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April 26, 2016

Dr. Kirby Olson
New Mexico Environment Department
Air Quality Bureau
525 Camino de los Marquez, Suite 1
Santa Fe, New Mexico, 87505-1816

RE: Air Permit Amendment Application
Permit No. PSD 3449-M3
Hobbs Generating Station
Hobbs, New Mexico

Dear Dr. Olson,

On behalf of Lea Power Partners, LLC (LPP), CAMS eSPARC is submitting updates to the March 30, 2016 Air Permit Amendment Application. These updates include the following items, as requested in your email dated April 14, 2016:

(1) Revised Section 12 BACT Analysis (Attachment A);
(2) Revised Section 3 (Attachment B);
(3) Revised Section 6 (Attachment C);
(4) Revised Section 7 (Attachment D);
(5) Updated UA2 Tables (Attachment E).

The Section 12 BACT Analysis addresses the following points:

(1) Reason for requested change: The current SSM VOC BACT limit of 187 ppmvdc assumes that the oxidation catalyst is able to control VOC emissions during the early phases of startup. Both VOC and CO emissions are controlled during normal operation by the oxidation catalyst in each unit. During the early phases of startup, the oxidation catalyst has been shown to not efficiently control CO emissions. It is expected that VOC emissions are similarly not fully controlled during SSM events.

(2) Basis for calculation new VOC BACT limit. The currently authorized CO SSM BACT limit is based on the maximum uncontrolled emissions from the combustion turbine, as represented by the turbine manufacturer, with a 20% safety factor applied. We propose that the VOC SSM BACT limit also be based on the maximum uncontrolled emissions from the combustion turbine, as represented by the turbine manufacturer, with a 20% safety factor applied. This basis maintains consistency with BACT already in place. Hobbs will continue to minimize startup duration as a BACT operating practice.

(3) Manufacturer Information. The manufacturer's information for the uncontrolled at various loads and temperatures is provided as Attachments 1 and 2 to Section 12.

(4) Rationale for why the VOC mass emission rate SSM limit needs to be increased. The current VOC lb/hr emission rate was based on some level of control being achieved during startups. It was calculated as the maximum of the hot, warm, and cold calculated ramps (example calculations are provided in updated Section 6). Since the CO lb/hr limit is based on the operational data, a methodology for scaling the VOC mass emission rate off of the observed CO limit is proposed.

(5) Rationale for why the SSM ton per year values will not need to increase. The annual emissions due to SSM were calculated based on a representative number of hot, cold, and warm starts per year multiplied by the vendor representation for pounds per event on an average annual basis. The pound per event was demonstrated to be a good representation of actual events in operation for CO. Therefore, it is assumed that the pound per event values for VOC will similarly be valid. Thus, it is not necessary to change the current representation for the annual emissions of VOC.

Thank you for working with us to incorporate the changes necessary to update the VOC emission representations in this application. Please contact me at (281) 333-3339 ext 201 or via email at mjohnson@camsesparc.com or Michael Barnett at (575) 397-6731 or via email at mbarnett@camsops.com if you have any questions or need additional information.

Sincerely,

Mona Caesar Johnson, PE
CAMS eSPARC, LLC

cc:

Roger Schnabel
Hobbs Generating Station
98 N. Twombly Lane
Hobbs, NM 88242

Matt Lindsey
Consolidated Asset Manager Services
919 Milam Street, Suite 2300
Houston, TX 77002

Attachment A
Revised Section 12 BACT Analysis

Section 12

Section 12.A
PSD Applicability Determination for All Sources

(Submitting under 20.2.72, 20.2.74 NMAC)

A PSD applicability determination for all sources. For sources applying for a significant permit revision, apply the applicable requirements of 20.2.74.AG and 20.2.74.200 NMAC and to determine whether this facility is a major or minor PSD source, and whether this modification is a major or a minor PSD modification. It may be helpful to refer to the procedures for Determining the Net Emissions Change at a Source as specified by Table A-5 (Page A.45) of the EPA New Source Review Workshop Manual to determine if the revision is subject to PSD review.

A. This facility is:

- ☐ a minor PSD source before and after this modification (if so, delete C and D below).
- ☐ a major PSD source before this modification. This modification will make this a PSD minor source.
- ☐ an existing PSD Major Source that has never had a major modification requiring a BACT analysis.
- ☒ an existing PSD Major Source that has had a major modification requiring a BACT analysis
- ☐ a new PSD Major Source after this modification.

B. This facility is one of the listed 20.2.74.501 Table I – PSD Source Categories. The "project" emissions for this modification are not significant as proposed project increases do not exceed the PSD Significant Emission Rate (SER) for each pollutant (refer to Table 12-1 below). The "project" emissions listed below only result from changes described in this permit application, thus no emissions from other revisions or modifications, past or future to this facility. This project will not cause or generate any additional emissions. Also, specifically discuss whether this project results in "de-bottlenecking", or other associated emissions resulting in higher emissions. The project emissions (before netting) for this project are as follows [see Table 2 in 20.2.74.502 NMAC for a complete list of significance levels]:

a. **NOx: 184.7 TPY**
b. **CO: 280.9 TPY**
c. **VOC: 96.7 TPY**
d. **SOx: 48.5 TPY**
e. **TSP (PM): 88.6 TPY**
f. **PM10: 87.3 TPY**
g. **PM2.5: 86.1 TPY**
h. **Fluorides: N/A**
i. **Lead: N/A**
j. **Sulfur compounds (listed in Table 2): N/A**
k. **GHG: 1,897,124 TPY**

C. **Netting** is not required (no annual emission rate increases proposed)

D. **BACT** is not required for the update in the CO SSM limit, as this application is a minor modification and no change to the current CO SSM concentration limit is requested. The current CO SSM BACT representation is the minimization of startup duration. This CO SSM BACT limit represents uncontrolled combustion turbine emissions with a 20% safety factor. However, the VOC SSM BACT value requires modification because it does not accurately reflect the exhaust VOC emission concentrations that are expected to occur during startups. Since the oxidation catalysts used on the CTG/HRSG units systems are not immediately available at 100% efficiency upon startup, Hobbs is operated to minimize the duration of the startups to the extent possible for each turbine unit. This practice represents BACT for the affected sources as there is no other physical control technology available to reduce these emissions. However, the current SSM VOC BACT limit, unlike the CO BACT limit, assumes that some control is achieved during startup. Since both CO and VOC are controlled by the same

oxidation catalyst, both pollutants should have the same BACT standard, which reflects operational efforts to minimize startup time.

VOC SSM BACT History. PSD-3449-M1 did not include a SSM VOC BACT limit. As part of the PSD-3449-M2 revision, VOC emissions during SSM events were incorporated. In the original PSD-3449-M2 application (A-3449 Hobbs Station UA2_20140305.xls) a VOC concentration limit of 900 ppmv dry at 15% O_2 (ppmvdc) was requested. This value is consistent with combustion turbine vendor representations of uncontrolled VOC emissions from the combustion turbine with a 20% safety factor applied. Hourly mass emission limits for VOC and CO were calculated based on catalyst vendor representations that partial control of VOC and CO would be achieved during startups. Refer to the following attachments:

- **Attachment 1.** Mitsubishi Turbine Expected Performance Data Sheet for a sister M501F unit located in Victoria, Texas (dated January 14, 2008). The maximum VOC concentration of 750 ppmvdc is shown to occur in the 0 to 10% load range. With a 20% safety factor this is value is 900 ppmvdc.

- **Attachment 2.** Section D1 of the original 2006 permit application for Hobbs contains the vendor information on which the requested emission limits were based. The maximum VOC concentration of 750 ppmvdc is shown to occur in the 0 to 20% load range. With a 20% safety factor this is value is 900 ppmvdc.

- **Attachment 3.** On January 29, 2014, data was requested from the catalyst vendor to determine if the catalyst provided any control of VOC and CO during startup.

- **Attachment 4.** On February 5, 2014, the catalyst vendor provided information indicating that some VOC and CO control would be achieved during by the catalyst during startups.

A maximum hourly mass emission rate limit was established during the 2014 permit revision based on information supplied by the catalyst vendor related to expected post-catalyst mass emissions during different types of startups (Attachment 4). Based on the vendor information, a mass permit limit of 441 lb/hr was requested. In late 2015, Hobbs experienced a number of exceedances of the allowable CO hourly mass emission rate for startups. The CO BACT level of 3,000 ppmvd @ 15% O_2 (uncontrolled combustion turbine exhaust concentration with a 20% safety factor) was not exceeded. Further review of plant historical data showed that the representation for the CO SSM mass emission limit in the turbine upgrade permit application in 2014 is not achievable during actual operations. The CO mass emission representation provided in the 2014 permitting action assumed that a catalyst temperature of approximately 400ºF would be achieved during the early phases of startup. However, the actual operating data show that startups are frequently initiated with the catalyst temperature below this level. It is evident that the equipment is not capable of achieving the CO mass emission limit as established by PSD-3449-M2. A revision to the PSD permit is therefore necessary to provide the site with an achievable startup mass emission limit for CO. Since the existing 3,000 ppmvdc BACT limit will continue to be met, no additional BACT analysis for CO SSM is necessary for this permitting action. A new hourly SSM mass emission rate limit of 2,060 lb/hr from each unit (HOBB-1 and HOBB-2) is proposed. This represents the maximum mass emission rate observed in actual operating data (1,648 lb/hr) with a 25% safety factor applied. No increase in the achievable BACT limit of 3,000 ppmvdc or in the annual mass emission rate is proposed since these remain unchanged per startup. The annual CO emissions due to SSM events were calculated based on the total mass emission rate of during each type of startup (i.e., 1,723 lbs/cold-startup, Attachment 4) multiplied by the expected number of startups during the year for those types of startups. The operational data show that the vendor representation of pounds of CO per startup event is accurate on an average annual basis.

In Revision #0, a request was made that the SSM VOC emission rate limit not be enforceable since it is not possible to demonstrate compliance with this limit. The limit in the current permit (PSD 3449-M3) assumes that some level of VOC control will be achieved during the startup sequence. Since it has been demonstrated that the catalyst is not able to control CO emissions during the early phases of startup, it is expected that VOC emissions will also not be controlled. In this Revision #1, it is requested that the combustion turbine vendor representation

for uncontrolled VOC emissions, with a 20% safety factor, be applied (i.e., 750 ppmvdc * 1.25 = 900 ppmvdc). This is consistent with the methodology applied for CO. Accordingly, it is proposed that the hourly mass emission rate for VOC be calculated to align with the CO emissions which are supported by operational data.

Actual operating data for CO show that the observed maximum mass emission rate for CO is 1,648 lbs/hr, which represents 95.65% of the vendor represented pounds per average annual cold startup. The requested permit limit for CO is 2,060 lbs/hr (1,648 lbs/hr with a 25% safety factor applied). Accordingly, a VOC mass emission rate limit of 95.65% of the vendor represented pounds per average annual cold startup, with a 25% percent safety factor applied is requested:

95.65% * 494 lbs/event * 1.25 = 591 lbs/hr

Since the operational CO data show that the vendor representation of pounds of CO per startup event is accurate on an average annual basis, it is further assumed that the vendor representation of pounds of VOC per startup event is accurate. The annual VOC emissions due to SSM events were calculated based on the total mass emission rate of during each type of startup multiplied by the expected number of each type of startup during the year.

E. If this is an existing PSD major source, or any facility with emissions greater than 250 TPY (or 100 TPY for 20.2.74.501 Table 1 – PSD Source Categories), determine whether any permit modifications are related, or could be considered a single project with this action, and provide an explanation for your determination whether a PSD modification is triggered.

A PSD modification is not required. There is no change in startup emissions since the original baseline period. The CO and VOC hourly mass emission rate limits and VOC concentration limit for SSM events were established for the first time when PSD Permit 3449-M3 was issued. This application provides a correction to these values to represent what is actually physically achievable. There have been no physical changes or changes in method of operation that impact the startup emissions.

Section 12.B
Special Requirements for a PSD Application

(Submitting under 20.2.74 NMAC)

Prior *to Submitting a PSD application*, the permittee shall:

- ☐ Submit the BACT analysis for review prior to submittal of the application. No application will be ruled complete until the final determination regarding BACT is made, as this determination can ultimately affect information to be provided in the application. A pre-application meeting is recommended to discuss the requirements of the BACT analysis.
  No BACT analysis was required for Revision #0 of this application. A BACT analysis is provided for Revision #1.
- ☒ Submit a modeling protocol prior to submitting the permit application. **[Except for GHG]**
  A modeling waiver request was submitted and approved. Therefore, a protocol was not required.
- ☐ Submit the monitoring exemption analysis protocol prior to submitting the application. **[Except for GHG]**
  N/A- this is not a PSD major modification.

For PSD applications, the permittee shall also include the following:

- ☐ Documentation containing an analysis on the impact on visibility. **[Except for GHG]**
- ☐ Documentation containing an analysis on the impact on soil. **[Except for GHG]**
- ☐ Documentation containing an analysis on the impact on vegetation, including state and federal threatened and endangered species. **[Except for GHG]**
- ☐ Documentation containing an analysis on the impact on water consumption and quality. **[Except for GHG]**
- ☐ Documentation that the federal land manager of a Class I area within 100 km of the site has been notified and provided a copy of the application, including the BACT and modeling results. The name of any Class I Federal area located within one hundred (100) kilometers of the facility.

In the original March 30 application (Revision #0), only a correction to the allowable hourly CO mass emission rate during startups was requested. This change was necessary to reflect actual operating conditions that were not fully understood when the limit was proposed in 2014 (PSD 3440-M3). There is no physical change or change in method of operation proposed. There is no increase in annual emission rates proposed.

In the Revision #1 application, a correction to the maximum allowable hourly VOC mass emission rate and concentration during startups is proposed. This change is necessary to reflect actual operating conditions that were not fully understood when the limits were proposed in 2014 (PSD 3440-M3). There is no physical change or change in method of operation proposed. There is no increase in annual emission rates proposed.

During startup it is technically infeasible to operate the post-combustion control equipment at full efficiency until these systems reach the required operating temperature. To reduce the amount of excess emissions (compared to routine operations), the duration of the startups is minimized to the best extent possible for each unit. Minimizing the startup time represents SSM BACT for these units.

.

Attachment 1

Att1-094-NuCoastelSITE08-All-R0x | gt_data

Mitsubishi

- Combustion Turbine Expected Performance Data Sheet

pfs_gt1g_e.xlt Sheet No. DATE: 1/14/08

COMMERCIAL DATA																		
Customer		New Coastal																
Project Name		Victoria Unit 7																
Manufacture Name		Mitsubishi Heavy Industries, LTD.																
INPUT INFORMATION																		
G/T Model		M501F																
NOx Control		Dry Low NOx																
Fuel Type		Gaseous Fuel (Site Specific)																
Fuel LHV	Btu/lb	20467	Ev. Co.		Ev. Co.												Ev. Co.	
CONDITION		100%	100%	100%	100%	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%	100%	100%
Ambient Temperature	deg.F	40	70	70	90	90	90	90	90	90	90	90	90	90	90	90	98	98
Relative Humidity	%	85	72	72	45	45	45	45	45	45	45	45	45	45	45	45	42	42
Barometric Pressure	psi	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663	14.663
Evaporative Cooler		OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
Exhaust Loss (total)	inH2O	18.9	17.2	16.9	16.5	15.6	14.8	12.9	11.2	9.7	8.3	7.9	7.4	7	6.4	5.8	16.1	15.1
PERFORMANCE																		
Gross Output	kW	185,060	169,890	166,990	163,940	153,770	139,420	123,710	107,990	92,300	76,660	60,990	45,210	29,340	13,820	120	160,020	147,810
Gross Heat Rate	btu/kWh	9,560	9,790	9,830	9,892	10,039	10,202	10,457	10,844	11,424	12,305	13,466	15,492	19,746	33,071	Inf.	9,956	10,150
Fuel Flow	lb/h	86,450	81,270	80,210	79,240	75,430	69,500	63,220	57,220	51,530	46,090	40,140	34,230	28,320	22,350	16,420	77,840	73,310
Injection Flow	lb/h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exhaust Flow	1000lb/h	3,673.4	3,480.1	3,449.2	3,396.4	3,298.9	3,270.0	3,062.0	2,863.5	2,674.5	2,502.4	2,497.1	2,491.9	2,486.6	2,481.2	2,476.3	3,348.2	3,236.6
Exhaust Temperature	deg.F	1137	1156	1158	1164	1166	1104	1090	1078	1068	1056	968	880	789	694	597	1166	1166
Exhaust Gas Composition																		
O2	wt.%	13.94	13.84	13.9	13.74	14	14.63	14.86	15.12	15.4	15.73	16.63	17.54	18.46	19.38	20.3	13.7	14.02
CO2	wt.%	6.07	6.03	6	6.02	5.9	5.48	5.32	5.15	4.97	4.75	4.15	3.55	2.94	2.32	1.71	6	5.84
H2O	wt.%	5.24	5.96	5.84	6.4	5.99	5.66	5.53	5.4	5.25	5.08	4.6	4.13	3.66	3.17	2.69	6.7	6.2
SOx	wt.%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2	wt.%	73.44	72.87	72.95	72.54	72.81	72.92	72.98	73.02	73.07	73.13	73.31	73.46	73.62	73.81	73.98	72.31	72.64
Ar	wt.%	1.31	1.3	1.31	1.3	1.3	1.31	1.31	1.31	1.31	1.31	1.31	1.32	1.32	1.32	1.32	1.29	1.3
SOx	ppmvd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exhaust Emission																		
NOx (@15%O2)	ppmvd	25	25	25	25	25	25	25	25	30	40	70	70	70	75	80	25	25
CO (@15%O2)	ppmvd	10	10	10	10	10	10	10	10	12.8	15	117	900	2500	2500	2500	10	10
VOC (@15%O2)	ppmvd	1	1	1	1	1	1	1	1	1.2	1.4	7.73	43	198	750	750	1	1
Particle (@actual O2)	mg/Nm3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NO/NOx	%	77	77	77	77	77	77	77	71.5	60	50	40	40	40	40	40	77	77

Notes:

1. Above performance data are based on New & Clean condition.
2. Sulfur contents and Fuel Bound Nitrogen in fuel gas is not considered.
3. Tolerance of exhaust gas flow +/-5% and exhaust temp. +/-18°F should be considered to above values for the HRSG design.
4. All supplied values are estimations.
5. MPSA does not recommend operating the Evaporative Cooler when the engine is not at full load for prolonged periods.

