5. and PCC 17.12.210.A.2 , I hereby certify that, based on information provided after reasonable inquiry of El Paso Natural Gas Company staff, the information contained in this submittal is true, accurate, and complete to the best of my understanding."

Signature of Responsible Official: _____

Print Name: **Jesus Soto, Jr.**

Date: 2/23/11

Enclosure – Emissions Test Protocol

Carbon copy – for respective environmental files
Les Ragland –Vail Compressor Station
Mechanical Testing Group File # 11-003

Electronic carbon copy - FYI
Vince Brindley – Corporate Environmental
Anu Pundari – Field Environmental
Don Cantrell – Area Manager
Les Ragland – Area Supervisor
Nathan Applewhite – Reliability Superintendent
Mike Garcia – Reliability Engineer
Tommy Hall – Reliability Specialist
Donny Gray – Maintenance Planner
Dennis Randolph – Maintenance Planner
Jeffrey McCluer – Maintenance Planner
Kevin Johnson – Gas Control
Ronnie Ford – Gas Control
Chris Nowak – Mechanical Testing Group Manager
Rob Melloy – Emission Logistical Coordinator
James Trent – Emission Team Supervisor

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Plant Services Department
1001 Louisiana Street
Houston, TX 77002
(713) 420-2344

Emissions Test Report

Three (3) General Electric M3002-RA Natural Gas Fired Gas Turbines

Permit No: 425

Mechanical Testing File #11-003

El Paso Natural Gas Company
Vail Compressor Station
Tucson, Arizona

Date: **February 15, 2011**

Prepared for: **Pima County Department of Environmental Quality**

Prepared by: **Jared North**
Mechanical Testing Group
(713) 420-5436

Reviewed by: **Jeremy Nye**
Mechanical Testing Group
(713) 420-5664

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Introduction

The Plant Services Department of El Paso Pipeline Group conducted source emissions testing at the Vail Compressor Station in fulfillment of operating permit conditions (Permit No: 425)

Table 1 presents the emission species measured during the testing along with emission limits. The test was conducted in basic accordance with approved Environmental Protection Agency (EPA) test methods as described in the Code of Federal Regulations, Title 40, Part 60 and EP's protocol.

Testing occurred the week of January 31, 2011 as proposed by the test protocol submitted to the Pima County Department of Environmental Quality (DAQ). Testing was performed by Jeremy Nye (EP) and Tommy Hall (EP).

Table 1. Emissions units and requirements.

Unit	Engine Type	Emission Species	Applicable Limits	Applicable Methods	Test Date
A-01	General Electric M3002-RA Natural Gas Fired Gas Turbines	NOx CO	NA	Method 7E Method 10	February 1, 2011
A-02					February 2, 2011
A-03					February 2, 2011

FACILITY INFORMATION

Facility: El Paso Natural Gas Company
Vail Compressor Station
10200 South Rita Road
Tucson, Arizona 85706

Contact: Ms. Anu Pundari
El Paso Natural Gas
5151 E. Broadway, Suite 1680
Tucson, Arizona 85711
(520) 663-4222

PLANT SERVICES INFORMATION

Location: El Paso Pipeline Group
Plant Services Department
1001 Louisiana Street
Houston, TX 77002

Contact: Jared North
Mechanical Testing Group
(713) 420-5436

Test Summary

As stated in the submitted protocol each engine's exhaust gas was sampled continuously to determine NO_x, CO and O_2 concentrations for 3-20 minute test runs for the turbine units per subpart KKKK. A summary of results from the units are depicted in the tables below.

Table 2. Emissions Summary, Unit 1A Turbine.

Run	1	2	3	AVG
Date	2/1/2011			
% HP Speed	99.70	99.72	99.67	**99.69**
% Load	71.3	74.2	75.7	**73.7**
NOx (ppm) bias corrected	51.03	51.63	51.84	**51.50**
NOx (ppm@15%O2)	108.71	108.89	110.04	**109.21**
NOx (lb/hr)	26.92	26.96	27.19	**27.02**
CO (ppm) bias corrected	13.56	14.13	14.30	**14.00**
CO (ppm@15%O2)	28.89	29.81	30.36	**29.69**
CO (lb/hr)	4.35	4.49	4.57	**4.47**

Table 3. Emissions Summary, Unit 2A Turbine.

