Tucson Electric Power
88 East Broadway Blvd.
Tucson, AZ 85701-1720

Hand Delivery

September 21, 2017

Rupesh Patel, Air Permit Engineering Manager
Pima County Dept. of Environmental Quality
33 N. Stone Avenue, Suite 700
Tucson, AZ 85701

Subject: Confidential Business Information - Vendor Emissions Performance Specifications
H. Wilson Sundt Generating Station RICE Project

Dear Mr. Patel:

Tucson Electric Power Company ("TEP") submitted a letter on September 19, 2017, in response to your request for information ("RFI") dated September 8, 2017. This correspondence is in addition to TEP's September 19, 2017 letter and contains the following vendor-specified emissions performance information that should address Items 4 and 6 of your RFI:

- Flue gas emission statement Tucson Electric Power; and
- Expected start-up emissions Tucson Electric Power.

Because of proprietary nature of the vendor's technical data, TEP requests that the two attached vendor specifications be treated as confidential business information. If you have any questions in this regard, please feel free to contact Charles Komadina at (520) 918-8316 or me at (520)745-3388.

Sincerely,

Conrad Spencer,
Director, Sundt Modernization Project

cc: R. Grimaldi, PCDEQ
E. Bakken, TEP
C. Komadina, TEP
C. Campbell, RTP
M. Kaplan, AECOM

Attachments

Title:	Flue gas emission statement Tucson Electric Power	**Doc.ID:**	DBAE544322
		Revision:	-
Author:	Riitta Raudaskoski	**Status:**	Finalised
Finalised by:	Riitta Raudaskoski / 17.08.2017	**Pages:**	1 (3)
Organisation:	- General Energy Solutions		
Project:	– Project information		

This document provides flue gas emissions, i.e. maximum average values for emissions measured over a period of minimum 60 minutes. The emissions are based on the site conditions, gas composition and measurement methods specified in this document.

Engine: **Wärtsilä 18V50SG-B, 514 rpm (constant speed)**

Site conditions:

Altitude	2620	ft
Ambient temperature, design	90	°F
Relative humidity	9	%

Gas composition [Note1]

The emissions are valid for the following gas composition. It is understood that variations in the gas composition inside this specification will occur and are permitted; however sudden extreme changes in gas temperature, pressure or composition are not allowed.

Methane number			80		
Methane	CH_4	typical	91.56	vol-%	
Ethane	C_2H_6	typical	6.56	vol-%	
Propane	C_3H_8	max	0.39	vol-%	Note1
i-Butane	i-C_4H_{10}	max	0.02	vol-%	Note 1
n-Butane	n-C_4H_{10}	max	0.03	vol-%	Note 1
i-Pentane	i-C_5H_{12}	max	0.00	vol-%	Note 1
n-Pentane	n-C_5H_{12}	max	0.00	vol-%	Note 1
n-Hexane	C_6H_{13}	max	0.00	vol-%	Note 1
Sum of other hydrocarbons			0.00	vol-%	Note 1
Nitrogen/Oxygen	N_2/O_2	typical	1.35	vol-%	
Carbon dioxide	CO_2	typical	0.09	vol-%	
Total sulphur	S	max.	5	ppm (mass base)	

Aromatic hydrocarbons, silicon based compounds or impurities resulting from the operating and maintenance of the gas delivery systems are not allowed.

Lubricating oil quality according to Wärtsilä specifications for gas engines.

Note 1) VOC emissions in gas operation depend on the composition of the pipeline natural gas. This document includes a table with corrected VOC emissions after the emission control system for natural gas with concentrations of C_3 to C_6 hydrocarbons in excess of the values specified above.

Flue gas emissions after emission control system Note 2) **at 25-100% engine loads as 60 minutes average:**

			Load 25-100%
NO_x	as NO_2	lb/h	1.50
CO		lb/h	2.64
VOC	as CH_4	lb/h	2.07
PM_{10} (total)		lb/h	1.78
Formaldehyde		ppm-v 15% O_2, dry	14
NH_3		ppm-v 15% O_2, dry	5

Correction based upon the influence of gas composition on VOC emissions:

If the concentration the = sum of propane + butane + pentane + hexane (C_3H_8 + C_4H_{10} + C_5H_{12} + C_6H_{14}) in the pipeline natural gas exceed the values specified in paragraph *"Gas composition"* in this document the VOC emissions shall be corrected according to the table below. In the table the sum of propane + butane + pentane + hexane is denoted C_{GasVOC}.

	Factor for VOC correction
Concentration of VOC components in feed natural gas	**VOC number guarantee*factor**
0 vol-% ≤ C_{GasVOC} < 0.50 vol-%	1
0.50 vol-% ≤ C_{GasVOC} < 1.00 vol-%	1.3
1.00 vol-% ≤ C_{GasVOC} < 1.50 vol-%	1.6

Measurement Methods

Emission data are provided based upon the emission measurement methods listed below and are valid only for these methods. Based upon mutual written consent, evaluation of measurement levels can be made using alternative methods.

Emission data assumes that individual compounds identified above the sensitivity limit, but at concentrations below the lower limit of detection are reported as maximum one-half of the daily lower-limit of calibration. Measurements shall be performed so that minimum feasible detection limits are achieved if this is required for determining compliance with emission guarantees.