ATTACHMENT D.1

Manufacturer's Estimates

MPS Standard Engineering Document No. 9-B

START-UP/SHUT-DOWN CURVE

FOR

M501F POWER TRAIN 2 ON 1 CONFIGURATION

Combined Cycle Engineering Section

CONTENT	REMARKS	PURCHASER	ORDER No. / ITEM No.	DATE / REFERENCE	POWER PLANT ENGINERRING DEPARTMENT PROPOSAL ENGINEERING GROUP	
DESCRITION PAGE		—	8007302	H14.6.20	APPROVED BY	
FIGURE SHEET			6000		CHECK BY	
TOTAL 6 SHEETS					DESIGNED BY	
					DATE	H14.6.20

COPY FOR	MPS	プ技二	ガ技		ガ計	ガ設	タ設	プ機設	配設	装置	電計設		建設	C/C設				控
	1	1	1		1	1	1				1		1	1				1

DRAWING No. S4-50299

REV No. R-0

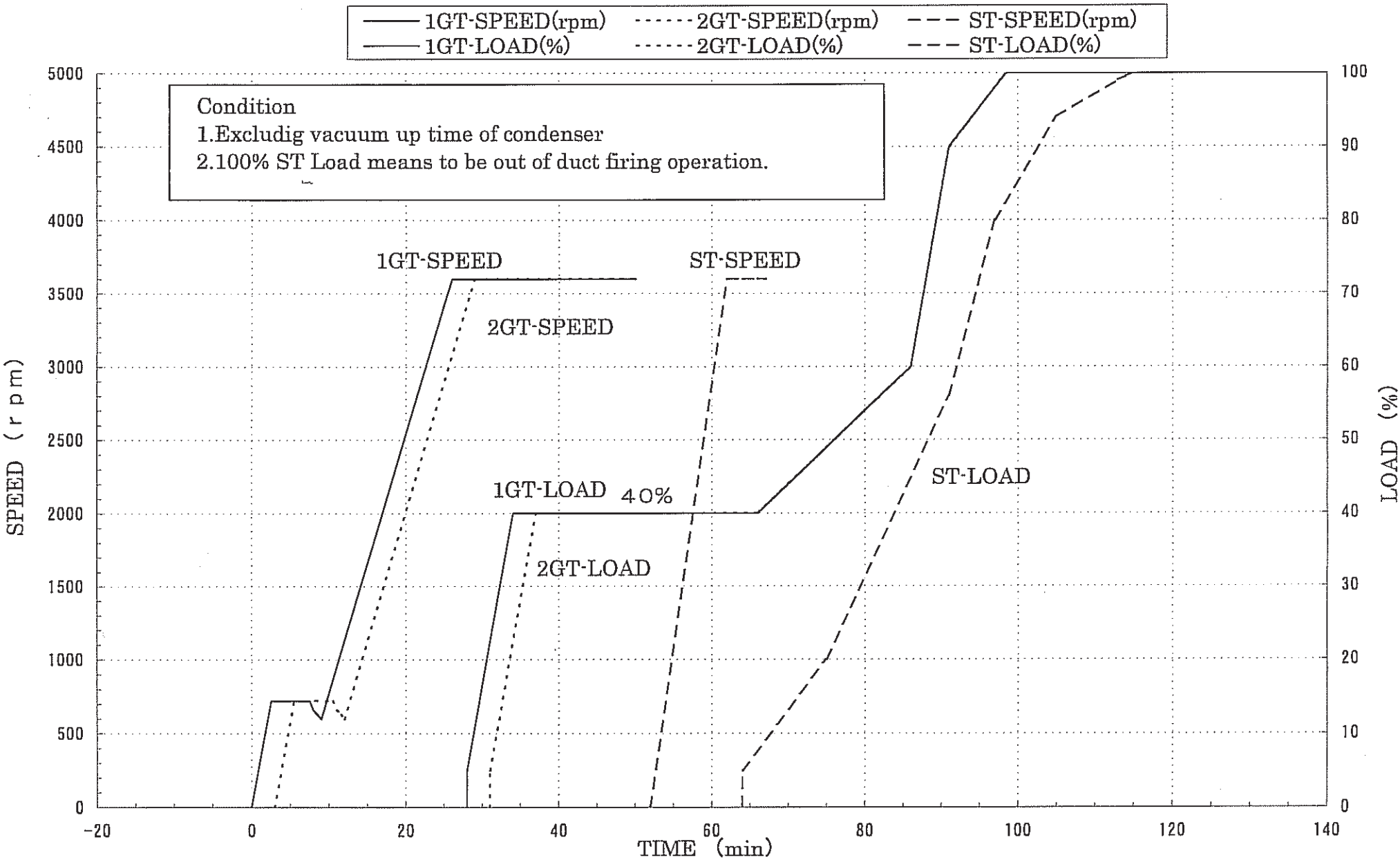
PA-CODE | CODE

MITSUBISHI HEAVY INDUSTRIES, LTD. TAKASAGO MACHINERY WORKS

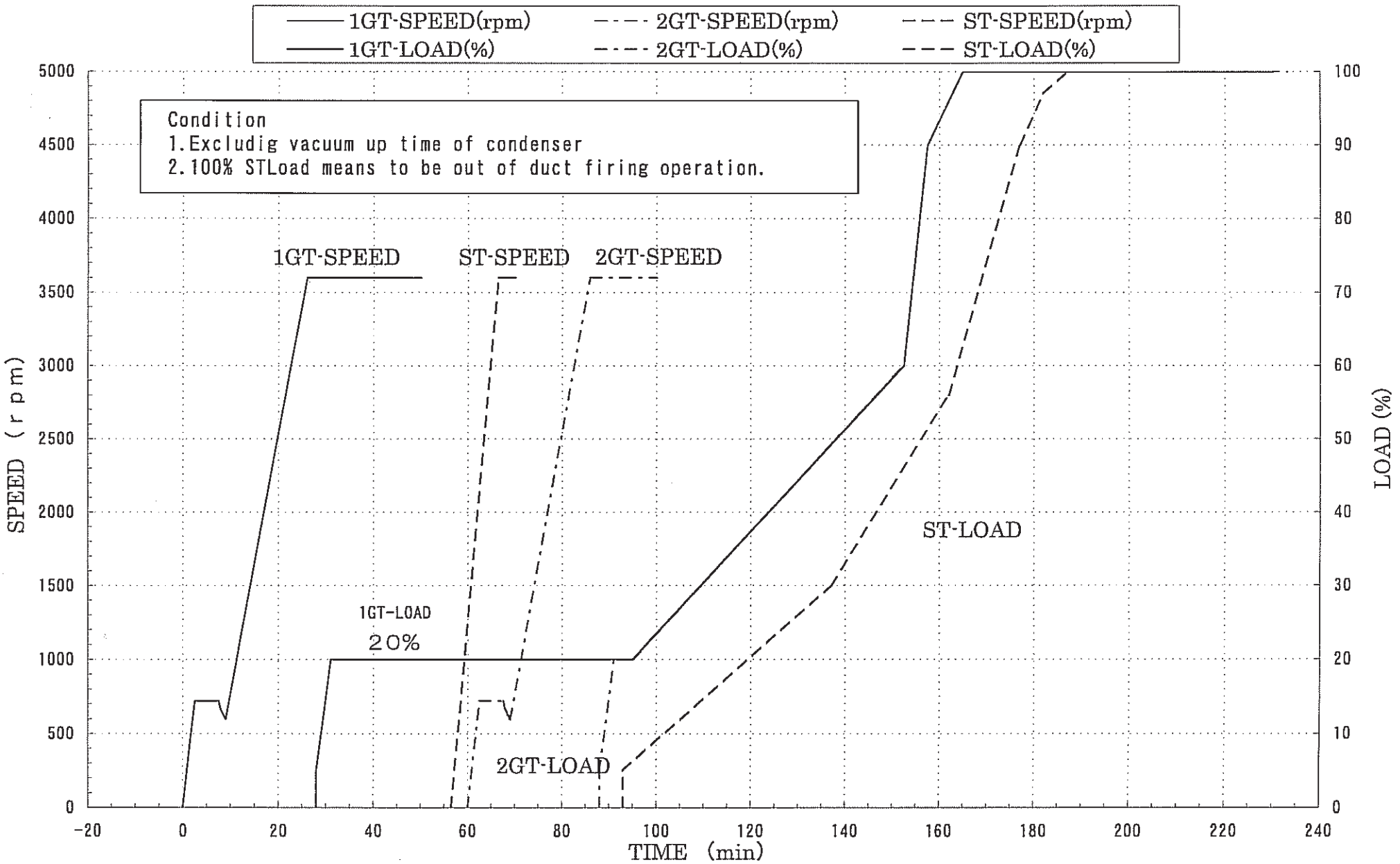
PLAN RECORD

REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
R-0	Jun.20 2002	First Issue	———	———	———

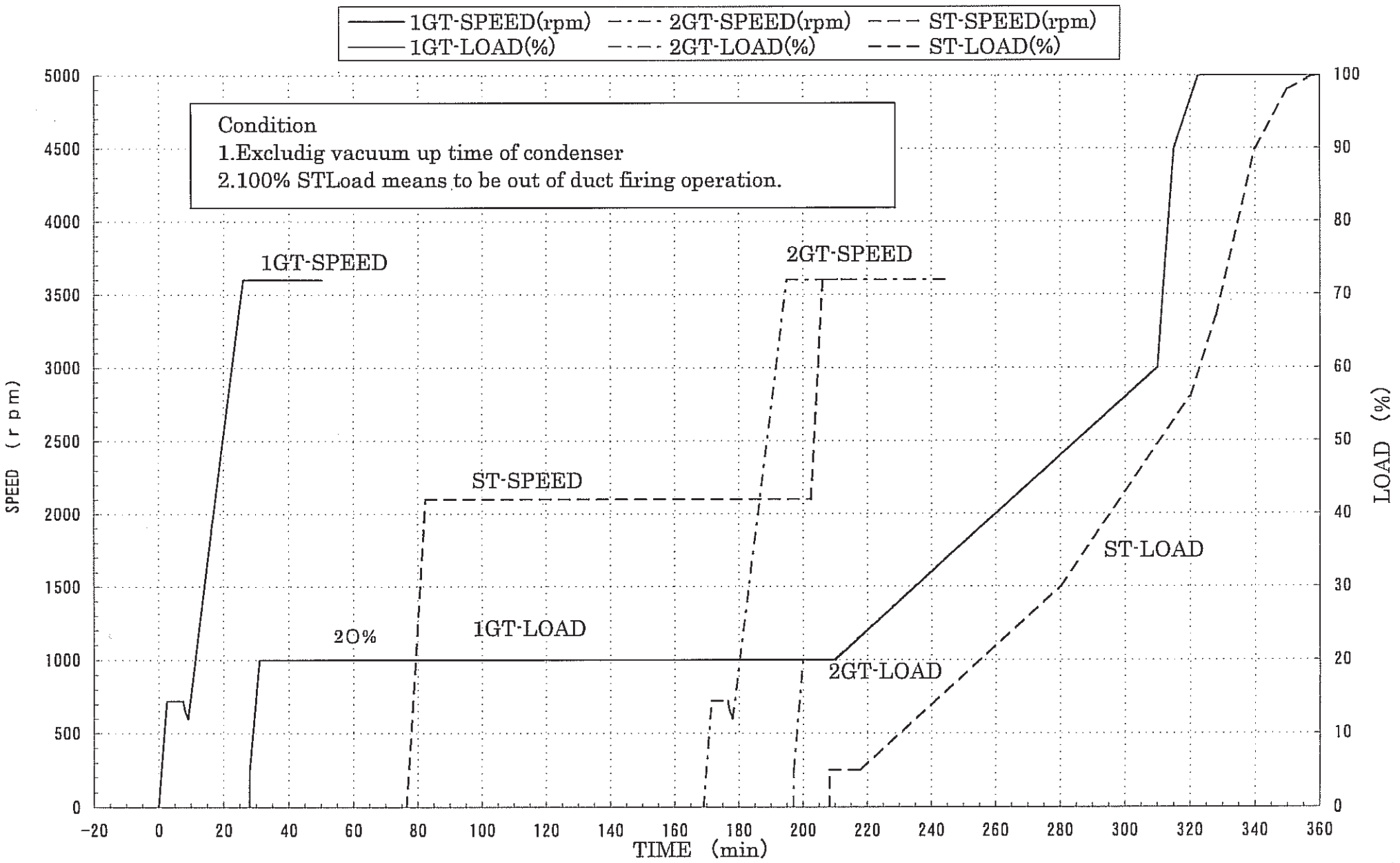
HOT START MODE (501F/2on1)



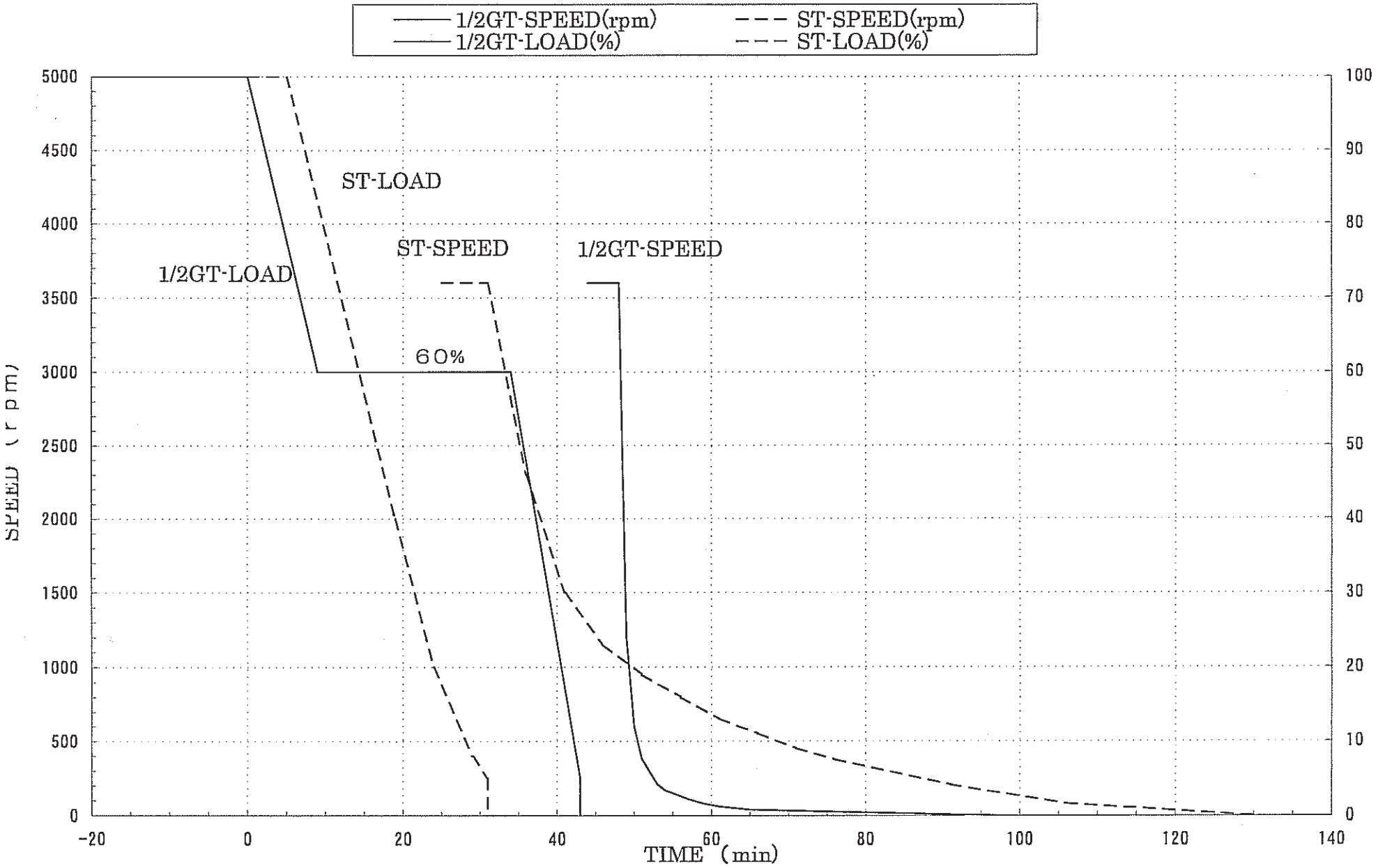
WARM START MODE (501F/2on1)



COLD START MODE (501F/2on1)



NORMAL STOP MODE (501F/2on1)



Mitsubishi

- Combustion Turbine Expected Performance Data Sheet

pfs_gt1g_e.xlt Sheet No. DATE: 01-Aug-06

COMMERCIAL DATA							
Customer		Ch2M Hill					
Project Name		Colorado Energy Management					
Manufacture Name		Mitsubishi Power Systems					
INPUT INFORMATION							
G/T Model		M501F					
NOx Control		Dry Low NOx					
Fuel Type		Gaseous Fuel (MPS Std)					
Fuel LHV	Btu/lb	19682.7					
CONDITION		1	2	3	4	5	6
Ambient Temperature	deg.F	30	45	95	95		
Relative Humidity	%	70	60	20	20		
Barometric Pressure	psi	12.833	12.833	12.833	12.833		
Exhaust Loss (total)	inH2O	16.8	16	13.3	14.6		
PERFORMANCE							
Gross Output	kW	166,840	158,740	131,000	146,270		
Gross Heat Rate	btu/kWh	9,501	9,618	10,115	9,848		
Fuel Flow	lb/h	80,530	77,570	67,330	73,190		
Evaporation water flow	lb/h	0	0	0	18,080		
Exhaust Flow	1000lb/h	3,379.7	3,282.8	2,955.6	3,111.9		
Exhaust Temperature	deg.F	1132	1141	1166	1159		
Exhaust Gas Composition							
O2	wt.%	13.93	13.98	14.22	13.8		
CO2	wt.%	6.02	5.97	5.75	5.94		
H2O	wt.%	5.07	5.18	5.37	6.08		
SOx	wt.%	0	0	0	0		
N2	wt.%	73.66	73.56	73.35	72.88		
Ar	wt.%	1.32	1.31	1.31	1.3		
SOx	ppmvd	N/A	N/A	N/A	N/A		
Exhaust Emission							
NOx (@15%O2)	ppmvd	25	25	25	25		
CO (@15%O2)	ppmvd	10	10	10	10		
VOC (@15%O2)	ppmvd	1	1	1	1		
Particle (@actual O2)	mg/Nm3	1	1	1	1		

(Note) 1 Above performance data are based on New & Clean condition.

2 Sulfur contents and Fuel Bound Nitrogen in fuel gas is not considered.

3 Allowable performance test tolerance will be permitted as follows;

Power Output : +/- 1.0%

Heat Rate : +/- 1.5%

4 The fuel is assumed, when it changes then the performance will change.

Mitsubishi

- Combustion Turbine Expected Performance Data Sheet

pfs_gt1g_e.xlt Sheet No. DATE: 25-Aug-06

COMMERCIAL DATA							
Customer		Ch2M Hill					
Project Name		Colorado Energy Management					
Manufacture Name		Mitsubishi Power Systems					
INPUT INFORMATION							
G/T Model		M501F					
NOx Control		Dry Low NOx					
Fuel Type		Gaseous Fuel (MPS Std)					
Fuel LHV	Btu/lb	19682.7					
CONDITION		100%	75%	50%	40%	20%	0%
Ambient Temperature	deg.F	30	30	30	30	30	30
Relative Humidity	%	70	70	70	70	70	70
Barometric Pressure	psi	12.833	12.833	12.833	12.833	12.833	12.833
Exhaust Loss (total)	inH2O	16.8	12.3	8.5	7.9	6.7	5.5
PERFORMANCE							
Gross Output	kW	166,840	124,710	82,530	65,700	31,720	0
Gross Heat Rate	btu/kWh	9,501	9,905	11,308	12,245	17,504	#DIV/0!
Fuel Flow	lb/h	80,530	62,760	47,420	40,880	28,220	15,290
Injection Flow	lb/h	0	0	0	0	0	0
Exhaust Flow	1000lb/h	3,379.7	2,972.5	2,474.0	2,467.5	2,454.9	2,442.1
Exhaust Temperature	deg.F	1132	1037	1007	911	721	514
Exhaust Gas Composition							
O2	wt.%	13.93	15	15.77	16.77	18.72	20.73
CO2	wt.%	6.02	5.31	4.82	4.16	2.88	1.56
H2O	wt.%	5.07	4.51	4.11	3.59	2.57	1.52
SOx	wt.%	0	0	0	0	0	0
N2	wt.%	73.66	73.86	73.98	74.15	74.5	74.85
Ar	wt.%	1.32	1.32	1.32	1.33	1.33	1.34
SOx	ppmvd						
Exhaust Emission							
NOx (@15%O2)	ppmvd	25	25	40	70	70	80
CO (@15%O2)	ppmvd	10	10	15	120	2500	2500
VOC (@15%O2)	ppmvd	1	1	1.5	7.8	196	750
Particle (@actual O2)	mg/Nm3	1	1	1	1	1	1

(Note) 1 All values above are, "For Information Only", they are NOT considered Guarenteed.