Run	1	2	3	AVG
Date	2/2/2011			
% HP Speed	86.90	86.96	86.96	**86.95**
% Load	80.8	79.0	85.0	**81.6**
NOx (ppm) bias corrected	34.67	34.61	34.61	**34.63**
NOx (ppm@15%O2)	92.31	92.47	93.40	**92.73**
NOx (lb/hr)	18.36	18.22	18.31	**18.30**
CO (ppm) bias corrected	27.03	26.70	26.76	**26.83**
CO (ppm@15%O2)	71.98	71.32	72.22	**71.84**
CO (lb/hr)	8.71	8.55	8.62	**8.63**

Table 4. Emissions Summary, Unit 3A Turbine.

Run	1	2	3	AVG
Date	2/2/2011			
% HP Speed	86.9	86.95	87.0	**86.96**
% Load	66.2	64.3	59.3	**63.2**
NOx (ppm) bias corrected	36.03	35.47	35.13	**35.54**
NOx (ppm@15%O2)	85.63	94.85	94.41	**91.63**
NOx (lb/hr)	16.76	18.25	17.99	**17.66**
CO (ppm) bias corrected	22.31	22.40	22.63	**22.44**
CO (ppm@15%O2)	53.02	59.91	60.80	**57.91**
CO (lb/hr)	6.32	7.02	7.05	**6.79**

Emissions Sampling Process

PROCESS DESCRIPTION

The GE M3002-RA are regenerative cycle, natural gas fired, two shaft turbines. In a simple cycle turbine, filtered atmosphere air is first compressed by the axial flow compressor. The hot compressed air is then fired with natural gas in the combustor. The hot exhaust gases expand through two turbine stages. The high pressure (HP) turbine drives the axial flow air compressor while the low pressure turbine (LP) drives the centrifugal pipeline compressor. The pipeline gas compressor moves natural gas through the pipeline by compressing it from an initial "suction" state to a more compressed "discharge" state.

EMISSIONS TEST VEHICLE

The Plant Services department has conducted emissions tests on reciprocating engines and turbines for many years. This testing experience has enabled the Plant Services Department to design and assemble an accurate and versatile emissions test vehicle (ETV). The ETV is one of two environmentally controlled box trailers housing all analyzers, computers and auxiliary equipment.

A National Instruments Data Acquisition Control System (DACS) scans instrument outputs. The data is transferred to a computer for analysis and storage. The computer monitors the readings in real-time and outputs the data averages to a video monitor and the hard drive. In addition, electronic strip chart channels are available as a visual aid and back up to the data recording system. Copies of the strip chart data will be included in the final report.

All instruments and transducers used in the ETV are designed to produce a near linear response. The DACS samples the response (amperage) from the instruments. The computer converts the amperage into engineering units by multiplying the amperage by a slope and adding an intercept. For the analyzers, the slope and intercept are to be generated by introducing a zero concentration of gas (zero grade nitrogen for NO_x, CO and O_2 analyzers) and then a known span gas. A linear fit is then applied and the response is recorded.

SAMPLING SYSTEM

Continuous analyzers were used to determine the nitrogen oxides (NO_x), carbon monoxide (CO), and oxygen (O_2). Available instrumentation and analyzers are listed in **Table 5**. Brand names and specific models are for reference only and instruments of equal nominal performance may be substituted from time to time.

Exhaust gas enters the system through a stainless steel probe, a 3-way sample valve assembly, and a glass wool filter. The sample is transported via a heat-traced Teflon sample line through a stainless steel sample pump, and into a minimum contact condenser specially designed to dry the sample. The sample is then passed through 3/8" Teflon tubing to a Balston Microfibre coalescing filter and then to the sample manifold. The sample manifold is maintained at a constant pressure by means of a pressure bypass regulator. Stainless steel needle valves control the sample flow to each analyzer. See **Figure 1** for the flow schematic.

Table 5: Available Instrumentation

Parameters	Manufacturer / Model	Detection Principle	Range	Number
NOx	Thermo-Environmental Model 42i	Thermal reduction of NO2 to NO. Chemiluminescent reaction of NO with O3	Variable to 10,000 ppm	2
CO	Thermo-Environmental Model 48i	NDIR with Gas Filter Correlation	Variable to 10,000 ppm	2
CO_2	Servomex Model 1440	NDIR	0 to 25%	2
O_2	Servomex Model 1440	Paramagnetic	0 to 25%	2
Barometric Pressure	Viatran 346DH		20 – 31 "Hg	2
Wet/Dry Temperature Humidity	Vaisala Model HMT 330		-40 F to 140 F 0% - 100%	1