The flue gas stack emission measurements will be performed at steady operating condition of the engine. Prior to the start of the flue gas emission (stack) measurements, the engine shall have reached steady state operating conditions and the flue gas temperature measured after the emission control system shall be allowed to reach normal operating temperature.

Sufficiently long measurement sampling periods and number of samples shall be taken in order to get statistically representative results. To ensure accurate particulate matter (PM10) emission results of 3 samples are to be collected with a minimum sampling time of 1 hour per sample. Based on the judgement of the measurement consultant, the results of individual samples with abnormally high deviation shall be excluded.

Note 2) Minimum allowed engine load 10%

Time to reach compliance

The time required to reach compliance with the emission levels specified in this document will depend on operating conditions and on the temperature of the catalyst system at start. Compliance with emission data in this document will for a normal start sequence and under normal conditions be reached within 10 to 30 minutes from start signal. The emission data in this document are given for stable load operation at the continuous operating loads specified in this document.

Oxygen (O_2): EPA Method 3A (USA): Determination of Oxygen and Carbon Dioxide Emissions from Stationary Sources.

Nitrogen oxides (NOx): EPA Method 7E (USA): Determination of nitrogen oxides from stationary sources.

Carbon monoxide (CO): EPA Method 10 (USA): Determination of carbon monoxide emissions from stationary sources.

Volatile organic compounds (VOC defined as Non Methane Non Ethane Hydrocarbons): USA EPA Method 18: Measurement of gaseous organic compound emissions by gas chromatography. VOC is calculated as the sum of relevant components, which for a gas engine equipped with a high efficiency catalyst are considered to be: propane, n-butane, n-pentane, n-hexane. *Wärtsilä reserves the rights to use other commonly accepted measurement methods to show compliance with the emission guarantees for VOC emissions.*

PM10 (total): Total PM_{10} is defined as the sum of the particulate matter measured with a combination of EPA 201 and 202 methods
USA EPA Method 201 (front half): Determination of particulate emissions from stationary sources.
USA EPA Method 202 Determination of condensable particulate matter from stationary sources.

Formaldehyde (HCHO)
USA EPA Method 323: Measurement of formaldehyde emissions from natural gas-fired stationary sources-acetyl acetone derivatization method. In case formaldehyde guarantee is exceeded or if significant interference from acetaldehyde is suspected CARB Method 430: Determination of Formaldehyde and Acetaldehyde in Emissions from stationary sources shall be used.

Ammonia (NH_3): Bay Area Air Quality Management District (BAAQMD) test Method ST-1B: Ammonia integrated sampling.

WÄRTSILÄ

Title:	Expected start-up emissions Tucson Electric Power	**Doc.ID:**	DBAE577489
		Revision:	-
Author:	Riitta Raudaskoski	**Status:**	Finalised
Finalised by:	Riitta Raudaskoski / 14.09.2017	**Pages:**	1 (1)
Organisation:	- General Energy Solutions		
Project:	– Project information		

Expected start up emissions after catalyst system

This document provides engineering estimates on the start-up emissions for one Wärtsilä® 18V50SG B engine equipped with an efficient emission control system. The system includes a selective catalytic reduction system and an oxidation catalyst. The figures are best estimates only and shall not be considered as guarantee data.

The fast start-up of the engine results in varying exhaust gas flow, non-stable temperature, high and low range emission and oxygen levels which make accurate measurement and prediction of emissions very challenging. The flue gas emission estimates herein are based on emission measurement for steady conditions at different loads together with limited measurements performed during start-up. A standard catalyst volume loading has been selected and more accurate start up values can be estimated when final project specific catalyst design is known. The emission control performance in a start-up situation is based on supplier estimates and laboratory data. The data assumes that the engines will reach full load within 5 minutes.

The estimated cumulative start up flue gas emissions with optimized reagent injection are expressed as lb per a start period (30 min) of one (1) Wärtsilä® 18V50SG B engine and are given for 3 different conditions in the table 1 below.

- Start 1: Cold start - A cold catalyst start is when the temperature of the catalyst material inside the reactor is close to ambient temperature. Cold catalyst starts are expected after over haul periods or when the engine has not been operated during the last 2-3 days.
- Start 2: Warm start – Restart after 6 h engine down time
- Start 3: Warm start - Restart after 12 h engine down time

The emission control system will reach its full abatement efficiency within 10-30 minutes from the start.

Table 1. Expected flue gas emissions during start up when using ammonia solution as reagent.

18V50SG-B	Unit	NO_X (as NO_2)	CO	VOC (as CH_4)	PM10	CH_2O
Start 1	lb/30 min	10.3	9.1	4.3	1.8	2.3
Start 2	lb/30 min	3.5	1.4	3.8	1.8	1.3
Start 3	lb/30 min	3.5	4.6	4.0	1.8	1.9

The VOC (volatile organic compounds) emissions depend on the composition of the fuel gas. The VOC emissions in table 1 above are based on max 0.50 vol-% VOC components in the feed fuel gas.

Stack emission measurements during start up sequences or heavy transient loads are challenging and the repeatability of start up emission measurement on site is low. The analysator respons time for the gaseous emissions needs special attention. Moreover the particulate emissions will stay on a theoretical level since the particulates can not be determinate by an isokinetic sampling reference method.