2 Above performance data are based on New & Clean condition.

3 Sulfur contents and Fuel Bound Nitrogen in fuel gas is not considered.

4 The fuel is assumed, (below, mol%), when it changes then the performance will change.

CH4=90%, C2H6=5%, N2=5%

Attachment 3

Mona Johnson

From: Mona Johnson
Sent: Wednesday, January 29, 2014 12:29 PM
To: ted.fuhrman@cmigroupe.com
Cc: Roger Schnabel; Nuria de las Casas; Matthew Lindsey; Michael Barnett
Subject: FW: LPP CO Catalyst info
Attachments: 2013-01-29 CO Startup Info- with Comments.xlsx; 2014-01-29 Hobbs Hourly Calcs.xlsx

Hi Ted-
Thanks for looking at this information so quickly. I realize now that I did not explain very well in the spreadsheets that I sent to Roger previously the specific information that we need. I have attempted to clarify this by adding some comment boxes to the spreadsheet. Ultimately, our goal is to try to quantify mass emission rates during startup and shutdown events at the facility. For typical environmental permitting, we just look at the base load case and use vendor information for any control technologies (SCR and oxidation catalyst) to establish permit allowable emission rates. In the last few years, permitting agencies have been requiring that startup/shutdown emission rates also be quantified. For NOx, we have done this using part load GT exhaust concentration data information, emission factors for duct burner contribution, and assumed that the SCR does not effectively control the NOx until it reaches required temperature set points, at about 75% load (which is basically the end of the startup sequence).

I am not sure how the oxidation catalyst performance might vary as the unit comes up in a startup sequence or ramps down in a shutdown sequence. Therefore, we would like to get information from you regarding what the expected performance of the catalyst is likely to be at various part load conditions. This will allow us to estimate the mass emission rates that can be represented in the air permit application. In the spreadsheet that was originally sent (rows 8 through 11), we have provided GT exhaust concentrations expected at the part load scenarios of 1%, 20%, 40%, 50%, and 75% during a startup. If you could indicate what you expect the post-catalyst controlled concentrations or control efficiencies will be for each of these loads, it would be very helpful (row 7). The same loads are listed for a shutdown sequence (rows 17 – 20) and need input regarding catalyst performance in row 16.

The very last table is designed to show what the mass emission rate per startup or shutdown event will be. Rows 26 through 29 list how much time the unit is expected to stay at each load level during a hot, warm, or cold startup and a shut down. If you can create this information, please add it to the table. Otherwise, we will use the control efficiency and the emission rate information in the other two tables to estimate this value.

I am also attaching an emission rate calculation sheet that provides some of the design information for the base load case. Unfortunately, we do not have this level of detail for the part load cases. Hopefully you can help us out with your best estimates. Please feel free to call me with any questions.

--Mona

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HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

CO & VOC Emission Rate out Stack at Each Load Level per Unit during Startup

Air Pollutant	Units	75% CTG Load	50% CTG Load	40% CTG Load	20% CTG Load	0% CTG Load
Oxidation Catalyist Efficiency (%)						
CO	ppmvd @ 15% O_2	10	15	120	2,500	2,500
	maximum 1-hr lb/hr	30.0	33.8	232.6	3,315.5	1,753.6
VOC	ppmvd @ 15% O_2	2.0	2.5	7.8	196.0	750.0
	maximum 1-hr lb/hr	3.4	3.2	8.7	148.9	301.3

-

Mona Johnson:
The values in Row 8 trhough Row 11 are the pre-control values that we have right now. We need to understand if the catalyst is actually in operation at these loads, and, if so, what the actual controlled concentration out the stack will be and what the catalyst efficiency is at the given load.

In short, please replace bright yellow highlighted information with correct vendor information for the part load scenarios that the unit experiences during the startupand shut down sequences.

CO & VOC Emission Rate out Stack at Each Load Level per Unit during Shutdown

Air Pollutant	Units	75% CTG Load	50% CTG Load	40% CTG Load	20% CTG Load	0% CTG Load
Oxidation Catalyist Efficiency (%)						
CO	ppmvd @ 15% O_2	10	15	120	2,500	2,500
	maximum 1-hr lb/hr	30.0	33.8	232.6	3,315.5	1,753.6
VOC	ppmvd @ 15% O_2	2.0	2.5	7.8	196.0	750.0
	maximum 1-hr lb/hr	3.4	3.2	8.7	148.9	301.3

Mona Johnson:
Same comment as above for the shut-down sequence shown in this table.

Duration at Each Load Level

Mode	Duration per Load Level (min)					CO lbs/event	Total Event Time (min)	No. of Events (ev/yr)	Event Duration (hr/yr)
	75% CTG Load	50% CTG Load	40% CTG Load	20% CTG Load	0% CTG Load				
Cold Startup	6	14	14	128	17		180	60	180
Warm Startup	7	12	10	68	23		120	70	140
Hot Startup	9	11	39	3	28		90	50	75
Shutdown	3	3	11	1	8		25	180	75
					Total		**415**	**360**	**470**

Mona Johnson:
If possible, add the lb/event expected. Otherwise we will calculate based on information in tables above.

Notes:

(1) Based on historical operational knowledge on startup duration and frequency.

HOBBS 501F4 Hourly Emission Rate Calculation (100% Load)

		Case 4 Unfired Winter Chillers Off	Case 4 Fired Winter Chillers Off	Case 5 Unfired Summer Chillers On	Case 5 Fired Summer Chillers On	Case 6 Unfired Summer Chillers Off	Case 6 Fired Summer Chillers Off
SITE CONDITIONS							
Ambient Temperature	ºF	30	30	95	95	95	95
Ambient Relative Humidity	%	20	20	95	95	20	20
Barometric Pressure	psia	12.83	12.83	12.83	12.83	12.83	12.83
Compressor Inlet Temperature	ºF	30	30	46	46	95	95
FACILITY CONDITIONS							
GT Power Output	MW	180.3	180.3	171.7	171.7	140.8	140.8
GT Model		Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4
GT Load		Base	Base	Base	Base	Base	Base
Chillers ON/OFF		Off	Off	**On**	**On**	Off	Off
GT Fuel Flow Rate	lb/hr	82,176	82,176	79,115	79,115	67,668	67,668
GT Heat Input (LHV)	MMBtu/hr	1,697	1,697	1,633	1,633	1,397	1,397
GT Heat Input (HHV)	MMBtu/hr	1,811	1,811	1,743	1,743	1,491	1,491
GT Fuel Flow Rate	MMscf/hr	1.75	1.75	1.69	1.69	1.44	1.44
DB Model		Forney	Forney	Forney	Forney	Forney	Forney
DB Status		Off	On	Off	On	Off	On
DB Heat Input (LHV)	MMBtu/hr	-	330	-	330	-	330
DB Heat Input (HHV)	MMBtu/hr	-	366	-	366	-	366
DB Fuel Flow Rate	MMscf/hr	-	0.35	-	0.35	-	0.35
FUEL ANALYSIS							
Fuel Type		PNG	PNG	PNG	PNG	PNG	PNG
Fuel Molecular Weight	lb/lbmole	17.3	17.3	17.3	17.3	17.3	17.3
Sulfur Content	grains/100scf	1.7	1.7	1.7	1.7	1.7	1.7
Fuel Heat Content (LHV)	Btu/scf	932	932	932	932	932	932
Fuel Heat Content (HHV)	Btu/scf	1,033	1,033	1,033	1,033	1,033	1,033
HHV/LHV Ratio		1.11	1.11	1.11	1.11	1.11	1.11
GT EXHAUST GAS ANALYSIS							
Oxygen, O2	%vol	12.3	12.3	12.1	12.1	12.5	12.5
Carbon Dioxide, CO2	%vol	4.0	4.0	3.9	3.9	3.8	3.8
Water, H2O	%vol	7.9	7.9	8.8	8.8	8.6	8.6
Nitrogen, N2	%vol	74.9	74.9	74.3	74.3	74.2	74.2
Argon, Ar	%vol	0.9	0.9	0.9	0.9	0.9	0.9
Total	%vol	100.00	100.00	100.00	100.00	100.00	100.00
Molecular Weight (GT Exhaust Gases)	lb/lbmole	28.5	28.5	28.3	28.3	28.4	28.4
GT Exhaust Temperature	ºF	1,145	1,145	1,156	1,156	1,168	1,168
GT Exhaust Flow Rate	lb/hr	3,592,532	3,592,532	3,467,318	3,467,318	3,113,817	3,113,817
GT Exhaust Flow Rate	lbmole/hr	126,232	126,232	122,320	122,320	109,774	109,774
GT Exhaust Flow Rate	MMscf/hr	48.64	48.64	47.13	47.13	42.30	42.30
GT Exhaust Flow Rate	Nm3/hr	1,377,266	1,377,266	1,334,591	1,334,591	1,197,698	1,197,698
GT Exhaust Oxygen, O2	lbmole/hr	15,527	15,527	14,816	14,816	13,722	13,722
GT Exhaust Carbon Dioxide, CO2	lbmole/hr	5,049	5,049	4,775	4,775	4,171	4,171
GT Exhaust Water, H2O	lbmole/hr	9,972	9,972	10,775	10,775	9,441	9,441
GT Exhaust Nitrogen, N2	lbmole/hr	94,548	94,548	90,853	90,853	81,452	81,452
GT Exhaust Argon, Ar	lbmole/hr	1,136	1,136	1,102	1,102	988	988

HOBBS 501F4 Hourly Emission Rate Calculation (100% Load)

		Case 4 Unfired Winter Chillers Off	Case 4 Fired Winter Chillers Off	Case 5 Unfired Summer Chillers On	Case 5 Fired Summer Chillers On	Case 6 Unfired Summer Chillers Off	Case 6 Fired Summer Chillers Off
GT EMISSION RATES							
NOx	ppmvd @ 15% O2	25	25	25	25	25	25
NOx	ppmvd	32	32	32	32	31	31
NOx (as NO2)	lb/hr	172	172	165	165	141	141
CO	ppmvd @ 15% O2	15	15	15	15	15	15
CO	ppmvd	19	19	19	19	18	18
CO	lb/hr	63	63	60	60	52	52
VOC	ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0
VOC	ppmvd	2.6	2.6	2.6	2.6	2.4	2.4
VOC (as CH4)	lb/hr	4.8	4.8	4.6	4.6	3.9	3.9
Sulfur Content	grains/100scf	1.7	1.7	1.7	1.7	1.7	1.7
SO2	lb/hr	8.4	8.4	8.0	8.0	6.9	6.9
PM10	mg/Nm3	3.70	3.70	3.70	3.70	3.70	3.70
PM10	lb/hr	11.2	11.2	10.9	10.9	9.8	9.8
Formaldehyde, HCHO	ppbvd @ 15% O2	91	91	91	91	91	91
Formaldehyde, HCHO	ppmvd	0.1	0.1	0.1	0.1	0.1	0.1
Formaldehyde, HCHO	lb/hr	0.4	0.4	0.4	0.4	0.3	0.3
DB EMISSION RATES							
NOx	lb/MMBtu (LHV)	0.02	0.02	0.02	0.02	0.02	0.02
NOx	lb/hr	-	6.6	-	6.6	-	6.6
CO	lb/MMBtu (LHV)	0.012	0.012	0.012	0.012	0.012	0.012
CO	lb/hr	-	3.8	-	3.8	-	3.8
VOC	lb/MMBtu (LHV)	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013
VOC (as CH4)	lb/hr	-	0.4	-	0.4	-	0.4
Sulfur Content	grains/100scf	1.67	1.67	1.67	1.67	1.67	1.67
SO2	lb/hr	-	1.7	-	1.7	-	1.7
PM10	lb/MMBtu (LHV)	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175
PM10	lb/hr	-	5.8	-	5.8	-	5.8
Formaldehyde, HCHO	lb/MMscf (HHV)	7.50E-02	7.50E-02	7.50E-02	7.50E-02	7.50E-02	7.50E-02
Formaldehyde, HCHO	lb/MMBtu (HHV)	7.35E-05	7.35E-05	7.35E-05	7.35E-05	7.35E-05	7.35E-05
Formaldehyde, HCHO	lb/hr	-	0.03	-	0.03	-	0.03
STACK EXHAUST GAS							
Fuel x, in CxHy		1.04	1.04	1.04	1.04	1.04	1.04
Fuel y, in Cx,Hy		4.02	4.02	4.02	4.02	4.02	4.02
DB Fuel Flow Rate	lbmole/hr	-	919.3	-	919.3	-	919.3
Oxygen Consumed at DB, O2	lbmole/hr	-	1,874.8	-	1,874.8	-	1,874.8
Carbon Dioxide Produced at DB, CO2	lbmole/hr	-	951.4	-	951.4	-	951.4
Water Produced at DB, H2O	lbmole/hr	-	1,846.7	-	1,846.7	-	1,846.7
Stack Exhaust Oxygen, O2	lbmole/hr	15,527	13,652	14,816	12,941	13,722	11,847
Stack Exhaust Carbon Dioxide, CO2	lbmole/hr	5,049	6,001	4,775	5,727	4,171	5,123
Stack Exhaust Water, H2O	lbmole/hr	9,972	11,819	10,775	12,622	9,441	11,287
Stack Exhaust Nitrogen, N2	lbmole/hr	94,548	94,548	90,853	90,853	81,452	81,452
Stack Exhaust Argon, Ar	lbmole/hr	1,136	1,136	1,102	1,102	988	988
Stack Exhaust Flow Rate	lbmole/hr	126,232	127,155	122,320	123,244	109,774	110,697
Stack Exhaust Oxygen, O2	%vol	12.3	10.7	12.1	10.5	12.5	10.7
Stack Exhaust Carbon Dioxide, CO2	%vol	4.0	4.7	3.9	4.6	3.8	4.6
Stack Exhaust Water, H2O	%vol	7.9	9.3	8.8	10.2	8.6	10.2
Stack Exhaust Nitrogen, N2	%vol	74.9	74.4	74.3	73.7	74.2	73.6
Stack Exhaust Argon, Ar	%vol	0.9	0.9	0.9	0.9	0.9	0.9
Stack Exhaust Flow Rate	%vol	100.0	100.0	100.0	100.0	100.0	100.0
Molecular Weight (Stack Exhaust Gases)	lb/lbmole	28.5	28.4	28.3	28.3	28.4	28.3
Stack Exhaust Flow Rate	scfm	810,628	816,558	785,510	791,440	704,938	710,868
Stack Exhaust Flow Rate	dscfm	746,589	740,659	716,316	710,387	644,313	638,384
Stack Exit Temperature	ºF	179	179	179	179	179	179
Stack Exit Pressure	psia	12.83	12.83	12.83	12.83	12.83	12.83
Stack Exhaust Flow Rate	acfm	1,206,138	1,214,960	1,168,765	1,177,587	1,048,881	1,057,704
Stack Diameter	ft	18.0	18.0	18.0	18.0	18.0	18.0
Stack Velocity	fps	79.0	79.6	76.5	77.1	68.7	69.3

HOBBS 501F4 Hourly Emission Rate Calculation (100% Load)

		Case 4 Unfired Winter Chillers Off	Case 4 Fired Winter Chillers Off	Case 5 Unfired Summer Chillers On	Case 5 Fired Summer Chillers On	Case 6 Unfired Summer Chillers Off	Case 6 Fired Summer Chillers Off
STACK EMISSION RATES							
NOx (pre-SCR)	ppmvd @ 15% O2	25.1	21.9	24.9	21.6	24.9	21.2
NOx (pre-SCR)	ppmvd	32.2	33.7	32.2	33.7	30.5	32.3
NOx (pre-SCR as NO2)	lb/hr	172.0	178.6	165.0	171.6	141.0	147.6
NOx (post-SCR)	ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0
NOx (post-SCR)	ppmvd	2.6	3.1	2.6	3.1	2.4	3.0
NOx (post-SCR as NO2)	lb/hr	13.7	16.3	13.3	15.9	11.3	13.9
CO (pre-Catalytic Oxidation)	ppmvd @ 15% O2	15.1	13.5	14.9	13.2	15.1	13.2
CO (pre-Catalytic Oxidation)	ppmvd	19.3	20.7	19.2	20.6	18.5	20.1
CO (pre-Catalytic Oxidation)	lb/hr	63.0	66.8	60.0	63.8	52.0	55.8
CO (post-Catalytic Oxidation)	ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0
CO (post-Catalytic Oxidation)	ppmvd	2.6	3.1	2.6	3.1	2.4	3.0
CO (post-Catalytic Oxidation)	lb/hr	8.3	9.9	8.1	9.7	6.9	8.5
VOC (pre-Catalytic Oxidation)	ppmvd @ 15% O2	2.0	1.8	2.0	1.8	2.0	1.8
VOC (pre-Catalytic Oxidation)	ppmvd	2.57	2.82	2.6	2.8	2.4	2.7
VOC (pre-Catalytic Oxidation as CH4)	lb/hr	4.8	5.2	4.6	5.0	3.9	4.3
VOC (post-Catalytic Oxidation)	ppmvd @ 15% O2	1.0	1.0	1.0	1.0	1.0	1.0
VOC (post-Catalytic Oxidation)	ppmvd	1.3	1.5	1.3	1.6	1.2	1.5
VOC (post-Catalytic Oxidation as CH4)	lb/hr	2.4	2.8	2.3	2.8	2.0	2.4
SO2	ppmvd @ 15% O2	0.9	0.9	0.9	0.9	0.9	0.9
SO2	ppmvd	1.12	1.36	1.13	1.37	1.07	1.35
SO2	lb/hr	8.36	10.04	8.04	9.73	6.88	8.57
PM10	lb/hr	11.23	17.01	10.89	16.66	9.77	15.54
HCHO	lb/hr	0.41	0.43	0.39	0.42	0.34	0.36
NH3	ppmvd @ 15% O2	10.0	10.0	10.0	10.0	10.0	10.0
NH3	ppmvd	12.79	15.36	12.91	15.60	12.24	15.22
NH3	lb/hr	25.32	30.17	24.53	29.38	20.92	25.77

Attachment 4

Mona Johnson

From: FUHRMAN Ted <ted.fuhrman@cmigroupe.com>
Sent: Monday, February 03, 2014 12:56 PM
To: Roger Schnabel
Cc: DENBOW Jarrod; Michael Barnett; Mona Johnson
Subject: RE: LPP CO Catalyst info
Attachments: CMI Hobbs Startup Emissions Expected.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Roger,

Attached is a summary of the estimated stack CO and VOC emissions based upon the information you have provided. We performed thermal evaluations for each CTG load point to determine the bulk temperatures in the catalyst region. These, with the information you provided, were used to generate the start-up emission values. The catalyst retains heat for a fairly long period and as a result, the shutdown values were based on no temperature degradation.

Please advise of any questions. Good luck on your permit acceptance.