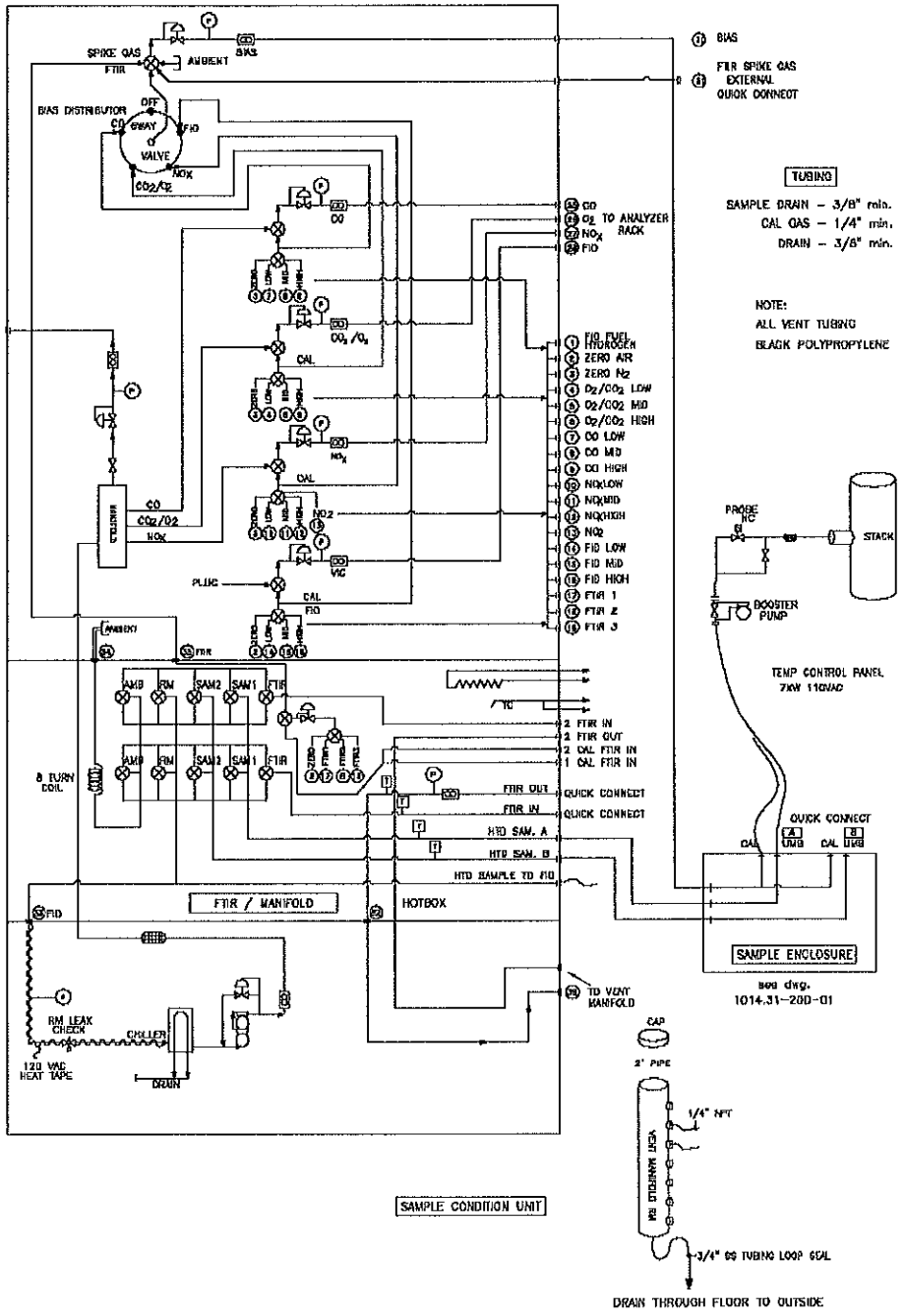

Figure 1: Sample System Schematic

General Testing Procedure

EPA reference methods, as described in 40CFR60 Appendix A, were followed to conduct this test. Compliance of emission rates were determined by the procedures described in Method 20 (turbine) for Oxides of Nitrogen and Method 10 for Carbon Monoxide. Dilution concentration of exhaust oxygen was determined by Method 3A. Determination of mass emission rates was determined by Method 19. Calibration and test procedures are detailed under their respective sections of the GENERAL TESTING PROCEDURE portion of this report.

INSTRUMENT CHECKS AND CALIBRATIONS

The following instrument checks and calibrations guarantee the integrity of our sampling system and the accuracy of our data.

EPA PROTOCOL GASES (40CFR60A – M7E.7.1)

Calibration sheets for EPA certified calibration gases are included in the test report APPENDICES.