Regards,

Ted

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HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

CO & VOC Emission Rate out Stack at Each Load Level per Unit during a COLD Startup

Air Pollutant	Units	75% CTG Load 565 °F @ Catalyst		50% CTG Load 529 °F @ Catalyst		40% CTG Load 524 °F @ Catalyst		20% CTG Load 468 °F @ Catalyst		0% CTG Load 404 °F @ Catalyst	
Oxidation Catalyist Efficiency (%)		To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst
CO	ppmvd @ 15% O_2	10	1.8	15	1.9	120	15.4	2,500	332.5	2,500	352.5
	maximum 1-hr lb/hr	30.0	5.5	33.8	4.3	232.6	29.8	3,315.5	441.0	1,753.6	247.3
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196.0	68.6	750.0	300.0
	maximum 1-hr lb/hr	3.4	1.2	3.2	1.1	8.7	3.0	148.9	52.1	301.3	120.5

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CO & VOC Emission Rate out Stack at Each Load Level per Unit during a WARM Startup

Air Pollutant	Units	75% CTG Load 584.5 °F @ Catalyst		50% CTG Load 564 °F @ Catalyst		40% CTG Load 531 °F @ Catalyst		20% CTG Load 492.4 °F @ Catalyst		0% CTG Load 435.4 °F @ Catalyst	
Oxidation Catalyist Efficiency (%)		To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst
CO	ppmvd @ 15% O_2	10	1.8	15	1.9	120	15.2	2,500	322.5	2,500	340.0
	maximum 1-hr lb/hr	30.0	5.4	33.8	4.2	232.6	29.5	3,315.5	427.7	1,753.6	238.5
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196.0	68.6	750.0	300.0
	maximum 1-hr lb/hr	3.4	1.2	3.2	1.1	8.7	3.0	148.9	52.1	301.3	120.5

CO & VOC Emission Rate out Stack at Each Load Level per Unit during a HOT Startup

Air Pollutant	Units	75% CTG Load 586 °F @ Catalyst		50% CTG Load 581 °F @ Catalyst		40% CTG Load 559 °F @ Catalyst		20% CTG Load 522 °F @ Catalyst		0% CTG Load 491 °F @ Catalyst	
Oxidation Catalyist Efficiency (%)		To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst
CO	ppmvd @ 15% O_2	10	1.8	15	1.8	120	14.9	2,500	315.0	2,500	322.5
	maximum 1-hr lb/hr	30.0	5.4	33.8	4.2	232.6	28.8	3,315.5	417.8	1,753.6	226.2
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196.0	68.6	750.0	300.0
	maximum 1-hr lb/hr	3.4	1.2	3.2	1.1	8.7	3.0	148.9	52.1	301.3	120.5

CO & VOC Emission Rate out Stack at Each Load Level per Unit during Shutdown

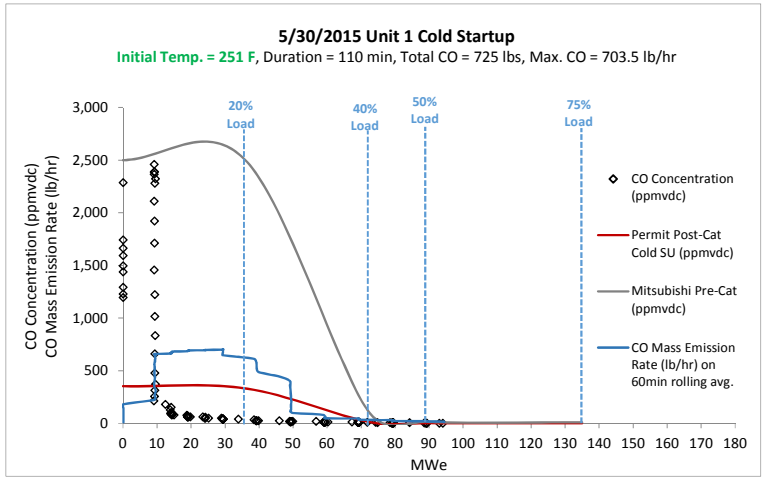
Air Pollutant	Units	75% CTG Load		50% CTG Load		40% CTG Load		20% CTG Load		0% CTG Load	
Oxidation Catalyist Efficiency (%)		To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst	To Catalyst	Out Catalyst
CO	ppmvd @ 15% O_2	10	1.7	15	1.7	120	13.9	2,500	285.0	2,500	285.0
	maximum 1-hr lb/hr	30.0	5.2	33.8	3.9	232.6	27.0	3,315.5	378.0	1,753.6	199.9
VOC	ppmvd @ 15% O_2	2.0	0.6	2.5	0.8	7.8	2.3	196.0	58.8	750.0	225.0
	maximum 1-hr lb/hr	3.4	1.0	3.2	1.0	8.7	2.6	148.9	44.7	301.3	90.4

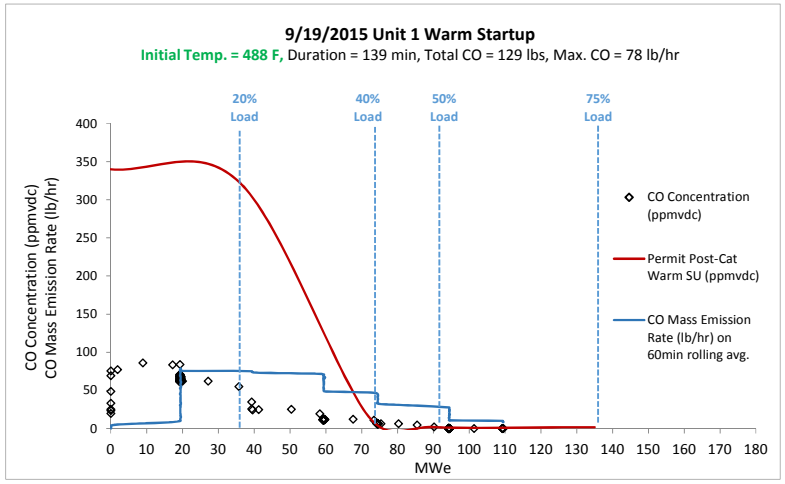
Duration at Each Load Level

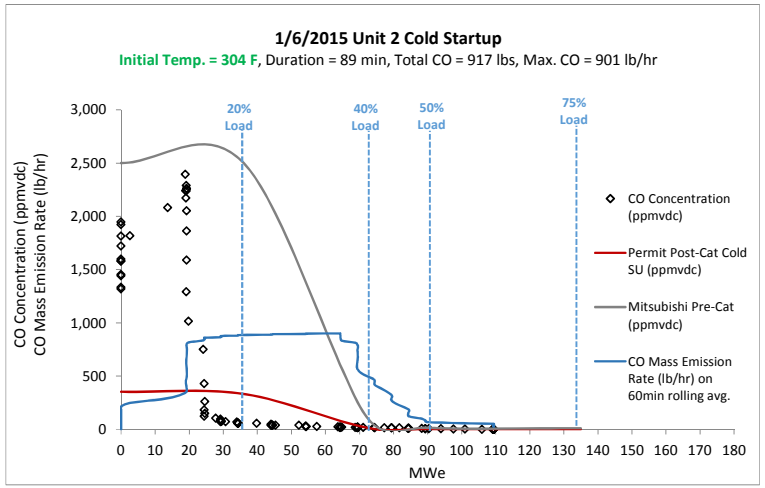
Mode	Duration per Load Level (min)					CO lbs/event	VOC lbs/event	Total Event Time (min)	No. of Events (ev/yr)	Event Duration (hr/yr)
	75% CTG Load	50% CTG Load	40% CTG Load	20% CTG Load	0% CTG Load					
Cold Startup	6	14	14	128	17	1,723	494	180	60	180
Warm Startup	7	12	10	68	23	1,056	405	120	70	140
Hot Startup	9	11	39	3	28	375	311	90	50	75
Shutdown	2.55	3.06	10.71	0.77	7.91	93	65	25	180	75
					Total (lbs/yr)	212,745.97	85,282.31	415	360	470

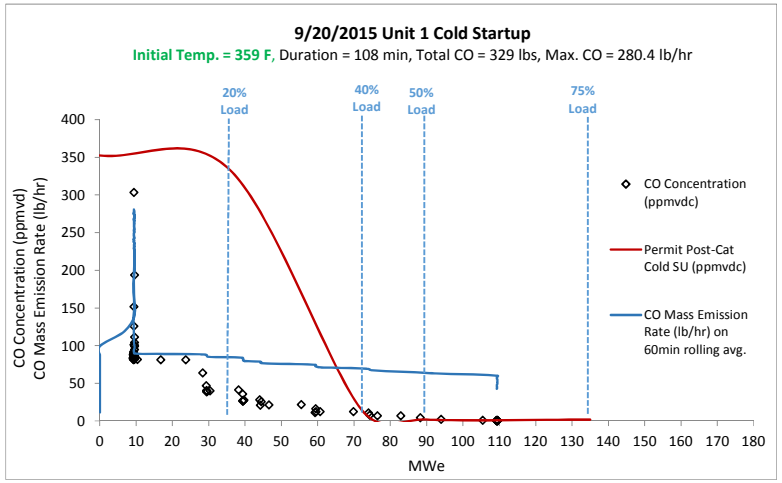
Notes:

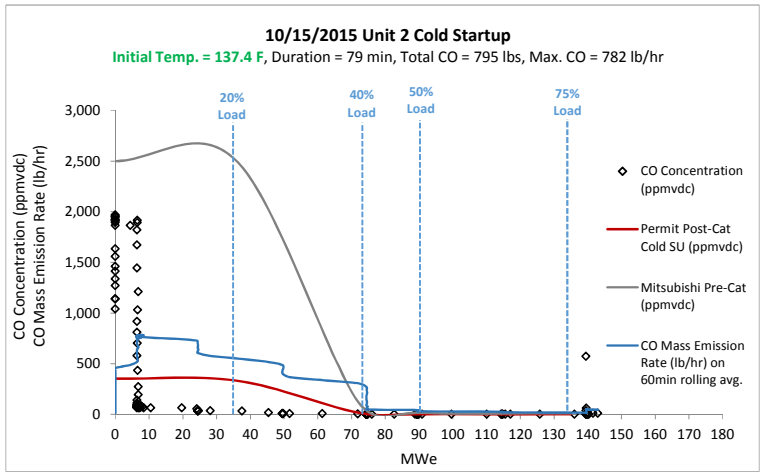
(1) Based on historical operational knowledge on startup duration and frequency.

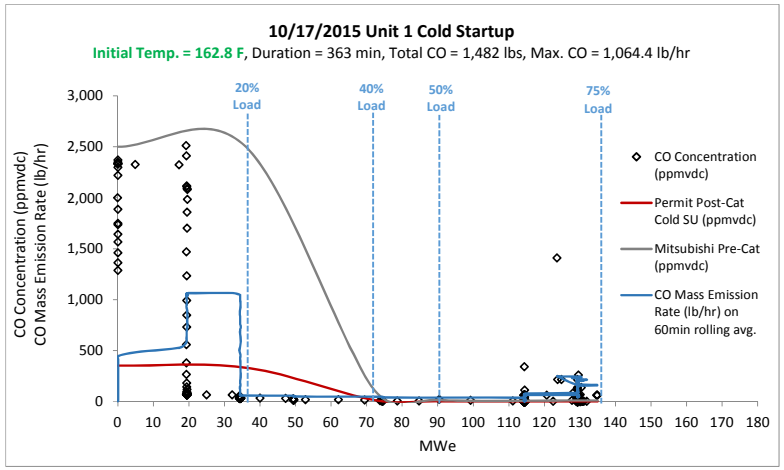

5/30/2015 Unit 1 Cold Startup
Initial Temp. = 251 F, Duration = 110 min, Total CO = 725 lbs, Max. CO = 703.5 lb/hr
20% Load
40% Load
50% Load
75% Load
CO Concentration (ppmvdc)
CO Mass Emission Rate (lb/hr)
MWe
CO Concentration (ppmvdc)
Permit Post-Cat Cold SU (ppmvdc)
Mitsubishi Pre-Cat (ppmvdc)
CO Mass Emission Rate (lb/hr) on 60min rolling avg.

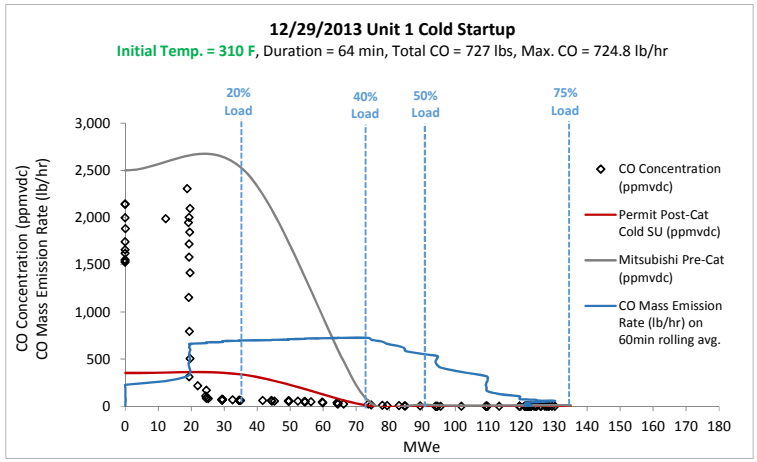

9/19/2015 Unit 1 Warm Startup
Initial Temp. = 488 F, Duration = 139 min, Total CO = 129 lbs, Max. CO = 78 lb/hr
20% Load
40% Load
50% Load
75% Load
CO Concentration (ppmvdc)
CO Mass Emission Rate (lb/hr)
MWe
CO Concentration (ppmvdc)
Permit Post-Cat Warm SU (ppmvdc)
CO Mass Emission Rate (lb/hr) on 60min rolling avg.

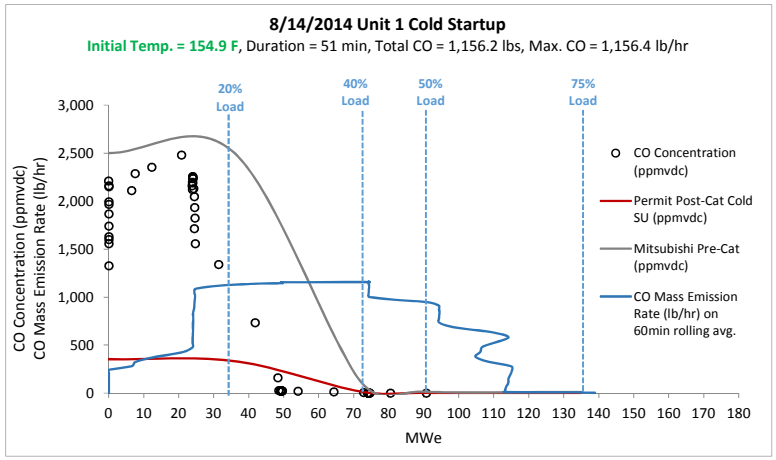

1/6/2015 Unit 2 Cold Startup
Initial Temp. = 304 F, Duration = 89 min, Total CO = 917 lbs, Max. CO = 901 lb/hr
20% Load
40% Load
50% Load
75% Load
CO Concentration (ppmvdc)
CO Mass Emission Rate (lb/hr)
MWe
CO Concentration (ppmvdc)
Permit Post-Cat Cold SU (ppmvdc)
Mitsubishi Pre-Cat (ppmvdc)
CO Mass Emission Rate (lb/hr) on 60min rolling avg.

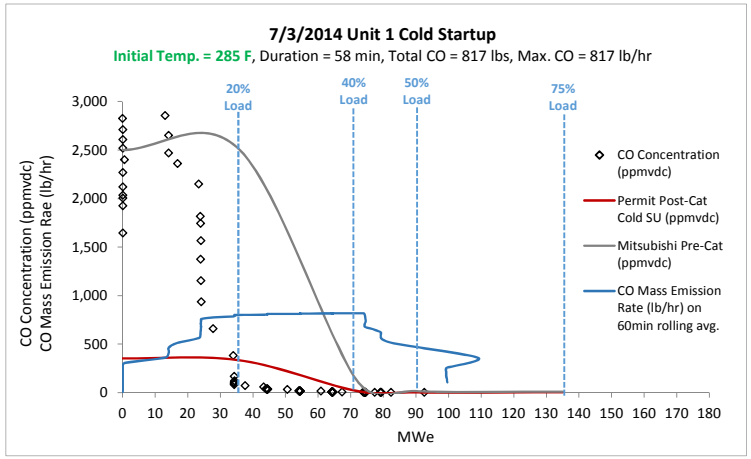

9/20/2015 Unit 1 Cold Startup
Initial Temp. = 359 F, Duration = 108 min, Total CO = 329 lbs, Max. CO = 280.4 lb/hr
20% Load
40% Load
50% Load
75% Load
CO Concentration (ppmvd)
CO Mass Emission Rate (lb/hr)
MWe
CO Concentration (ppmvdc)
Permit Post-Cat Cold SU (ppmvdc)
CO Mass Emission Rate (lb/hr) on 60min rolling avg.











2015 Startup Data	Event Duration (minutes)	Total Event CO Emissions (lb/event)	CO Max. 60-min Rolling Avg. Emissions (lb/hr)
Unit 1 Max.	363	1,482	1,259
Unit 2 Max.	250	1,668	1,648
Max. Both Units	363	1,668	1,648

* Unit 2 event on 1/1/15 driving the maximum emissions may need to be evaluated to confirm data is valid

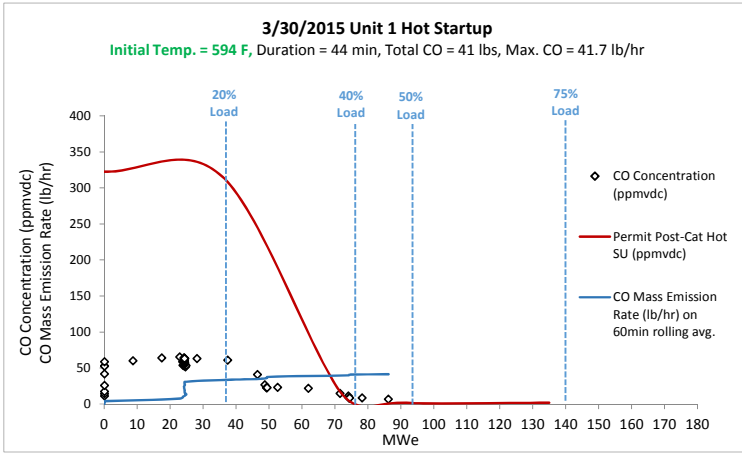
2014 Startup Data	Event Duration (minutes)	Total Event CO Emissions (lb/event)	CO Max. 60-min Rolling Avg. Emissions (lb/hr)
Unit 1 Max.	437	1,692	1,250
Unit 2 Max.	364	1,187	1,087
Max. Both Units	437	1,692	1,250

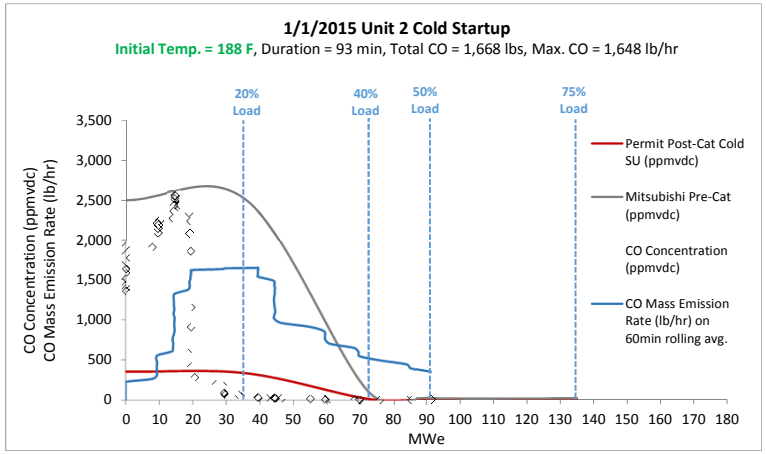
2013 Startup Data	Event Duration (minutes)	Total Event CO Emissions (lb/event)	CO Max. 60-min Rolling Avg. Emissions (lb/hr)
Unit 1 Max.	243	727	725
Unit 2 Max.	160	1,164	1,036
Max. Both Units	243	1,164	1,036

2013 - 2015 Startup Data	Event Duration (minutes)	Total Event CO Emissions (lb/event)	CO Max. 60-min Rolling Avg. Emissions (lb/hr)
Unit 1 Max.	437	1,692	1,259
Unit 2 Max.	364	1,668	1,648
Max. Both Units	**437**	**1,692**	**1,648**

Current Permit Representation	180	1,723	441
Proposed limit			**2,060**

***lb/event representation is on an annual average basis for the purpose of calculating annual MSS emissons and does not represent a discrete limit.*


3/30/2015 Unit 1 Hot Startup
Initial Temp. = 594 F, Duration = 44 min, Total CO = 41 lbs, Max. CO = 41.7 lb/hr
20% Load
40% Load
50% Load
75% Load
CO Concentration (ppmvdc)
CO Mass Emission Rate (lb/hr)
MWe
CO Concentration (ppmvdc)
Permit Post-Cat Hot SU (ppmvdc)
CO Mass Emission Rate (lb/hr) on 60min rolling avg.


1/1/2015 Unit 2 Cold Startup
Initial Temp. = 188 F, Duration = 93 min, Total CO = 1,668 lbs, Max. CO = 1,648 lb/hr
20% Load
40% Load
50% Load
75% Load
CO Concentration (ppmvdc)
CO Mass Emission Rate (lb/hr)
MWe
Permit Post-Cat Cold SU (ppmvdc)
Mitsubishi Pre-Cat (ppmvdc)
CO Concentration (ppmvdc)
CO Mass Emission Rate (lb/hr) on 60min rolling avg.

Attachment B
Revised Section 3

Section 3

Application Summary

The **Application Summary** shall include a brief description of the facility and its process, the type of permit application, the applicable regulation (i.e. 20.2.72.200.A.X, or 20.2.73 NMAC) under which the application is being submitted, and any air quality permit numbers associated with this site. If this facility is to be collocated with another facility, provide details of the other facility including permit number(s). In case of a revision or modification to a facility, provide the lowest level regulatory citation (i.e. 20.2.72.219.B.1.d NMAC) under which the revision or modification is being requested. Also describe the proposed changes from the original permit, how the proposed modification will effect the facility's operations and emissions, de-bottlenecking impacts, and changes to the facility's major/minor status (both PSD & Title V).

Routine or predictable emissions during Startup, Shutdown, and Maintenance (SSM): Provide an overview of how SSM emissions are accounted for in this application. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions on SSM emissions.

This application proposes a significant revision to NSR Permit PSD 3449-M3 for Lea Power Partners, LLC (LPP) Hobbs Generating Station (Hobbs).

Hobbs is a natural gas fueled, nominal 600 MW net output power plant with two advanced firing temperature, Mitsubishi 501F combustion turbine generators (CTGs), each provided with its own heat recovery steam generator (HRSG) including duct burners, a single condensing, reheat steam turbine generator (STG), and an air cooled condenser serving the STG. The plant generates electricity for sale to Southwestern Public Service Company, its successors or assigns. The facility is located approximately 9 miles west of Hobbs, New Mexico in Lea County.

In 2014, Hobbs submitted a significant revision application to allow the upgrade of both CTGs in order to improve the station performance. Row 1 Blade Ring, Row 1 Compressor Blades, Rows 1, 2 and 3 Turbine Blades, Rows 1, 2 and 4 and Vanes and Rows 1 and 2 Ring Segments were replaced with new parts with superior cooling technology. This change resulted in the need for less cooling air with a corresponding increase in fuel consumption, exhaust flow rate, temperature, and electricity production.

Although concentrations of NO_x, CO and VOC emitted from the turbine exhaust remained constant, there was an increase in the actual mass emission rates of these pollutants due to the increased exhaust flow rate compared to historical past actual emission rates. Increases in particulate matter (PM_{10} and $PM_{2.5}$) and SO_2, also occurred due to increased fuel consumption. Startup, Shutdown and Maintenance (SSM) emissions did not change as a result of this project. However, during the permit application review process, NMED noted that although the permit included a concentration limit for CO during startups, it did not include a mass emission rate limit for CO or VOC, or a SSM concentration limit for VOC.

Maximum hourly SSM mass emission rate limits were established for CO and VOC during the 2014 permit revision based on information supplied by the catalyst vendor related to expected post-catalyst mass emissions during different types of startups. Based on the vendor information, a maximum SSM mass permit limit of 441 lb-CO/hr was requested and 77.8 lb-VOC/hr. In late 2015, Hobbs experienced a number of exceedances of the allowable CO hourly mass emission rate for startups. The CO BACT level of 3,000 ppmvd @ 15% O_2 (ppmvdc) was not exceeded. Further review of plant historical data showed that the representation for the CO mass emission limit in the turbine upgrade permit application in 2014 is not achievable during actual operations. Since both CO and VOC are controlled by the same oxidation catalyst, it expected that the previously represented SSM VOC mass emission rate and concentration limits are also not achievable.

The mass emission representation provided in the 2014 permitting action assumed that a catalyst temperature of approximately 400ºF would be achieved during the early phases of startup. However, the actual operating data shows that startups are frequently initiated with the catalyst temperature below this level. It is evident that the equipment is not capable of achieving the SSM CO mass emission limit as established by PSD-3449-M2. As represented during the 2014 permitting action, SSM emissions did not change as a result of the turbine upgrade project. A revision to the PSD permit is therefore necessary to provide the site with an achievable startup mass emission limit for CO. Since the existing 3,000 ppmvdc CO BACT limit (i.e., uncontrolled combustion turbine exhaust with a 20% safety factor) will continue to be met, no additional BACT analysis is necessary for this permitting action. However, the current SSM VOC BACT limit, unlike the CO BACT limit, assumes that some control is achieved during startup. Since both CO and VOC are controlled by the same oxidation catalyst, both pollutants should have the same BACT standard, which reflects operational efforts to minimize startup time.

In Revision #0, a request was made that the SSM VOC emission rate limit description be changed because it is not possible to demonstrate compliance with this limit. The limit in the current permit (PSD 3449-M3) assumes that some level of VOC control will be achieved during the startup sequence. Since it has been demonstrated that the catalyst is not able to control CO emissions during the early phases of startup, it is expected that VOC emissions will also not be controlled. In this Revision #1, it is requested that the combustion turbine vendor representation for uncontrolled VOC emissions, with a 20% safety factor, be applied (i.e., 750 ppmvdc * 1.25 = 900 ppmvdc). This is consistent with the methodology applied for CO. Accordingly, it is proposed that the hourly mass emission rate for VOC be calculated to align with the CO mass emission rate limit supported by operational data.

Actual operating data for CO show that the observed maximum SSM mass emission rate for CO is 1,648 lbs/hr, which represents 95.65% of the vendor represented pounds per average annual cold startup (1,723 lbs-CO/event). The requested hourly SSM permit limit for CO is 2,060 lbs/hr (1,648 lbs/hr with a 25% safety factor applied). Accordingly, a VOC mass emission rate limit of 95.65% of the vendor represented pounds per average annual cold startup, with a 25% percent safety factor applied is requested:

95.65% * 494 lbs/event * 1.25 = 591 lbs/hr

Since the operational CO data show that the vendor representation of pounds of CO per startup event is accurate on an average annual basis, it is further assumed that the vendor representation of pounds of VOC per startup event is accurate. The annual VOC emissions due to SSM events were calculated based on the total mass emission rate for each type of startup (i.e., 494 lbs-cold/startup) multiplied by the expected number of startups during the year.

The following new limits are proposed from each unit (HOBB-1 and HOBB-2):

- CO SSM mass emission rate limit of 2,060 lb/hr
- VOC SSM mass emission rate limit of 591 lbs/hr
- VOC SSM concentration limit of 900 ppmvdc

Only one unit will be in start-up mode at any given time. The CO SSM mass emission rate limit is based on actual plant operating data, with a safety factor of 25 percent applied. The CO and VOC SSM concentration limits are based on uncontrolled combustion turbine manufacturer representations with a 20 percent safety factor applied. No increase in the achievable CO BACT limit of 3,000 ppmvdc or in the annual mass emission rates of VOC or CO are proposed since these remain unchanged. Since both CO and VOC are controlled by the same oxidation catalyst, both pollutants should have the same BACT standard (i.e., operational efforts to minimize startup time). Accordingly a change in the represented SSM VOC concentration limit is requested.

Additionally, changes to the permit language are necessary to provide clarity regarding three issues that were discovered during the development of this permit application:

(1) The site DAHS was not calculating the mass emission rate for partial hours as a clock hour (60 minute) average of

actual mass emissions emitted over a one-hour period. As a result, hourly emission rates were being recorded in excess of the amount of mass emissions that could be emitted in a 60-minute averaging period. Additional language is proposed to clarify that for the purposes of compliance with the hourly emission rates specified in this permit, one-hour average emission rates (i.e., Block Average) will be calculated as the actual mass of pollutant emitted in a given clock hour.

(2) It was discovered that the practice specified Permit Condition A401C(3)(iii) of using Part 75 SO_2 data substitution methods for non-valid hours of CO emissions was causing SSM emissions to be substituted into normal operating hour periods. To resolve this issue, Hobbs proposes that an alternate data substitution method be applied.

A suggested permit markup of affected sections of the permit is included in the following pages, starting with Section 3, Page 3. Within the markup, the text requested to be modified has been changed to red strikethrough font. In blue font is the suggested new text.

SUGGESTED PERMIT MARKUP FOLLOWS

SUGGESTED PERMIT MARKUP

PART A FACILITY SPECIFIC REQUIREMENTS

A100 Introduction

A. This permit, PSD 3449-~~M3~~M4, supersedes all portions of Air Quality Permit PSD 3449-~~M2~~M3, issued ~~September 5, 2014~~October 8, 2015, except the portion requiring compliance tests. Compliance test conditions from previous permits, if not completed, are still in effect, in addition to compliance test requirements contained in this permit.

A101 Facility: Description

A. This facility is a natural gas fueled, nominal 600 MW net output power plant with two advanced firing temperature, Mitsubishi 501F combustion turbine generators (CTGs), each provided with its own heat recovery steam generator (HRSG) including duct burners, a single condensing, reheat steam turbine generator (STG), and an air cooled condenser serving the STG. The plant generates electricity for sale to Southwestern Public Service Company, its successors or assigns.

B. This facility is located approximately 9 miles west of Hobbs, New Mexico in Lea County.

C. This modification consists of an increase in the short-term allowable CO SSM mass emission rate to 2,060 lbs/hr, the short-term allowable VOC SSM mass emission rate to 591 lbs/hr, and the VOC SSM concentration value to 900 ppmvd from each HOBB-1 and HOBB-2. No increase in annual mass emission rates is proposed since the annual average mass emissions per startup remain unchanged. Additional clarifications in the permit language are proposed related to missing data procedures outlined in Condition A401C(3)(iii), the clarification that one-hour block averaging on a clock-hour applies to all short term mass emission rate limits represented in this permit, and the enforceability of the stated VOC emission rate and concentration limits during SSM events. ~~changes to the emissions for auxiliary equipment (units FP-1, G-1, AC1 to 3, and IC 1 to 3). The emission rates have increased for NOx, CO, PM10 and PM2.5 from FP-1 and G-1. The emission rates have increased for TSP, PM10 and PM2.5 from AC-1, AC-2, AC-3, IC-1, IC-2, and IC-3. This modification also adds a new 500 gallon gasoline tank, a 500 gallon diesel tank, and a 100 gallon diesel tank (exempt sources). This modification also removes the "A" and "B" designations from units AC-1 to 3 and units IC1-3 in Table 106.B because these units do not have any subunits: there are only 3 chillers and 3 cooling towers.~~ This description of this modification is for informational purposes only and is not enforceable.

A102 Facility: Allowable Emissions

A. The following Section lists the emission units and their allowable emission limits. (40 CFR 50, 40 CFR 60, Subparts A, IIII, and KKKK, 40 CFR 63 Subparts A and ZZZZ, 20.2.72.210.A and B.1 NMAC)

Table 106.A: Allowable Emissions for Turbine Generators (Units HOBB-1/DB-1 & HOBB-2/DB-2)

Pollutant	CT w/Duct Burner	CT w/o Duct Burner	CTG[9] Startup & Shutdown	Averaging Period
NO_2[2] (lbs/hr), each	18.1	14.5	193.2	Hourly rolling 24-hour average based on CEMS data (SSM limits are based on a 1-hour block[11] average)
NO_2[2,3] (ppmv) dry @ 15% O_2, each	2.0 BACT		96[1] BACT	Hourly rolling 24-hour average based on CEMS data
NO_2[2,4] (lb/MWh), each	0.43		Per NSPS KKKK	Daily rolling 30-day average (NSPS KKKK)
NO_2[2] (tons/yr), combined	181.0			Daily rolling 365-day total (includes SSM emissions)
CO (lbs/hr), each	11.0	8.8	~~441~~2,060	1-hour block average[11] (Normal operation and SSM)
CO[5] (ppmv) dry @ 15% O_2, each	2.0 BACT		3000[1] BACT	1-hour block average[11] (Normal operation and SSM)
CO (tons/yr), combined	279.5			Daily rolling 365-day total (includes SSM emissions)
VOC (lbs/hr), each	2.8	2.4	~~77.8~~ 591	Hourly rolling 24-hour average, calculation based on emission factor determined from compliance test data (compliance with VOC SSM limit will be demonstrated through compliance with CO SSM limits, 1-hour block average[11].)
VOC[6] (ppmv) dry @ 15% O_2, each	1.0 BACT		~~187~~900[1] BACT	Hourly rolling 24-hour average (compliance with VOC SSM limits will be demonstrated through compliance with CO SSM limits, 1-hour block average[11].)

Pollutant	CT w/Duct Burner	CT w/o Duct Burner	CTG[9] Startup & Shutdown	Averaging Period
VOC (tons/yr), combined	96.4			Daily rolling 365-day total (includes SSM emissions)
SO_2 (lbs/hr), each	10.7	8.4	N/A	1-hour block average[11], calculation based on Sulfur content of fuel
SO_2[7] (lb/MMBtu), each	0.06		Per NSPS KKKK	Daily rolling 30-day average (NSPS KKKK)
SO_2 (tons/yr), combined	48.2			Daily rolling 365-day total (includes SSM emissions)
TSP/PM_{10}/$PM_{2.5}$[8] (lbs/hr), each	17.1	11.3	N/A	Hourly rolling 24-hour average, calculation based on emission factor determined from compliance test data
TSP/PM_{10} (lb/MMBtu), each[10]	0.0089	0.0071	N/A	Hourly rolling 24-hour average
TSP/PM_{10}/$PM_{2.5}$ (tons/yr), combined	85.8			Daily rolling 365-day total (includes SSM emissions)
NH_3 (lbs/hr) each	32.1		N/A	Calculation based on compliance test data
NH_3 (tons/yr), combined	281.3		N/A	Daily rolling 365-day total

[1] NO_2, VOC and CO CTG Startup not-to-exceed concentration emissions are based on manufacturer's data + a 20% safety factor as a 1-hr average. Compliance with these limits shall be demonstrated by the monitoring required in Condition A401.C.
[2] Nitrogen oxide emissions include all oxides of nitrogen expressed as NO_2.
[3] The NO_2 limit of 2.0 ppmvd is based on the SCR BACT determination submitted with the application no. 3449.
[4] This NO_2 limit is in accordance with Table 1 to NSPS Subpart KKKK.
[5] The CO limit of 2.0 ppmvd is based on the CatOx BACT determination submitted with the application no. 3449.
[6] The VOC limit of 1.0 ppmvd is based on the CatOx BACT determination submitted with the application no. 3449.
[7] The SO_2 limit is in accordance with 40 CFR 60.4330.
[8] The TSP/PM_{10}/$PM_{2.5}$ limits include condensable particulate matter.
[9] N/A" indicates that startup and shutdown emissions are less than or included in the emissions limits established for normal operation.
[10] PSD3449R6 reduced lb/MMBtu from 0.015 combined to 0.0089 and 0.0071.
[11] A "Block Average" is defined as the total mass of emissions emitted in a clock hour (xx:00 to xx:59) divided by 1 hour.

B. Routine and Predictable SSM lb/hr (1-hour block average) and BACT Emission Limits – HOBB-1/DB-1 and HOBB-2/DB-2

C. Continuous Emission Monitoring (CEMS) For Units HOBB-1/DB-1 and HOBB-2/DB-2

Requirement: To demonstrate compliance with the allowable NO_X, CO, VOC, SO_X and TSP/PM_{10}/$PM_{2.5}$ emission limits in Table 106.A and with NSPS KKKK limits, the permittee shall meet the following Continuous Emissions Monitoring System (CEMS) requirements and the following monitoring, recordkeeping, and reporting requirements.

1. The exhaust stacks for these units shall be equipped and maintained with NOx, CO and O_2 CEMS. The permittee shall maintain the units according to manufacturer's requirements.

2. The NO_X and O_2 CEMS shall be designed, installed and certified in accordance with 40 CFR Part 75. Alternatively, the NO_X CEMS may be installed and certified in accordance with the provisions of 40 CFR Part 60, Appendix B, Performance Specification 2 (PS2) – Specifications and Test Procedures for SO_2 and NO_X Continuous Emissions Monitoring Systems in Stationary Sources.

3. The CO CEMS shall be designed, installed and certified in accordance with the provisions of 40 CFR Part 60, Appendix B, Performance Specification 4A – Specification and Test Procedure for Carbon Monoxide Continuous Emissions Monitoring Systems in Stationary Sources. Following certification testing, the CO CEMS shall be operated in accordance with the provisions of 40 CFR Part 60, Appendix F – Quality Assurance Requirements for Continuous Emissions Monitoring Systems.

Monitoring:

1. All CEMS shall comply with the requirements of 40 CFR 60.13, Monitoring Requirements. For the purpose of complying with one hour emission rate limits specified in this permit, all data collected will be used [60.13(h)(2)(v)] to determine the mass of pollutant emitted during any given clock hour (i.e., Block Average).

2. The NOX CEMS shall also comply with the requirements of 40 CFR 60.4345.

3. The CEMS shall monitor all instances of excess emissions during startups, shutdowns, maintenance and malfunctions, including those associated with control equipment upset.

Recordkeeping:

(1) The permittee shall keep a quality assurance plan for all CEMS in accordance with 40 CFR 60.4345 and 40 CFR 75, Appendix B.

(2) The permittee shall monitor and record all instances in which the CEMS are not in operation or accurately recording stack concentrations.

(3) The permittee shall ensure that all of the required monitoring systems are installed and meet the following requirements:

i) The NO_X and CO_2 or O_2 CEMS shall be audited in accordance with 40 CFR Part 60 Subpart KKKK or 40 CFR Part 75. The CO CEMS shall be audited in accordance with 40 CFR Part 60, Appendix F.

ii) The reported output of the CEMS shall be in:

a. ppmv of NO_X and CO at dry standard conditions;
b. ppmv of NOx and CO corrected to 15% oxygen at dry standard conditions; and lbs/hr of NOx and CO.

iii) Hobbs Generating Station shall provide CO substitute data for missing data periods as follows:

For each missing hour of CO CEMS data, the arithmetic average of the CO concentration or CO mass emission rate recorded by the monitoring system during the previous 2,160 quality-assured monitor operating hours at the corresponding unit load range or operational bin will be substituted.

Whenever no prior quality-assured concentration data exist for the corresponding load range, the maximum potential CO concentration or mass emission rate will be substituted for the missing data. Alternatively, if it can be demonstrated that the control equipment was operating properly during the hour of missing data, the maximum controlled emission rate or the maximum expected controlled concentration may be substituted. The QA/QC plan required by 40 CFR Part 60, Appendix F, will reflect this procedure. ~~shall include a data substitution procedure for the CO CEMS that is consistent with requirements of 40 CFR Part 75's missing data procedure for SO2 data. The QA/QC plan shall be submitted to the Department with the test protocols.~~

(4) For each CEMS, the permittee shall maintain records of performance test measurements, all performance evaluations, calibration checks, and all adjustment and maintenance activities.

(5) The permittee shall maintain records of the following requirements using data from the CEMS (DAHS) to demonstrate compliance with established emission limits:

i) For NO_X:

(1) The 24-hour average lb/hr.