DETERMINATION OF STRATIFICATION (40CFR60A – M7E.8.1.2)

For the three (3) General Electric M3002-RA Natural Gas Fired Gas Turbines a stratification test was performed using the sample probe prior to the first test run. Three points on a line passing through the centroidal area were used, spaced at 16.7, 50.0, and 83.3 percent of the measurement line. The sampling time was twice the system response time at each traverse point. Since the concentration at each traverse point was not within +/-5% or +/-0.5 ppm of the mean concentration, the gas stream is considered stratified and three sample points were used, spaced at 16.7, 50.0, and 83.3 percent of the measurement line.

INTERFERENCE RESPONSE (40CFR60A – M7E.8.2.7)

Vendor instrument data concerning interference response in the NO_x and O_2 analyzers are included in the test report APPENDICES.

ANALYZER CALIBRATION ERROR TEST (40CFR60A – M7E.8.2.3)

The measurement system was first prepared for use. Each analyzer was set to the correct response and that response was recorded by the data acquisition system. A calibration curve was then established to convert each analyzer's response to equivalent gas concentrations as introduced to each analyzer. Then zero, mid and high calibration gases were introduced without adjustment to the analyzers and their responses was recorded. These linearity checks were performed daily, and their responses were considered acceptable if they were within +/- 2 percent of the span. This curve remains unchanged throughout the test. The analyzer calibration checks (linearity) sheets are included in the APPENDICES.

NO_2 TO NO CONVERSION EFFICIENCY (40CFR60A – M7E.8.2.4)

An NO_2 to NO conversion efficiency test was performed once upon arrival at the site daily and followed the procedure described in 40CFR60 Section 8.2.4. The results of the conversion efficiency test are included in the APPENDICES.

SAMPLE LINE LEAK CHECK

The sample line was leak checked before and after the test by closing the calibration valve assembly while the sample pump is operating. Once the maximum vacuum is reached (approximately 12 - 15 inches of mercury) the valve on the pressure side of the pump was closed (See

Figure 1) thus sealing off the vacuum section of the sampling system. The leak tests for each unit were considered acceptable if the vacuum gauge reading drops by an amount less than 1 inch of mercury over a period of 1 minute.

RESPONSE TIME TEST (40CFR60A – 7E.8.2.6)

Before sampling begins, it was determined if the high-level or mid-level calibration gas best approximates the emissions and it was used as the upscale gas. A response time test was performed by first introducing the zero gas into the sample system at the outlet of the probe until all readings are stable. The calibration valve was then switched to sample the upscale gas at the outlet of the probe until a stable reading was obtained, within 5% of the certified value of the upscale gas. The upscale response time was recorded. Next, the low-level gas was introduced in the same manner as the upscale gas. Once a stable reading is noted, within 5% of the certified value of the low-level gas, the downscale response time was recorded.

This process was completed once per analyzer to determine upscale and downscale responses. The greater of the upscale response or downscale response was classified as the response time and all test points will be monitored for a period of time no less than twice the response time. The response check forms are included in the APPENDICIES.

SYSTEM BIAS CHECK (40CFR60A – M7E.8.2.5 & M7E.8.5)

Before sampling begins, the upscale gas was determined as mentioned in the *Response Time Test* section. The system bias check was conducted once prior to and once following the test runs and consisted of first introducing the NO_x analyzer's upscale gas directly at the analyzer. The analyzer was allowed to stabilize and the reading noted. The same gas was then introduced at the probe, passing through the entire sample train to the analyzer, and the reading noted. The resulting readings indicated any bias attributed to the sample train. This process was repeated with the NO_X analyzer's zero gas. The bias check was considered acceptable if the direct gas reading of the analyzer is within +/- 5% of the complete sample train reading of the analyzer [per 7E.13.2].

This same procedure was repeated for the CO and O_2 analyzers. Sample system bias check forms are included in the APPENDICIES.

Bias checks before and after each test run were used to determine a zero and span drift for the NO_x, CO and O_2 analyzers. The zero and span drift for the test run period will be less than +/- 3 percent of the span value for each of the analyzers [per 7E.13.3] The calibration forms and data sheets for each test are included in the APPENDICES.

CHART RECORDING

A copy of the chart recordings for the tests are labeled and included in the APPENDICES.

EMISSIONS TESTING

SAMPLE LOCATION AND SET-UP

A single point probe consisting of 3/8 inch stainless tubing open at one end was used to collect the samples. The sampling point in the exhaust stack was at least two stack diameters downstream from any flow disturbance and at least one-half stack diameters upstream from any flow disturbance.

FUEL GAS ANALYSIS

A fuel gas sample was taken during the testing. The sample was analyzed by the pipeline gas chromatograph. This analysis gives the actual specific gravity and BTU so that fuel flow and mass emissions can be accurately calculated. The data sheet for the analysis is included in the APPENDICES.

COMPLIANCE TEST RUNS

Each engine's exhaust gas was sampled continuously to determine NO_x, CO and O_2 concentrations for 3-20 minute test runs for the turbine unit per subpart KKKK at each unit's maximum load condition. The sampling point(s) were determined by the *Determination of Stratification* section above. The maximum possible load depended on the ambient and pipeline conditions available during the test. Other important parameters such as compressor suction and discharge pressures, engine speed, and ambient conditions were monitored during the test.

Fuel use for each turbine was calculated from AGA specified equations by monitoring the temperature, static pressure and differential pressure from an AGA specified orifice meter. These calculations are detailed in the CALCULATIONS section.

Data summaries, raw data, calibration sheets, gas analysis, operating parameters and other relevant information are contained in the APPENDICIES.

Calculations

MASS EMISSIONS CALCULATIONS, METHOD 19

The F-factor Method and guidance from Part 75 is used to calculate the mass emission rates (lb/hr and/or g/BHP-hr) for NOX, CO and NM/NE VOC. A fuel specific Fd factor is calculated as described in EPA Method 19, "Determination of Sulfur Dioxide Removal Efficiency and Particulate, Sulfur Dioxide and Nitrogen Oxides Emission Rates from Electric Utility Steam Generators" for natural gas. Equation 1 and Equation 2 are used to determine the mass emissions rates.

$$Em = Cd \times Fd \times \frac{20.9}{(20.9 - \%O_2)} \times Qh \times \frac{GCV}{10^6}$$

Equation 1: Mass Emission Rate, lb/hr

$$Em = Cd \times Fd \times \frac{20.9}{(20.9 - \%O_2)} \times Qh \times \frac{GCV}{10^6} \times \frac{453.6}{BHP}$$

Equation 2: Mass Emission Rate, g/BHP-hr

Nomenclature:

E_m:	Pollutant emission rate
C_d:	Pollutant concentration, lb/scf
F_d:	Fuel specific F-factor for dry C_d measurement, dscf per 10^6 BTU
$\%O_2$:	Oxygen concentration in percent, measured on a dry basis
Q_h:	Fuel rate from calibrated AGA specified meter, scfh
GCV:	Heating value of the fuel, BTU/scf
BHP:	Brake horsepower

The conversion factor in **Table 6** is used to correct the pollutant concentration in ppm to lb/scf:

Table 6: Unit Conversion Factors

To Convert from:	To	Multiply by:
ppm CO	lb/scf	7.268×10^{-8}
ppm NO_X	lb/scf	1.194×10^{-7}

EPA F-FACTOR

Equation 3 is used to determine the EPA fuel specific F-factor.

$$F_d = \frac{\left[\left(3.64 \cdot H_{Wt\%} \cdot 100\right) + \left(1.53 \cdot C_{Wt\%} \cdot 100\right) + \left(0.14 \cdot N_{2Wt\%} \cdot 100\right) - \left(0.46 \cdot O_{2Wt\%} \cdot 100\right)\right]}{\frac{GCV}{\rho_{FuelGas}}} \cdot 10^6$$

Equation 3: EPA Fuel Specific F - factor

Nomenclature:

F_d:	Fuel specific F-factor, dscf/MMBTU
$H_{Wt\%}$:	Hydrogen weight percent
$C_{Wt\%}$:	Carbon weight percent
$N_{2Wt\%}$:	Nitrogen weight percent
$O_{2Wt\%}$:	Oxygen weight percent
GCV:	Heating value of the fuel, BTU/dscf
$\rho_{Fuel\ Gas}$:	Density of the fuel gas, lb/scf

FUEL FLOW

For fuel flow measured with an orifice plate installed on the fuel line leading to the engine, differential pressure, line pressure, and temperature will be monitored and flow calculated. **Equation 4**, **Equation 5**, and **Equation 6** below depict the manner in which the flow will be calculated.[1]

$$C' = Fb \times Fpb \times Fg \times Ftf \times Fr \times Y2 \times Fpv \times Fm$$

Equation 4: Orifice Flow Constant

$$Qh = C' \times \sqrt{hw \times Pf}$$

Equation 5: Flow Quantity (ft^3/hr)

$$Q_{tm} = Qh \div 60$$

Equation 6: Flow Quantity (scfm)

Nomenclature:

Q_h:	Quantity of flow at base conditions, $ft.^3/hr$	F_{tf}:	Flowing temperature factor
Q_{tm}:	Quantity of flow at base conditions, SCFM	F_r:	Reynolds number factor
C':	Orifice flow constant	Y_2:	Expansion factor (pressure from downstream tap)
F_b:	Basic orifice flow factor	F_{pv}:	Super compressibility factor
F_{pb}:	Pressure base factor	F_m:	Manometer factor
F_{tb}:	Temperature base factor	H_w:	Differential pressure in inches of water
F_g:	Specific gravity factor	P_f:	Static pressure, psia

[1] Beck, H.V. Orifice Meter Constants, Handbook E-2. American Meter Company, 1955. Based on AGA Report No. 3.