(2) The 24-hour average parts per million by volume (on a dry standard cubic foot basis, corrected to 15% O_2).

(3) The daily-rolling 30-day average lb/MWh (calculated in accordance with NSPS KKKK, 60.6350).

(4) The daily-rolling 365-day total tons/year for the combined units (updated monthly by the 15th of the following month) including any emissions during routine or predictable startup, shutdown, and scheduled maintenance (SSM).

ii) For CO:

(1) The one-hour block average lb/hr (Normal operation and SSM).

(2) The one-hour block average ppmvd @ 15% O_2 (Normal operation and SSM).

(3) The daily-rolling 365-day total tons/year for the combined units (updated monthly by the 15th of the following month) including any emissions during routine or predictable startup, shutdown, and scheduled maintenance (SSM).

iii) For VOC:

(1) The 24-hour average lb/hr calculated by DAHS using the heat input and the

emission factor determined by the most recent compliance test.

(2) The 24-hour average CO concentration in ppmvd @ 15% O_2, using the 1 hr block average CO CEMS output (Compliance with the 24-hr average CO concentration limits in ppmvd@15% O_2 shall also demonstrate compliance with the 24-hr average VOC concentration in ppmvd@15% O_2.).

(3) The daily-rolling 365-day total tons/year for the combined units (updated monthly by the 15th of the following month) including any emissions during routine or predictable startup, shutdown, and scheduled maintenance (SSM).

iv) For SO_2:

(1) One-hour block average lb/hr calculated by DAHS using the heat input and the emission factor calculated using (1) Equation D-1h from 40 CFR 75, Appendix D, Section 2.3.2.1.1 and (2) the sulfur content from the current valid tariff or annual sulfur sampling results. Additionally, 40 CFR 75, Appendix D, Section 2.3.1.1 may also be used for the SO_2 emission factor as applicable.

(2) The daily-rolling 30-day average lb/MMBtu calculated by the DAHS using (1) Equation D-1h from 40 CFR 75, Appendix D, Section 2.3.2.1.1 and (2) the sulfur content from the current valid tariff or annual sulfur sampling results. Additionally, 40 CFR 75, Appendix D, Section 2.3.1.1 may also be used for the SO_2 emission factor as applicable.

(3) The daily-rolling 365-day total tons/year for the combined units (updated monthly by the 15th of the following month) including any emissions during routine or predictable startup, shutdown, and scheduled maintenance (SSM).

v) For TSP/PM_{10}/$PM_{2.5}$:

(1) The 24-hour average lb/hr calculated by DAHS using the heat input and the emission factor determined by the most recent compliance test required by Condition A401.A.

(2) The daily-rolling 24-hour average lb/MMBtu rates of TSP and PM_{10} calculated by direct conversion of the hourly emissions calculated above in v)(1). This requirement is not applicable for $PM_{2.5}$.

(3) The daily-rolling 365-day total tons/year emissions calculated by DAHS using the heat input and the emission factor determined by the most recent initial compliance test required by Condition A401.A. The ton per year emissions shall include any emissions during routine or predictable startup, shutdown, and scheduled maintenance (SSM).

Reporting: All CEMS shall be subject to the notification requirements of 40 CFR 60.7. The QA/QC plan shall be submitted to the Department with the Compliance Test Protocols.

Attachment C
Section 6

Section 6

All Calculations

Show all calculations used to determine both the hourly and annual controlled and uncontrolled emission rates. All calculations shall be performed keeping a minimum of three significant figures. Document the source of each emission factor used (if an emission rate is carried forward and not revised, then a statement to that effect is required). If identical units are being permitted and will be subject to the same operating conditions, submit calculations for only one unit and a note specifying what other units to which the calculations apply. All formulas and calculations used to calculate emissions must be submitted. The "Calculations" tab in the UA2 has been provided to allow calculations to be linked to the emissions tables. Add additional "Calc" tabs as needed. If the UA2 or other spread sheets are used, all calculation spread sheet(s) shall be submitted electronically in Microsoft Excel compatible format so that formulas and input values can be checked. Format all spread sheets and calculations such that the reviewer can follow the logic and verify the input values. Define all variables. If calculation spread sheets are not used, provide the original formulas with defined variables. Additionally, provide subsequent formulas showing the input values for each variable in the formula. All calculations, including those calculations are imbedded in the Calc tab of the UA2 portion of the application, the printed Calc tab(s), should be submitted under this section.

Tank Flashing Calculations: The information provided to the AQB shall include a discussion of the method used to estimate tank-flashing emissions, relative thresholds (i.e., NOI, permit, or major source (NSPS, PSD or Title V)), accuracy of the model, the input and output from simulation models and software, all calculations, documentation of any assumptions used, descriptions of sampling methods and conditions, copies of any lab sample analysis. If Hysis is used, all relevant input parameters shall be reported, including separator pressure, gas throughput, and all other relevant parameters necessary for flashing calculation.

SSM Calculations: It is the applicant's responsibility to provide an estimate of SSM emissions or to provide justification for not doing so. In this Section, provide emissions calculations for Startup, Shutdown, and Routine Maintenance (SSM) emissions listed in the Section 2 SSM and/or Section 22 GHG Tables and the rational for why the others are reported as zero (or left blank in the SSM/GHG Tables). Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions on calculating SSM emissions. If SSM emissions are greater than those reported in the Section 2, Requested Allowables Table, modeling may be required to ensure compliance with the standards whether the application is NSR or Title V. Refer to the Modeling Section of this application for more guidance on modeling requirements.

Glycol Dehydrator Calculations: The information provided to the AQB shall include the manufacturer's maximum design recirculation rate for the glycol pump. If GRI-Glycalc is used, the full input summary report shall be included as well as a copy of the gas analysis that was used.

Road Calculations: Calculate fugitive particulate emissions and enter haul road fugitives in Tables 2-A, 2-D and 2-E for:

1. If you transport raw material, process material and/or product into or out of or within the facility and have PER emissions greater than 0.5 tpy.
2. If you transport raw material, process material and/or product into or out of the facility more frequently than one round trip per day.

Significant Figures:

A. All emissions standards are deemed to have at least two significant figures, but not more than three significant figures.

B. At least 5 significant figures shall be retained in all intermediate calculations.

C. In calculating emissions to determine compliance with an emission standard, the following rounding off procedures shall be used:

(1) If the first digit to be discarded is less than the number 5, the last digit retained shall not be changed;

(2) If the first digit discarded is greater than the number 5, or if it is the number 5 followed by at least one digit other than the number zero, the last figure retained shall be increased by one unit; **and**

(3) If the first digit discarded is exactly the number 5, followed only by zeros, the last digit retained shall be rounded upward if it is an odd number, but no adjustment shall be made if it is an even number.

(4) The final result of the calculation shall be expressed in the units of the standard.

Control Devices: In accordance with 20.2.72.203.A(3) and (8) NMAC, 20.2.70.300.D(5)(b) and (e) NMAC, and 20.2.73.200.B(7) NMAC, the permittee shall report all control devices and list each pollutant controlled by the control device

regardless if the applicant takes credit for the reduction in emissions. The applicant can indicate in this section of the application if they chose to not take credit for the reduction in emission rates. For notices of intent submitted under 20.2.73 NMAC, only uncontrolled emission rates can be considered to determine applicability unless the state or federal Acts require the control. This information is necessary to determine if federally enforceable conditions are necessary for the control device, and/or if the control device produces its own regulated pollutants or increases emission rates of other pollutants.

As required by NMED, emission rate calculations are provided in the UA2 workbook. The only change proposed are related to CO and VOC SSM emission rates:

The following new limits are proposed from each unit (HOBB-1 and HOBB-2):

- CO SSM mass emission rate limit change from 441 lbs/hr to 2,060 lbs/hr
- VOC SSM mass emission rate limit change from 77.8 lbs/hr to 591 lbs/hr
- VOC SSM BACT concentration limit change from 187 ppmvdc to 900 ppmvdc

Catalyst vendor data for startups assumed that the oxidation catalyst will be at a temperature at which some level of control efficiency may be achieved for the full startup sequence. However, the actual operating data shows that for cold startups, there is a period of time during which there is fuel flow and emissions, but during which time the catalyst is not yet performing optimally. During the early phases of the cold startup events, operational data show that there is virtually no CO control available. It is assumed that there will also be virtually no VOC control available. During these times, the emissions are consistent with the turbine vendor estimate of the uncontrolled exhaust concentration from the combustion turbines.

CO Representations:
An analysis of the 2015 startup emissions and corresponding catalyst temperatures was conducted to identify the maximum hourly CO mass emission rate that was actually achievable during normal startup scenarios. The raw data, summary graphs, and emission rate calculation basis are all provided in the UA2 workbook. A comparison was made to the 2013 and 2014 startup data (pre-turbine upgrade) to confirm that startup emission characteristics did not change from pre-upgrade project to post-upgrade project.

The requested new hourly SSM mass emission rate limit for CO of 2,060 lb/hr from each unit (HOBB-1 and HOBB-2) represents the maximum cold startup hourly mass emission rate experienced during 2015 (1,648 lbs/hr) with a safety factor of 25% applied. Additionally, permit language changes are requested to make it clear that the hourly mass emission rate limits apply to block hour average emissions during any given clock hour (HH:00 to HH:59) proposed.

No increase in the achievable BACT limit of 3,000 ppmvdc (uncontrolled combustion turbine exhaust concentration with a 20% safety factor) or in the annual emissions is necessary, since only the short-term maximum hourly mass emission rate is impacted. On an annual average basis, the total emissions per startup remains unchanged from the previous permit application representation.

VOC Representations:
The SSM VOC concentration and mass emission limits in the current permit (PSD 3449-M3) assume that some level of VOC control will be achieved during the startup sequence. Since it has been demonstrated that the catalyst is not able to control CO emissions during the early phases of startup, it is expected that VOC emissions will also not be controlled. In this Revision #1, it is requested that the combustion turbine vendor representation for uncontrolled VOC emissions, with a 20% safety factor, be applied (i.e., 750 ppmvdc * 1.25 = 900 ppmvdc). This is consistent with the methodology applied for CO. Since both CO and VOC are controlled by the same oxidation catalyst, both pollutants should have the same BACT standard and basis, which reflects operational efforts to minimize startup time.

It is also proposed that the hourly mass emission rate for VOC be calculated to align with the CO emissions which are supported by operational data. Actual operating data for CO show that the observed maximum mass emission rate for CO is 1,648 lbs/hr, which represents 95.65% of the vendor represented pounds per average annual cold startup. The requested permit limit for CO is 2,060 lbs/hr (1,648 lbs/hr with a 25% safety factor applied). Accordingly, a VOC mass emission rate limit of 95.65% of the vendor represented pounds per average annual cold startup, with a 25% percent safety factor applied is requested:

95.65% * 494 lbs/event * 1.25 = 591 lbs/hr

Since the operational CO data show that the vendor representation of pounds of CO per startup event is accurate on an average annual basis, it is further assumed that the vendor representation of pounds of VOC per startup event is accurate. The annual VOC emissions due to cold SSM events were calculated based on the total mass emission rate of 494 lbs/cold-startup multiplied by the expected number of startups during the year.

The basis of the startup/shutdown emissions has not changed since the original permit application submittal in 2014:

> *A startup is initiated when the Data Acquisition and Handling System (DAHS) detects a flame signal (or equivalent signal) and ends when the permissive for the emission control system are met (i.e., steady state emissions compliance is achieved). The turbines will have the following typical startups, defined in general as:*
>
> - *Cold Startup: is a startup after an extended CTG shutdown of greater than 12 hours or after such time as the SCR or oxidation catalyst has cooled to below levels that allow optimal control efficiency.*
> - *Warm Startup: is a startup after a CTG shutdown of 6 to 12 hours.*
> - *Hot Startup: is a startup after a CTG shutdown of less than 6 hours.*
>
> *A shutdown begins when the load drops to the point at which steady state emissions compliance can no longer be assured and ends when a flame-off signal is detected.*
>
> *For permitting purpose only, a worst case scenario has been developed, which assumes for each turbine a total of 60 cold startups, 70 warm startups, 50 hot startups and 180 shutdowns on an annual basis. Based on historical performance information, the duration of the cold startup is approximately 180 minutes per event, a warm startup approximately 120 minutes per event, and a hot startup approximately 90 minutes per event. Shutdowns are 25 minutes per event. These numbers and/or durations of planned startup and shutdown events are provided solely for the purpose of estimating maximum mass emission rates. This specific number of events and event durations are not to be construed as binding. Rather, Hobbs will demonstrate compliance by meeting the stated short and long term mass emission rates and concentration limits.*

Section 6.a

Green House Gas Emissions

(submitting under 20.2.70, 20.2.72 20.2.74 NMAC)

Title V (20.2.70 NMAC), NSR (20.2.72 NMAC), and PSD (20.2.74 NMAC) applicants must estimate and report green house gas (GHG) emissions to verify the emission rates reported in the public notice, determine applicability to 40 CFR 60 Subparts, and to complete Prevention of Significant Deterioration (PSD) applicability. GHG emissions are the sum of the aggregate group of six green house gases that include carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Calculating GHG Emissions:

1. Calculate mass GHG and CO_2e emissions from your source. Start up, shut down, and maintenance emissions must be included.
2. GHG mass emissions are the sum of the total annual tons of green house gases without adjusting with the global warming potentials (GWPs). CO_2e emissions are the sum of the mass emissions of each individual GHG multiplied by its GWP found in Table A-1 in 40 CFR 98 Mandatory Greenhouse Gas Reporting.
2. Report GHG mass and CO_2e emissions in Table 2-P of this application. Emissions are reported in **short** tons per year and represent each emission unit's Potential to Emit (PTE).

Sources for Calculating GHG Emissions:

- Manufacturer's Data
- AP-42 Compilation of Air Pollutant Emission Factors at http://www.epa.gov/ttn/chief/ap42/index.html
- EPA's Internet emission factor database WebFIRE at http://cfpub.epa.gov/webfire/
- 40 CFR 98 Mandatory Green House Gas Reporting except that tons should be reported in short tons rather than in metric tons for the purpose of PSD applicability.
- API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry. August 2009 or most recent version.
- Sources listed on EPA's NSR Resources for Estimating GHG Emissions at http://www.epa.gov/nsr/clean-air-act-permitting-greenhouse-gases:

Global Warming Potentials (GWP):
Applicants must use the Global Warming Potentials codified in Table A-1 of the most recent version of 40 CFR 98 Mandatory Greenhouse Gas Reporting. The GWP for a particular GHG is the ratio of heat trapped by one unit mass of the GHG to that of one unit mass of CO_2 over a specified time period.

"Greenhouse gas" for the purpose of this part is defined as the aggregate group of the following six gases: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. **(20.2.70.7.O NMAC, 20.2.74.7.Y NMAC).** You may also find GHGs defined in 40 CFR 86.1818-12(a).

Metric to Short Ton Conversion:
Short tons for GHGs and other regulated pollutants are the standard unit of measure for PSD and title V permitting programs. 40 CFR 98 Mandatory Greenhouse Reporting requires metric tons.
1 metric ton = 1.10231 short tons (per Table A-2 to Subpart A of Part 98 – Units of Measure Conversions)

There are no changes in representation related to GHG emissions for this revision application. All emissions are reported on Table 2-P of the UA 2 Form.

HOBBS EMISSION RATE SUMMARY

Summary of Emission Rates

Air Pollutant	Averaging Period	Table 106.A PSD 3449-M3 (October 8, 2015)			Combustion Turbines Emission Rates		
		CT w/o Duct Burner	CT w/ Duct Burner	CTG Startup & Shutdown	CT w/o Duct Burner	CT w/ Duct Burner	CTG Startup & Shutdown
NO_2 (lbs/hr), each [1]	Hourly rolling 24-hour average based on CEMS data (SSM limits are based on a 1-hour block average)	14.5	18.1	193.2	14.5	18.1	193.2
NO_2 (ppmv) dry @ 15% O_2, each [2],[3]	Hourly rolling 24-hour average based on CEMS data	2.0 BACT		96 BACT	2.0		96
NO_2 (lb/MWh), each [4]	Daily rolling 30-day average (NSPS KKKK)	0.43		Per NSPS KKKK	0.43		Per NSPS KKKK
NO_2 (tons/yr), combined	Daily rolling 365-day total (includes SSM emissions)	181.0			181.0		
CO (lbs/hr), each	1-hour block average (Normal operation and SSM)	8.8	11.0	441.0	8.8	11.0	2,060
CO (ppmv) dry @ 15% O_2, each [5],[6]	1-hour block average (Normal operation and SSM)	2.0 BACT		3,000 BACT	2.0		3,000
CO (tons/yr), combined	Daily rolling 365-day total (includes SSM emissions)	279.5			279.5		
VOC (lbs/hr), each	Hourly rolling 24-hour average, calculation based on emission factor determined from compliance test. (compliance with VOC SSM limit will be demonstrated through compliance with CO SSM limits on a 1-hour block average basis).	2.4	2.8	77.8	2.4	2.8	591
VOC (ppmv) dry @ 15% O_2, each [7],[8]	Hourly rolling 24-hour average (data (compliance with VOC SSM limit will be demonstrated through compliance with CO SSM limits on a 1-hour block average basis.)	1.0 BACT		187 BACT	1.0		900
VOC (tons/yr), combined	Daily rolling 365-day total (includes SSM emissions)	96.4			96.4		
SO_2 (lbs/hr), each [9]	1-hour block average, calculation based on Sulfur content of fuel	8.4	10.7	N/A	8.4	10.7	N/A
SO_2 (lbs/MMBtu), each [10]	Daily rolling 30-day average (NSPS KKKK)	0.06		Per NSPS KKKK	0.06		Per NSPS KKKK
SO_2 (tons/yr), combined	Daily rolling 365-day total (includes SSM emissions)	48.2			48.2		
$TSP/PM_{10}/PM_{2.5}$ (lbs/hr), each	Hourly rolling 24-hour average, calculation based on emission factor determined from compliance test data	11.3	17.1	N/A	11.3	17.1	N/A
TSP/PM_{10} (lbs/MMBtu), each	Hourly rolling 24-hour average	0.0071	0.0089	N/A	0.0071	0.0089	N/A
$TSP/PM_{10}/PM_{2.5}$ (tons/yr), combined	Daily rolling 365-day total (includes SSM emissions)	85.8			85.8		
NH_3 (lbs/hr), each	Calculation based on compliance test data	32.1		N/A	32.1		N/A
NH_3 (tons/yr), combined	Daily rolling 365-day total	281.3		N/A	281.3		N/A

Notes:
(1) Nitrogen oxide emissions include all oxides of nitrogen expressed as NO_2.
(2) The NO_2 limit of 2.0 ppmvd @ 15% O_2 is based on the SCR BACT determination.
(3) The NO_2 limit of 96 ppmvd @ 15% O_2 during Startup & Shutdown is based on CTG performance manufacturer's data plus a 20% safety factor.
(4) NO_2 output base limit in accordance with Table 1 to NSPS Subpart KKKK.
(5) The CO limit of 2.0 ppmvd @ 15% O_2 is based on the oxidation catalyist BACT determination.
(6) The CO limit of 3,000 ppmvd @ 15% O_2 during Startup & Shutdown is based on CTG performance manufacturer's data plus a 20% safety factor.
(7) The VOC limit of 1.0 ppmvd @ 15% O_2 is based on the oxidation catalyist BACT determination.
(8) The VOC limit of 900 ppmvd @ 15% O2 during Startup & Shutdown is based on CTG performance manufacturer's data plus a 20% safety factor.
Compliance with VOC limits is to be demonstrated through compliance with CO limits.
(9) The proposed post-project SO_2 allowable emission rate is based in total sulfur content in the fuel (40 CFR Part 75).
(10) SO_2 input base limit in accordance with NSPS Subpart KKKK, §60.4330.
(1) Cold, warm and hot startup hourly mass emission rates (lb/hr) maximum expected emissions during SSM events.