EMISSIONS CORRECTED TO 15% OXYGEN

The measured concentration of NO_x and CO can be corrected to 15 % O_2 as set forth in CFR 40, Appendix A, Method 20 as follows:

$$NO_x = NO_{x\,obs} \times \left(\frac{5.9}{20.9 - \%O_2} \right)$$

Equation 7: Emissions Corrected to 15% Oxygen

Where:

NO_x = corrected emission rate, ppm

NO_{xobs} = observed emission concentration, ppm

$\%O_2$ = observed O_2 concentration, percent

CONCENTRATION CORRECTION

For the emissions concentration corrections required in 40CFR60, Appendix A, Method 7E, concentration corrections will be calculated by using the bias check zero and span values from before and after the test. The equation is as follows:

$$C_{gas} = (\overline{C} - C_o)\frac{C_{ma}}{C_m - C_o}$$

Equation 8: Bias Correction Calculation

Nomenclature:

C_{gas}: Effluent gas concentration (ppmv)

$\overline{C}$: Average gas concentration indicated by analyzer (ppmv)

C_o: Average of initial & final system calibration bias check responses for the zero gas (ppmv)

Cm: Average of initial & final system calibration bias check responses for the span gas (ppmv)

C_{ma}: Actual concentration of the upscale calibration gas (ppmv)

Appendix A

EPNG Vail Compressor Station
Pima County, AZ
Unit A-01, A-02 and A-03

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Appendix A

Section 1

Detailed Emissions Summary

Emissions Test Spreadsheet

elpaso Natural Gas

Company:	EPNG		Rated GP RPM:	6,900	RPM
Station:	VAIL		Rated PT RPM:	5,400	RPM
Unit:	A-01		Rated BHP:	5,290	BHP
Turbine Type:	GE FRAME 3		Fuel Orifice Dia.:	1.375	in.
Date:	1-Feb-11		Fuel Tube Dia.:	2.067	in.
			AGA UDHV :	1,018	btu/dscf
			AGA LDHV :	917	btu/dscf

Run	1	2	3	Average
Date	02/01/11	02/01/11	02/01/11	
Time	13:59	14:41	15:23	
Operating Parameters				
Turbine				
Horsepower	3,769	3,924	4,002	3,899
Ambient Rated Horsepower	5,290	5,290	5,290	5,290
% Load	71.3	74.2	75.7	73.7
GP RPM	6,879	6,881	6,877	6,879
% GP Speed	99.7	99.72	99.67	99.69
PT RPM	5,734	5,745	5,727	5,735
% PT Speed	106.2	106.4	106.1	106.2
Compressor				
T5 Exhaust Temperature Average (°F)	526.0	526.0	527.0	526.3
Compressor Suction Pressure (PSIG)	640.3	643.3	648.3	644.0
Compressor Suction Temperature (°F)	60.0	60.0	60.2	60.1
Compressor Discharge Pressure (PSIG)	729.3	733.5	738.5	733.8
Compressor Discharge Temperature (°F)	79.0	79.0	80.0	79.3
Compressor Flow (MMSCF/D)	592.2	610.9	588.2	597.1
Flow Measurements				
Fuel Gas Static Pressure (PSIG)	140.0	140.0	140.0	140.0
Fuel Gas Differential Pressure ("H_2O)	85.0	85.0	84.7	84.9
Fuel Gas Temperature (°F)	45.0	45.0	45.0	45.0
Fuel Flow (SCFH)	66,134	66,134	66,006	66,091
Fuel Flow (SCFM)	1,102.2	1,102.2	1,100.1	1,101.5
Exhaust Flow (LB/HR) - Method 19	271,796	268,177	267,646	269,206
Exhaust Flow (WSCFM) - Method 19	72,199	72,199	72,059	72,152
Exhaust Flow (ACFM) - Method 19	152,786	152,786	152,646	152,740
Air Flow (WSCFM)	69,647	68,676	68,544	68,955
Heat Rate (BTU/HP-HR)	16,096	15,460	15,130	15,562
Heat Rate (KJ/Watt-Hr)	22.765	21.865	21.397	22.009
Ambient Conditions				
Ambient Temperature (°F)	56.09	56.37	56.21	56.22
Barometric Pressure ("Hg)	26.80	26.80	26.80	26.80
Ambient Relative Humidity (%)	31.60	30.58	31.24	31.14
Absolute Humidity (grains/LB)	23.45	22.92	23.28	23.22
Emissions Concentrations & Calculated Mass Emissions				
NO ppm (raw measured dry)	42.54	40.26	39.97	40.92
NO_X ppm (raw measured dry)	49.37	49.80	49.98	49.72
NO_X ppm (BIAS Corrected)	51.03	51.63	51.84	51.50
NO_X LB/HR	26.92	26.96	27.19	27.02
NO_X (ppm @ 15% O_2)	108.71	108.89	110.04	109.21
CO ppm (raw measured dry)	13.86	14.37	14.53	14.25
CO ppm (BIAS Corrected)	13.56	14.13	14.30	14.00
CO LB/HR	4.354	4.492	4.567	4.471
CO (ppm @ 15% O_2)	28.89	29.81	30.36	29.69
% O_2 (raw measured dry)	18.12	18.08	18.08	18.09
% O_2 (BIAS Corrected)	18.13	18.10	18.12	18.12
Calculated Emissions Concentrations				
% H_2O	3.55	3.58	3.58	3.57

elpaso Natural Gas

Company:	EPNG	Rated GP RPM:	6,900	RPM
Station:	VAIL	Rated PT RPM:	5,400	RPM
Unit:	A-02	Rated BHP:	5,290	BHP
Turbine Type:	GE FRAME 3	Fuel Orifice Dia.:	1.375	in.
Date:	2-Feb-11	Fuel Tube Dia.:	2.067	in.
		AGA UDHV :	1,016	btu/dscf
		AGA LDHV :	916	btu/dscf

Run	1	2	3	Average
Date	02/02/11	02/02/11	02/02/11	
Time	10:36	11:12	11:47	
Operating Parameters				
Turbine				
Horsepower	4,277	4,179	4,494	4,317
Ambient Rated Horsepower	5,290	5,290	5,290	5,290
% Load	80.8	79.0	85.0	81.6
GP RPM	5,998	6,000	6,000	5,999
% GP Speed	86.9	86.96	86.96	86.95
PT RPM	5,890	5,900	5,894	5,895
% PT Speed	109.1	109.3	109.1	109.2
Compressor				
T5 Exhaust Temperature Average (°F)	479.7	479.8	480.5	480.0
Compressor Suction Pressure (PSIG)	586.0	580.8	580.0	582.3
Compressor Suction Temperature (°F)	57.0	57.0	57.0	57.0
Compressor Discharge Pressure (PSIG)	652.8	647.0	644.8	648.2
Compressor Discharge Temperature (°F)	75.0	75.7	76.0	75.6
Compressor Flow (MMSCF/D)	668.5	638.5	602.2	636.4
Flow Measurements				
Fuel Gas Static Pressure (PSIG)	144.0	144.0	144.0	144.0
Fuel Gas Differential Pressure ("H_2O)	52.2	51.3	51.0	51.5
Fuel Gas Temperature (°F)	37.0	38.2	39.5	38.2
Fuel Flow (SCFH)	53,208	52,716	52,469	52,798
Fuel Flow (SCFM)	886.8	878.6	874.5	880.0
Exhaust Flow (LB/HR) - Method 19	273,153	273,015	274,121	273,430
Exhaust Flow (WSCFM) - Method 19	72,174	71,508	71,172	71,618
Exhaust Flow (ACFM) - Method 19	144,155	142,850	142,281	143,095
Air Flow (WSCFM)	70,049	70,022	70,321	70,130
Heat Rate (BTU/HP-HR)	11,395	11,553	10,693	11,214
Heat Rate (KJ/Watt-Hr)	16.115	16.339	15.123	15.859
Ambient Conditions				
Ambient Temperature (°F)	28.78	30.27	32.15	30.40
Barometric Pressure ("Hg)	27.06	27.06	27.06	27.06
Ambient Relative Humidity (%)	26.24	23.73	22.33	24.10
Absolute Humidity (grains/LB)	6.72	6.46	6.56	6.58
Emissions Concentrations & Calculated Mass Emissions				
NO ppm (raw measured dry)	28.57	28.20	28.17	28.31
NO_X ppm (raw measured dry)	33.92	33.70	33.70	33.77
NO_x ppm (BIAS Corrected)	34.67	34.61	34.61	34.63
NO_X LB/HR	18.36	18.22	18.31	18.30
NO_X (ppm @ 15% O_2)	92.31	92.47	93.40	92.73
CO ppm (raw measured dry)	26.71	26.54	26.65	26.63
CO ppm (BIAS Corrected)	27.03	26.70	26.76	26.83
CO LB/HR	8.713	8.553	8.621	8.629
CO (ppm @ 15% O_2)	71.98	71.32	72.22	71.84
% O_2 (raw measured dry)	18.69	18.71	18.73	18.71
% O_2 (BIAS Corrected)	18.68	18.69	18.71	18.70
Calculated Emissions Concentrations				
% H_2O	2.59	2.57	2.55	2.57