Rollling average period was used to identify worst case scenario and is not intended to be an operational restriction.

(2) Emission factor (lb/event) represents the total mass emission during the event duration based on vendor performance data. Represented number reflects an average annual value.

Air Pollutant	Status	CT w/o Duct Burner ppmvd @ 15% O_2	CT w/ Duct Burner ppmvd @ 15% O_2	CT w/o Duct Burner per Unit		CT w/Duct Burner per Unit	
				Min. Hourly (lb/hr)	Max. Hourly (lb/hr)	Min. Hourly (lb/hr)	Max. Hourly (lb/hr)
NOx	pre-control	25.1	21.9	141.0	172.0	147.60	178.6
	post-control	2.0	2.0	11.3	13.7	13.9	16.3
CO	pre-control	15.1	13.5	52.0	63.0	55.8	66.8
	post-control	2.0	2.0	6.9	8.3	8.5	9.9
VOC	pre-control	2.0	1.8	3.9	4.8	4.3	5.2
	post-control	1.0	1.0	2.0	2.4	2.4	2.8
SO_2	-	0.9	0.9	6.9	8.4	8.6	10.0
$TSP/PM_{10}/PM_{2.5}$	-	-	-	9.8	11.2	15.5	17.0
NH_3	-	10	10	21	25.3	25.8	30.2

Notes:
(1) Estimated post-project hourly mass emission rates. Refer to "100% Load CTG Hourly" for detailed calculations.

HOBBS EMISSION RATE SUMMARY

Estimated Post-Project Annual Emission Rates Summary

Air Pollutant	Status	Annual Emission Rates Per Unit w/o SSM (1)			Annual Emission Rates Per Unit w/SSM (2)			Annual Both Units Combined w/o SSM (tpy)(3)	Annual Both Units Combined w/SSM (tpy)(4)
		CT w/o Duct Burner (tpy)	CT w/Duct Burner (tpy)	Annual per Unit (tpy)	CT w/o Duct Burner (tpy)	CT w/Duct Burner (tpy)	Annual per Unit (tpy)		
NOx	pre-control	392.2	310.4	676.8	355.2	310.4	639.7		
	post-control	31.4	28.6	57.8	28.4	28.6	54.8	115.52	181.0
CO	pre-control	143.7	116.3	250.3	130.1	116.3	236.7		
	post-control	19.1	17.4	35.2	17.3	17.4	33.4	70.3	279.5
VOC	pre-control	10.9	9.1	19.2	9.9	9.1	18.2		
	post-control	3.3	3.0	5.9	3.0	3.0	5.6	11.8	96.4
SO_2		12.6	11.6	22.8	11.4	11.6	21.6	45.6	48.2
$TSP/PM_{10}/PM_{2.5}$		18.4	24.4	40.7	16.7	24.4	38.9	81.3	85.8
NH_3		58.1	53.0	106.9	52.6	53.0	101.4	213.8	202.8
CO_2		492,156	452,894	945,051	445,652	452,894	898,546	1,890,101	1,832,534
N_2O		0.9	0.8	1.8	0.8	0.8	1.7	3.5	3.4
CH_4		9.1	8.4	17.5	8.3	8.4	16.7	35.1	34.0
GHG		492,166	452,904	945,070	445,661	452,904	898,564	1,890,140	1,832,571
CO_2e		492,656	453,355	946,011	446,105	453,355	899,459	1,892,022	1,834,397

Notes:

(1) Estimated post-project annual mass emission rates without SSM events per unit.

CTG w/o DB annual operational hours	4,974 hr/yr	(outage = 204 hr/yr)
CTG w/DB annual operational hours	3,786 hr/yr	(outage = 156 hr/yr)
CTG SSM annual operating hours	0 hr/yr	
CTG Annual Outage days	15 days/yr	
CTG Annual Outage hours	360 hr/yr	(No outage hours accounted for GHG calculations)
Total CTG annual operating hours	8,400 hr/yr	

Annual Total (w/o SSM) = CTG w/o DB (tpy) + CTG w/DB (tpy) - [Hourly (lb/hr) * Outage Hours (hr/yr) * 1 ton/2,000lb] $_{w/o\ DB}$ - [Hourly (lb/hr) * Outage Hours (hr/yr) * 1ton/2,000lb] $_{w/DB}$

NOx Post-Control Annual Total (w/o SSM) = 31.4 tpy + 28.6 tpy - [11.3 lb/hr * 204 hr/yr * 1 ton/2,000 lb] - [13.9 lb/hr * 156 hr/yr * 1 ton/2,000lb] = 57.8 tpy per unit

(2) Estimated post-project annual mass emission rates including SSM events per unit.

CTG w/o DB annual operational hours	4,504 hr/yr	(outage = 196 hr/yr)
CTG w/DB annual operational hours	3,786 hr/yr	(outage = 164 hr/yr)
CTG SSM annual operating hours	470 hr/yr	
CTG Outage days	15 days/yr	
CTG Outage hours	360 hr/yr	(No outage hours accounted for GHG calculations)
Total CTG annual operating hours	7,460 hr/yr	

Annual Total (w/SSM) = CTG w/o DB (tpy) + CTG w/DB (tpy) - [Hourly (lb/hr) * Outage Hours (hr/yr) * 1 ton/2,000lb] $_{w/o\ DB}$ - [Hourly (lb/hr) * Outage Hours (hr/yr) * 1ton/2,000lb] $_{w/DB}$

NOx Post-Control Annual Total (w/SSM) = 28.4 tpy + 28.6 tpy - [11.3 lb/hr * 196 hr/yr * 1 ton/2,000 lb] - [13.9 lb/hr * 164 hr/yr * 1 ton/2,000lb] = 54.8 tpy per unit

(3) Estimated post-project annual mass emission rates without SSM events. Represents an operation at 100% load for 8,400 hr/yr (360 hr of outage per year).

NOx Post-Control Annual Total w/o SSM = 57.8 tpy/unit * 2 units = 115.5 tpy both units combined

(4) Estimated post-project annual mass emission rates with SSM events. Represents an operation at 100% load for 7,460 hr/yr (470 hr/yr SSM and 360 hr of outage per year).

NOx Post-Control Annual Total (w/SSM) = (54.8 tpy/unit + 35.7 tpy/unit SSM) * 2 units = 181.0 tpy both units combined

Estimated Post-Project SSM Emission Rates Summary (1)

Air Pollutant	CTG Startup & Shutdown		
	ppmvd @ 15% O_2	lb/hr	tpy
NOx	96	193.2	35.7
CO	3,000	2,060.0	106.4
VOC	900	591.0	42.6
SO_2	-	10.7	2.5
$TSP/PM_{10}/PM_{2.5}$	-	17.1	4.0
CO_2	-	-	17,720.8
N_2O	-	-	0.033
CH_4	-	-	0.33
GHG	-	-	17,721.2
CO_2e	-	-	17,738.8

Notes:

(1) Estimated post-project hourly and annual SSM mass emission rates. Refer to "CTG SSM Events" for detailed calculations.

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY (Rev#1)

CTG Startup & Shutdown Emission Rates per Unit

Air Pollutant	ppmvd @ 15% O_2 (1)	Max. Hourly (lb/hr) (2)	Annual (tpy) (3)
NOx	96	193.2	35.7
CO	3,000	2,060	106.4
VOC	900	591	42.6
SO_2	-	10.7	2.5
$TSP/PM_{10}/PM_{2.5}$	-	17.1	4.0
CO_2	-	-	17,721
N_2O	-	-	0.03
CH_4	-	-	0.33
GHG (4)	-	-	17,721
CO_2e (4)	-	-	17,739

Notes:

(1) Maximum exhaust concentration per vendor performance data at reduced loads, plus a 20% safety factor for NOx, CO, and VOC.

(2) Proposed maximum hourly emissions represent the maxium 1-hr NOx, CO, SO2, and particulate emission rates due to any startup or shutdown event.

- Data as provided by vendor
- The CO mass emission rate is based on historical observations, and turbine vendor estimates.
- The VOC hourly rate is scaled based on catalyst vendor representations and historical operational CO data
- Hourly SO_2, $PM_{10}/PM_{2.5}$ and NH_3 emission rates are expected to be within the routine operations limits, therefore no SU/SD Hourly emission rates are proposed for these pollutants.

(3) Annual emissions represent the sum of total proposed annual startups and shutdowns.

(4) GHG and CO_2e represent the sum of all CTG startup & shutdown at reduced load performance

GHG CTG startup & shutdown = 2,196 tpy + 2,574 tpy + 4,333 tpy + 6,992 tpy + 1,627 tpy = 17,721 tpy

SSM VOC Max Hourly Concentration Calculation:

Rev#0: Maximum VOC Concentration = Max Post-Catalyst Concentration for each Calculated Ramp * 20% SF = Max {135.2 (cold); 155.6 (warm); 146.8 (hot) } * 1.2 = 155.6 * 1.2 = 187 ppmvdc [assumes control throughout startup]

Rev#1: Maximum VOC Concentration = Max Uncontrolled Concentration for each Start Type * 20% SF = Max {750.0 (cold); 68.6 (warm); 750.0 (hot) } * 1.2 = 750 * 1.2 = 900 ppmvdc [no control by catalyst at early phase of startup]

SSM VOC Max Hourly Mass Emission Rate Calculation:

Rev#0: Maximum Hourly Mass Emission Rate = Max Post-Catalyst lb/hr Rate for each Calculated Ramp = Max {71.8 (cold); 77.8 (warm); 61.0 (hot) } = 77.8 lb/hr [some control by catalyst assumed]

Rev#1: Maximum Hourly Mass Emission Rate = (Max Observed CO Rate)/(lb-CO per event by vendor)*(lb-VOC per event by vendor) * 1.25 = 1,648 / 1,723 * 494 * 1.25 = 591 lb/hr [scaled from observed CO values]

SSM VOC Max Hourly Mass Emission Rate Calculation:

Rev#0 & Rev#1: Anuual SSM Emission Rate = SUM[lbs/event type * number of events]/2000 = (494 lbs/cold start * 60 cold starts/yr) + (405 lbs/warm start * 70 warm starts/yr) + 311 hot starts/yr) +
= (494 lbs/cold start * 60 cold starts/yr) + (405 lbs/warm start * 70 warm starts/yr) + (311 lbs/hot start * 50 hot starts/yr) + (65 lbs/shutdown * 180 shutdowns/yr) = [(494*60) + (405*70) + (311*50) + (65*180)]/2000 tpy
= 42.6 tpy

Startup/Shutdown Events Characteristics per Unit

Air Pollutant	Cold Startup				Warm Startup				Hot Startup				Shutdown		
	Max. Emission Rate (lb/hr) (1)	Emission Factor (lb/event) (2)	Event Duration (min) (3)	No. Events per Year (3)	Max. Emission Rate (lb/hr) (1)	Emission Factor (lb/event) (2)	Event Duration (min) (3)	No. Events per Year (3)	Max. Emission Rate (lb/hr) (1)	Emission Factor (lb/event) (2)	Event Duration (min) (3)	No. Events per Year (3)	Emission Factor (lb/event) (2)	Event Duration (min) (3)	No. Events per Year (3)
NOx	169.5	453.0			164.4	289.8			193.2	240.0			66.7		
CO	11	1,723			11.0	1,056			11.0	375			93		
VOC	591	494	180	60	2.8	405	120	70	2.8	311	90	50	65	25	180
SO_2	10.7	32.1			10.7	21.4			10.7	16.1			4.5		
$TSP/PM_{10}/PM_{2.5}$	17.1	51.3			17.1	34.2			17.1	25.7			7.1		

Notes:

(1) Cold, warm and hot startup hourly mass emission rates (lb/hr) represent the worst 60 minute rolling period at reduced loads vendor performance data. Detailed calculations are provided below. Partial VOC control is assumed.
Rollling average period was used to identify worst case scenario and is not intended to be an operational restriction.

(2) Emission factor (lb/event) represents the total mass emission during the event duration based on vendor performance data. Represented number reflects an average annual value.
NOx, SO_2, PM, NH_3 (lb/event) = [(min/event * lb/hr) @ 0% Load + (min/event * lb/hr) @ 20% Load + (min/event * lb/hr) @ 40% Load + (min/event*lb/hr) @ 50% Load + (min/event * lb/hr) @ 75% Load] * 1hr / 60 minutes
CO, VOC (lb/event) as provided by vendor

(3) Based on historical operational knowledge on startup and shutdown duration and frequency.

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY (Rev#1)

Duration at Each Load Level per Unit

Mode	Duration per Load Level [1] (min)					Event Duration (min)	No. of Events (events/yr)	Duration of Events (hr/yr)	CO (lbs/event)[2]	VOC (lbs/event)[2]
	75% CTG Load	50% CTG Load	40% CTG Load	20% CTG Load	0% CTG Load					
Cold Startup	6	14	14	128	17	180	60	180	1,723	494
Warm Startup	7	12	10	68	23	120	70	140	1,056	405
Hot Startup	9	11	39	3	28	90	50	75	375	311
Shutdown	2.55	3.06	10.71	0.77	7.91	25	180	75	93	65
						Total	**360**	**470**		

Notes:

(1) Based on historical operational knowledge on startup duration and frequency.

(2) Based on data supplied by catalyst vendor.

Emission Rate at Each Load Level per Unit

COLD STARTUP

Air Pollutant	Units	75% CTG Load 565 °F @ Catalyst		50% CTG Load 529 °F @ Catalyst		40% CTG Load 524 °F @ Catalyst		20% CTG Load 468 °F @ Catalyst		0% CTG Load 404 °F @ Catalyst	
		Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst
NOx	ppmvd @ 15% O_2	25.0	-	40.0	-	70.0	-	70.0	-	80.0	-
	lb/hr	123.1	-	148.1	-	222.8	-	152.5	-	92.2	-
CO	ppmvd @ 15% O_2	10.0	1.8	15.0	1.9	120.0	15.4	2,500	2,500	2,500	2,500
	lb/hr	30.0	5.4	33.8	4.3	232.6	29.8	1,648	1,648	1,648	1,648
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196	196	750	750
	lb/hr	3.4	1.2	3.2	1.2	8.7	3.0	472.4	472.4	472.4	472.4

Notes:

(1) During cold startup period the SCR will not be operational. The oxidation catalyst will attain limited oxidation capabilities once adequate temperate is reached .

(2) As calculated in Reduced Load CTG Hourly

(3) Post catalyst CO and VOC concentration values for the 0 to 20% load cases assume that no control is achieved by the catalyst in the early stages of startup.

(4) Post catalyst CO mass emission rate for cold start 0 to 20% load are based on observed historical data.
Post catalyst VOC mass emission rate is scaled from observed CO data and catalyst vendor representations for mass of pollutant per event.

Ramp	COLD STARTUP
	NOx (lb/hr)
0% to 20%	135.1
20%	152.5
20% to 40%	169.5
20% to 50%	168.4
20% to 75%	165.4
Maximum	**169.5**

Notes:

(1) Cold startup NOx hourly mass emission rates (lb/hr) represent the worst 60 minute rolling period at reduced loads vendor performance data with no control.

NOx (Cold SU) (0% to 20% load) = [17 min * 92.2 lb/hr + (60 min - 17 min) * 152.5 lb/hr] / 60 min = 135.1 lb/hr

NOx (Cold SU) (at 20% load) = 152.5 lb/hr

NOx (Cold SU) (20% to 40% load) = [14 min * 222.8 lb/hr + (60 min - 14 min) * 152.5 lb/hr) / 60 min = 169.5 lb/hr

NOx (Cold SU) (20% to 50% load) = [14 min * 148.1 lb/hr + 14 min * 222.8 lb/hr + (60 min - 14 min - 14 min) * 152.5 lb/hr) / 60 min = 168.4 lb/hr

NOx (Cold SU) (20% to 75% load) = [6 min * 123.1 lb/hr + 14 min * 148.1 lb/hr + 14 min * 222.8 lb/hr + (60 min - 6 min - 14 min - 14 min) * 152.5 lb/hr) / 60 min = 165.4 lb/hr

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY (Rev#1)

WARM STARTUP

Air Pollutant	Units	75% CTG Load 584.5 F @ Catalyst		50% CTG Load 564 F @ Catalyst		40% CTG Load 531 F @ Catalyst		20% CTG Load 492.4 F @ Catalyst		0% CTG Load 435.4 F @ Catalyst	
		Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst
NOx	ppmvd @ 15% O_2	25.0	-	40.0	-	70.0	-	70.0	-	80.0	-
	lb/hr	123	-	148.1	-	222.8	-	152.5	-	92.2	-
CO	ppmvd @ 15% O_2	10.0	1.8	15.0	1.9	120.0	15.2	2,500	2,500	2,500	2,500
	lb/hr	30.0	5.4	33.8	4.3	232.6	29.5	1648	1648	1648	1648
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196.0	68.6	68.6	300.0
	lb/hr	3.4	1.2	3.2	1.2	8.7	3.0	472.4	472.4	472.4	472.4

Notes:

(1) During warm startup period the SCR will not be operational. The oxidation catalyst will retain partial oxidation capabilites throught warm startup period.

(2) As calculated in Reduced Load CTG Hourly

Ramp	WARM STARTUP NOx (lb/hr)
0% to 20%	129.8
at 20%	152.5
20% to 40%	164.4
20% to 50%	163.6
20% to 75%	160.0
Maximum	**164.4**

Notes:

(1) Warm startup NOx hourly mass emission rates (lb/hr) represent the worst 60 minute rolling period at reduced loads vendor performance data with no control.

NOx (Warm SU) (0% to 20% load) = [23 min * 92.2 lb/hr + (60 min - 23 min) * 152.5 lb/hr] / 60 min = 129.8 lb/hr

NOx (Warm SU) (at 20% load) = 152.5 lb/hr

NOx (Warm SU) (20% to 40% load) = [10 min * 222.8 lb/hr + (60 min - 10 min) * 152.5 lb/hr) / 60 min = 164.4 lb/hr

NOx (Warm SU) (20% to 50% load) = [12 min * 148.1 lb/hr + 10 min * 222.8 lb/hr + (60 min - 10 min - 12 min) * 152.5 lb/hr) / 60 min = 163.6 lb/hr

NOx (Warm SU) (20% to 75% load) = [7 min * 123.1 lb/hr + 12 min * 148.1 lb/hr + 10 min * 222.8 lb/hr + (60 min - 7 min - 12 min - 10 min) * 152.5 lb/hr) / 60 min = 160.0 lb/hr

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY (Rev#1)

HOT STARTUP

Air Pollutant	Units	75% CTG Load 586 F @ Catalyst		50% CTG Load 581 F @ Catalyst		40% CTG Load 559 F @ Catalyst		20% CTG Load 522 F @ Catalyst		0% CTG Load 491 F @ Catalyst	
		Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst
NOx	ppmvd @ 15% O_2	25.0	-	40.0	-	70.0	-	70.0	-	80.0	-
	lb/hr	123.1	-	148.1	-	222.8	-	152.5	-	92.2	-
CO	ppmvd @ 15% O_2	10.0	1.8	15.0	1.8	120.0	14.9	2,500	315.0	2,500	322.5
	lb/hr	30.0	5.4	33.8	4.1	232.6	28.9	1,648	417.8	1,648	226.2
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196.0	68.6	750.0	300.0
	lb/hr	3.4	1.2	3.2	1.2	8.7	3.0	472.4	52.1	472.4	120.5

Notes:

(1) During hot startup period the SCR will not be operational. The oxidation catalyst will retain partial oxidation capabilites throught hot startup period.