elpaso Natural Gas

Company:	EPNG	Rated GP RPM:	6,900	RPM
Station:	VAIL	Rated PT RPM:	5,400	RPM
Unit:	A-03	Rated BHP:	5,290	BHP
Turbine Type:	GE FRAME 3	Fuel Orifice Dia.:	1.5	in.
Date:	2-Feb-11	Fuel Tube Dia.:	4.026	in.
		AGA UDHV :	1,016	btu/dscf
		AGA LDHV :	916	btu/dscf

Run	1	2	3	Average
Date	02/02/11	02/02/11	02/02/11	
Time	14:02	14:39	15:22	
Operating Parameters				
Turbine				
Horsepower	3,502	3,399	3,136	3,345
Ambient Rated Horsepower	5,290	5,290	5,290	5,290
% Load	66.2	64.3	59.3	63.2
GP RPM	5,999	5,999	6,003	6,000
% GP Speed	86.9	86.95	87.00	86.96
PT RPM	5,896	5,899	5,897	5,898
% PT Speed	109.2	109.2	109.2	109.2
Compressor				
T5 Exhaust Temperature Average (°F)	488.8	490.0	489.0	489.3
Compressor Suction Pressure (PSIG)	566.3	563.7	562.0	564.0
Compressor Suction Temperature (°F)	57.5	58.0	58.0	57.8
Compressor Discharge Pressure (PSIG)	641.7	639.2	637.2	639.3
Compressor Discharge Temperature (°F)	75.0	76.0	76.0	75.7
Compressor Flow (MMSCF/D)	553.4	552.3	535.1	546.9
Flow Measurements				
Fuel Gas Static Pressure (PSIG)	143.0	143.0	143.0	143.0
Fuel Gas Differential Pressure ("H_2O)	45.3	43.8	43.0	44.1
Fuel Gas Temperature (°F)	40.8	41.0	41.3	41.1
Fuel Flow (SCFH)	52,361	51,484	50,975	51,607
Fuel Flow (SCFM)	872.7	858.1	849.6	860.1
Exhaust Flow (LB/HR) - Method 19	243,466	265,328	263,899	257,564
Exhaust Flow (WSCFM) - Method 19	64,377	63,299	62,673	63,450
Exhaust Flow (ACFM) - Method 19	129,933	127,914	126,610	128,153
Air Flow (WSCFM)	62,319	68,081	67,709	66,037
Heat Rate (BTU/HP-HR)	13,696	13,873	14,890	14,153
Heat Rate (KJ/Watt-Hr)	19,370	19,620	21,058	20,016
Ambient Conditions				
Ambient Temperature (°F)	34.79	35.48	35.49	35.25
Barometric Pressure ("Hg)	27.04	27.04	27.02	27.03
Ambient Relative Humidity (%)	17.43	17.53	15.76	16.91
Absolute Humidity (grains/LB)	5.69	5.88	5.29	5.62
Emissions Concentrations & Calculated Mass Emissions				
NO ppm (raw measured dry)	29.43	29.21	28.68	29.11
NO_x ppm (raw measured dry)	34.93	34.62	34.02	34.52
NO_x ppm (BIAS Corrected)	36.03	35.47	35.13	35.54
NO_x LB/HR	16.76	18.25	17.99	17.66
NO_x (ppm @ 15% O_2)	85.63	94.85	94.41	91.63
CO ppm (raw measured dry)	22.13	22.14	22.42	22.23
CO ppm (BIAS Corrected)	22.31	22.40	22.63	22.44
CO LB/HR	6.316	7.016	7.050	6.794
CO (ppm @ 15% O_2)	53.02	59.91	60.80	57.91
% O_2 (raw measured dry)	18.45	18.70	18.71	18.62
% O_2 (BIAS Corrected)	18.42	18.69	18.70	18.61
Calculated Emissions Concentrations				
% H_2O	2.82	2.57	2.55	2.65

Operating Data