(2) As calculated in Reduced Load CTG Hourly

Ramp	HOT NOx (lb/hr)
0% to 40%	157.6
40% to 75%	193.2
Maximum	**193.2**

Notes:

(1) Hot startup NOx hourly mass emission rates (lb/hr) represent the worst 60 minute rolling period at reduced loads vendor performance data with no control.

NOx (Hot SU) (0% to 40% load) = [28 min * 92.2 lb/hr + 3 min * 152.5 lb/hr + (60 min - 28 min - 3 min) * 222.8 lb/hr] / 60 min = 157.6 lb/hr

NOx (Hot SU) (40% to 75% load) = [3 min * 152.5 lb/hr + 39 min * 222.8 lb/hr + 11 min * 148.1 lb/hr + (60 min - 3 min - 39 min - 11 min) * 123.1 lb/hr] / 60 min = 193.2 lb/hr

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY (Rev #0)

CTG Startup & Shutdown Emission Rates per Unit

Air Pollutant	ppmvd @ 15% O_2 (1)	Max. Hourly (lb/hr) (2)	Annual (tpy) (3)
NOx	96.0	193.2	35.7
CO	3,000.0	2,060.0	106.4
VOC	187	77.8	42.6
SO_2	-	10.7	2.5
$TSP/PM_{10}/PM_{2.5}$	-	17.1	4.0
CO_2	-	-	17,721
N_2O	-	-	0.03
CH_4	-	-	0.33
GHG (4)	-	-	17,721
CO_2e (4)	-	-	17,739

Notes:

(1) Maximum exhaust concentration per vendor performance data at reduced loads, plus a 20% safety factor for NOx and VOC.
CO concentration value is based on historical observations, and turbine vendor estimates. VOC concentration assumes some control by the catalyst during startup sequence.

(2) Proposed maximum hourly emissions represent the maxium 1-hr NOx, CO, SO2, and particulate emission rates due to any startup or shutdown event.

- Data as provided by vendor
- The CO concentration value is based on historical observations, and turbine vendor estimates.
- The VOC hourly rate assumes partial control is achieved during the startup.
- Hourly SO_2, $PM_{10}/PM_{2.5}$ and NH_3 emission rates are expected to be within the routine operations limits, therefore no SU/SD Hourly emission rates are proposed for these pollutants.

(3) Annual emissions represent the sum of total proposed annual startups and shutdowns.

(4) GHG and CO_2e represent the sum of all CTG startup & shutdown at reduced load performance
GHG CTG startup & shutdown = 2,196 tpy + 2,574 tpy + 4,333 tpy + 6,992 tpy + 1,627 tpy = 17,721 tpy

Startup/Shutdown Events Characteristics per Unit

Air Pollutant	Cold Startup				Warm Startup				Hot Startup				Shutdown		
	Max. Emission Rate (lb/hr) (1)	Emission Factor (lb/event) (2)	Event Duration (min) (3)	No. Events per Year (3)	Max. Emission Rate (lb/hr) (1)	Emission Factor (lb/event) (2)	Event Duration (min) (3)	No. Events per Year (3)	Max. Emission Rate (lb/hr) (1)	Emission Factor (lb/event) (2)	Event Duration (min) (3)	No. Events per Year (3)	Emission Factor (lb/event) (2)	Event Duration (min) (3)	No. Events per Year (3)
NOx	169.5	453.0	180	60	164.4	289.8	120	70	193.2	240.0	90	50	66.7	25	180
CO	2,060.0	1,723			427.7	1,056			140.4	375			93		
VOC	71.8	494			77.8	405			61.0	311			65		
SO_2	10.7	32.1			10.7	21.4			10.7	16.1			4.5		
$TSP/PM_{10}/PM_{2.5}$	17.1	51.3			17.1	34.2			17.1	25.7			7.1		

Notes:

(1) Cold, warm and hot startup hourly mass emission rates (lb/hr) represent the worst 60 minute rolling period at reduced loads vendor performance data. Detailed calculations are provided below. Partial VOC control is assumed.
Rollling average period was used to identify worst case scenario and is not intended to be an operational restriction.

(2) Emission factor (lb/event) represents the total mass emission during the event duration based on vendor performance data. Represented number reflects an average annual value.
NOx, SO_2, PM, NH_3 (lb/event) = [(min/event * lb/hr) @ 0% Load + (min/event * lb/hr) @ 20% Load + (min/event * lb/hr) @ 40% Load + (min/event*lb/hr) @ 50% Load + (min/event * lb/hr) @ 75% Load] * 1hr / 60 minutes
CO, VOC (lb/event) as provided by vendor
NOx Cold SU = [17 min/event * 92.2 lb/hr + 128 min/event * 152.5 lb/hr + 14 min/event * 222.8 lb/hr + 14 min/event * 148.1 lb/hr + 6 min/event * 123.1 lb/hr] * 1hr/60 min = 453.0 lb/event

(3) Based on historical operational knowledge on startup and shutdown duration and frequency.

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY (Rev #0)

Duration at Each Load Level per Unit

Mode	Duration per Load Level [1] (min)					Event Duration (min)	No. of Events (events/yr)	Duration of Events (hr/yr)	CO (lbs/event)[2]	VOC (lbs/event)[2]
	75% CTG Load	50% CTG Load	40% CTG Load	20% CTG Load	0% CTG Load					
Cold Startup	6	14	14	128	17	180	60	180	1,723	494
Warm Startup	7	12	10	68	23	120	70	140	1,056	405
Hot Startup	9	11	39	3	28	90	50	75	375	311
Shutdown	2.55	3.06	10.71	0.77	7.91	25	180	75	93	65
						Total	**360**	**470**		

Notes:

(1) Based on historical operational knowledge on startup duration and frequency.

(2) Based on data supplied by catalyst vendor.

Emission Rate at Each Load Level per Unit

COLD STARTUP

Air Pollutant	Units	75% CTG Load 565 °F @ Catalyst		50% CTG Load 529 °F @ Catalyst		40% CTG Load 524 °F @ Catalyst		20% CTG Load 468 °F @ Catalyst		0% CTG Load 404 °F @ Catalyst	
		Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst
NOx	ppmvd @ 15% O_2	25.0	-	40.0	-	70.0	-	70.0	-	80.0	-
	lb/hr	123.1	-	148.1	-	222.8	-	152.5	-	92.2	-
CO	ppmvd @ 15% O_2	10.0	1.8	15.0	1.9	120.0	15.4	2,500	1,553	2,500	2,937
	lb/hr	30.0	5.4	33.8	4.3	232.6	29.8	3,316	2,060	1,754	2,060
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196.0	68.6	750.0	300.0
	lb/hr	3.4	1.2	3.2	1.2	8.7	3.0	148.9	52.1	301.3	120.5

Notes:

(1) During cold startup period the SCR will not be operational. The oxidation catalyst will attain limited oxidation capabilities once adequate temperate is reached .

(2) As calculated in Reduced Load CTG Hourly

(3) Post catalyst CO concentration values for the 0 to 20% load cases are back-calculated based on maximum observed historical mass emission rates. Refer to detailed calculations.

Ramp	COLD STARTUP						
	NOx (lb/hr)	CO (lb/hr)	VOC (lb/hr)	SO_2 (lb/hr)	TSP/PM_{10} (lb/hr)	VOC (ppmvd)	
						Pre Catalyst	Post Catalyst
0% to 20%	135.1	2,060	71.8	2.5	7.6	355.5	135.2
20%	152.5	2,060	52.1	2.8	7.6	196.0	68.6
20% to 40%	169.5	1,570	40.2	3.1	7.6	150.6	52.7
20% to 50%	168.4	1,073	27.9	3.6	7.7	103.8	36.3
20% to 75%	165.4	863	22.7	4.0	7.8	84.0	29.4
Maximum	**169.5**	**2,060**	**71.8**	**4.0**	**7.8**	**355.5**	**135.2**

Notes:

(1) Cold startup hourly mass emission rates (lb/hr) represent the worst 60 minute rolling period at reduced loads vendor performance data (NOx no control, CO and VOC partial control).

NOx (Cold SU) (0% to 20% load) = [17 min * 92.2 lb/hr + (60 min - 17 min) * 152.5 lb/hr] / 60 min = 135.1 lb/hr

NOx (Cold SU) (at 20% load) = 152.5 lb/hr

NOx (Cold SU) (20% to 40% load) = [14 min * 222.8 lb/hr + (60 min - 14 min) * 152.5 lb/hr) / 60 min = 169.5 lb/hr

NOx (Cold SU) (20% to 50% load) = [14 min * 148.1 lb/hr + 14 min * 222.8 lb/hr + (60 min - 14 min - 14 min) * 152.5 lb/hr) / 60 min = 168.4 lb/hr

NOx (Cold SU) (20% to 75% load) = [6 min * 123.1 lb/hr + 14 min * 148.1 lb/hr + 14 min * 222.8 lb/hr + (60 min - 6 min - 14 min - 14 min) * 152.5 lb/hr) / 60 min = 165.4 lb/hr

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY (Rev #0)

WARM STARTUP

Air Pollutant	Units	75% CTG Load 584.5 F @ Catalyst		50% CTG Load 564 F @ Catalyst		40% CTG Load 531 F @ Catalyst		20% CTG Load 492.4 F @ Catalyst		0% CTG Load 435.4 F @ Catalyst	
		Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst
NOx	ppmvd @ 15% O_2	25.0	-	40.0	-	70.0	-	70.0	-	80.0	-
	lb/hr	123.1	-	148.1	-	222.8	-	152.5	-	92.2	-
CO	ppmvd @ 15% O_2	10.0	1.8	15.0	1.9	120.0	15.2	2,500	322.5	2,500	340.0
	lb/hr	30.0	5.4	33.8	4.3	232.6	29.5	3,316	427.7	1,754	238.5
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196.0	68.6	750.0	300.0
	lb/hr	3.4	1.2	3.2	1.2	8.7	3.0	148.9	52.1	301.3	120.5

Notes:

(1) During warm startup period the SCR will not be operational. The oxidation catalyst will retain partial oxidation capabilites throught warm startup period.

(2) As calculated in Reduced Load CTG Hourly

Ramp	WARM STARTUP						
	NOx (lb/hr)	CO (lb/hr)	VOC (lb/hr)	SO_2 (lb/hr)	TSP/PM_{10} (lb/hr)	VOC (ppmvd)	
						Pre Catalyst	Post Catalyst
0% to 20%	129.8	356.6	77.8	2.4	7.6	404.2	155.6
at 20%	152.5	427.7	52.1	2.8	7.6	196.0	68.6
20% to 40%	164.4	360.1	43.8	3.1	7.6	164.1	57.4
20% to 50%	163.6	278.0	33.9	3.4	7.6	126.5	44.3
20% to 75%	160.0	226.8	27.7	3.9	7.8	103.0	36.1
Maximum	**164.4**	**427.7**	**77.8**	**3.9**	**7.8**	**404.2**	**155.6**

Notes:

(1) Warm startup hourly mass emission rates (lb/hr) represent the worst 60 minute rolling period at reduced loads vendor performance data (NOx no control, CO and VOC partial control).

NOx (Warm SU) (0% to 20% load) = [23 min * 92.2 lb/hr + (60 min - 23 min) * 152.5 lb/hr] / 60 min = 129.8 lb/hr

NOx (Warm SU) (at 20% load) = 152.5 lb/hr

NOx (Warm SU) (20% to 40% load) = [10 min * 222.8 lb/hr + (60 min - 10 min) * 152.5 lb/hr) / 60 min = 164.4 lb/hr

NOx (Warm SU) (20% to 50% load) = [12 min * 148.1 lb/hr + 10 min * 222.8 lb/hr + (60 min - 10 min - 12 min) * 152.5 lb/hr) / 60 min = 163.6 lb/hr

NOx (Warm SU) (20% to 75% load) = [7 min * 123.1 lb/hr + 12 min * 148.1 lb/hr + 10 min * 222.8 lb/hr + (60 min - 7 min - 12 min - 10 min) * 152.5 lb/hr) / 60 min = 160.0 lb/hr

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY (Rev #0)

HOT STARTUP

Air Pollutant	Units	75% CTG Load 586 F @ Catalyst		50% CTG Load 581 F @ Catalyst		40% CTG Load 559 F @ Catalyst		20% CTG Load 522 F @ Catalyst		0% CTG Load 491 F @ Catalyst	
		Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst
NOx	ppmvd @ 15% O_2	25.0	-	40.0	-	70.0	-	70.0	-	80.0	-
	lb/hr	123.1	-	148.1	-	222.8	-	152.5	-	92.2	-
CO	ppmvd @ 15% O_2	10.0	1.8	15.0	1.8	120.0	14.9	2,500	315.0	2,500	322.5
	lb/hr	30.0	5.4	33.8	4.1	232.6	28.9	3,316	417.8	1,754	226.2
VOC	ppmvd @ 15% O_2	2.0	0.7	2.5	0.9	7.8	2.7	196.0	68.6	750.0	300.0
	lb/hr	3.4	1.2	3.2	1.2	8.7	3.0	148.9	52.1	301.3	120.5

Notes:

(1) During hot startup period the SCR will not be operational. The oxidation catalyst will retain partial oxidation capabilites throught hot startup period.

(2) As calculated in Reduced Load CTG Hourly

Ramp	HOT STARTUP						
	NOx (lb/hr)	CO (lb/hr)	VOC (lb/hr)	SO_2 (lb/hr)	TSP/PM_{10} (lb/hr)	VOC (ppmvd)	
						Pre Catalyst	Post Catalyst
0% to 40%	157.6	140.4	61.0	2.8	7.6	368.6	146.8
40% to 75%	193.2	39.2	4.7	4.5	7.9	14.7	5.1
Maximum	**193.2**	**140.4**	**61.0**	**4.5**	**7.9**	**368.6**	**146.8**

Notes:

(1) Hot startup hourly mass emission rates (lb/hr) represent the worst 60 minute rolling period at reduced loads vendor performance data (NOx no control, CO and VOC partial control).

NOx (Hot SU) (0% to 40% load) = [28 min * 92.2 lb/hr + 3 min * 152.5 lb/hr + (60 min - 28 min - 3 min) * 222.8 lb/hr] / 60 min = 157.6 lb/hr

NOx (Hot SU) (40% to 75% load) = [3 min * 152.5 lb/hr + 39 min * 222.8 lb/hr + 11 min * 148.1 lb/hr + (60 min - 3 min - 39 min - 11 min) * 123.1 lb/hr] / 60 min = 193.2 lb/hr

SHUTDOWN

Air Pollutant	Units	75% CTG Load		50% CTG Load		40% CTG Load		20% CTG Load		0% CTG Load	
		Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst	Pre Catalyst	Post Catalyst
NOx	ppmvd @ 15% O_2	25.0	-	40.0	-	70.0	-	70.0	-	80.0	-
	lb/hr	123.1	-	148.1	-	222.8	-	152.5	-	92.2	-
CO	ppmvd @ 15% O_2	10.0	1.7	15.0	1.7	120.0	13.9	2,500.0	285.0	2,500.0	285.0
	lb/hr	30.0	5.1	33.8	3.8	232.6	26.9	3,315.5	378.0	1,753.6	199.9
VOC	ppmvd @ 15% O_2	2.0	0.6	2.5	0.8	7.8	2.3	196.0	58.8	750.0	225.0
	lb/hr	3.4	1.0	3.2	1.0	8.7	2.6	148.9	44.7	301.3	90.4

Notes:

(1) During startup period the SCR will not be operational, while the oxidation catalyst will retain parcial oxidation capabilites.

(2) As calculated in Reduced Load CTG Hourly

STARTUP / SHUTDOWN

Air Pollutant	Units	75% CTG Load	50% CTG Load	40% CTG Load	20% CTG Load	0% CTG LoaD
SO_2	lb/hr	6.3	4.8	4.1	2.8	1.5
TSP/PM_{10}/$PM_{2.5}$	lb/hr	9.3	7.7	7.7	7.6	7.5

Notes:

(1) As calculated in Reduced Load CTG Hourly

HOBBS 501F4 Hourly GT Emission Rate Calculation (Reduced Load)

		75% CTG Load			50% CTG Load			40% CTG Load	20% CTG Load	1,800 rpm 0% CTG Load
SITE CONDITIONS										
Ambient Temperature	ºF	30	45	95	30	45	95	30	30	30
Ambient Relative Humidity	%	70	60	20	70	60	20	70	70	70
Barometric Pressure	psia	12.83	12.83	12.83	12.83	12.83	12.83	12.83	12.83	12.83
FACILITY CONDITIONS										
GT Power Output	MW	125	119	98	83	79	65	66	32	-
Heat Rate	Btu/kWh	9,905	10,027	10,545	11,308	11,447	12,039	12,245	17,504	-
GT Model		Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4	Hobbs 501F4
GT Load	%	75	75	75	50	50	50	40	20	-
Temperature at Catalyst	ºF	565	565	565	529	529	529	5	468	404
Chillers ON/OFF		Off	Off	Off	Off	Off	Off	Off	Off	Off
GT Heat Input	MMBtu/hr	1,235	1,190	1,033	933	899	780	804	555	301
GT Fuel Flow Rate	MMscf/hr	1.3	1.3	1.1	1.0	1.0	0.8	0.9	0.6	0.3
FUEL ANALYSIS										
Fuel Type		PNG	PNG	PNG	PNG	PNG	PNG	PNG	PNG	PNG
Fuel Molecular Weight	lb/lbmole	17.29	17.29	17.29	17.29	17.29	17.29	17.29	17.29	17.29
Sulfur Content	grains/100scf	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Fuel Heat Content (LHV)	Btu/scf	932	932	932	932	932	932	932	932	932
Fuel Heat Content (HHV)	Btu/scf	1,033	1,033	1,033	1,033	1,033	1,033	1,033	1,033	1,033
HHV/LHV Ratio		1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
GT EXHAUST GAS ANALYSIS										
Oxygen, O2	%vol	13.36	13.39	13.60	14.06	14.10	14.32	14.98	16.78	18.65
Carbon Dioxide, CO2	%vol	3.44	3.41	3.28	3.12	3.10	2.98	2.70	1.88	1.02
Water, H2O	%vol	7.13	7.28	7.54	6.51	6.65	6.88	5.70	4.09	2.43
Nitrogen, N2	%vol	75.13	74.97	74.64	75.36	75.20	74.87	75.67	76.30	76.93
Argon, Ar	%vol	0.94	0.93	0.93	0.94	0.93	0.93	0.95	0.96	0.97
Total	%vol	100	100	100	100	100	100	100	100	100
Molecular Weight (GT Exhaust Gases)	lb/lbmole	28.5	28.5	28.4	28.5	28.5	28.5	28.6	28.7	28.8
GT Exhaust Flow Rate	lb/hr	2,972,500	2,863,014	2,484,789	2,474,000	2,382,875	2,068,080	2,467,500	2,454,900	2,442,100
GT Exhaust Flow Rate	lbmole/hr	104,326	100,561	87,413	86,706	83,577	72,650	86,323	85,581	84,825
GT Exhaust Flow Rate	scf/hr	40,197,178	38,746,457	33,680,802	33,408,389	32,202,676	27,992,546	33,260,811	32,974,931	32,683,343
GT Exhaust Flow Rate	Nm3/hr	1,138,257	1,097,177	953,734	946,020	911,878	792,661	941,841	933,746	925,489
GT Exhaust Oxygen, O2	lbmole/hr	13,934	13,469	11,890	12,192	11,785	10,404	12,931	14,361	15,820
GT Exhaust Carbon Dioxide, CO2	lbmole/hr	3,586	3,426	2,864	2,710	2,588	2,163	2,332	1,606	866
GT Exhaust Water, H2O	lbmole/hr	7,441	7,323	6,588	5,644	5,554	4,997	4,917	3,502	2,060
GT Exhaust Nitrogen, N2	lbmole/hr	78,382	75,393	65,246	65,343	62,851	54,392	65,321	65,295	65,259
GT Exhaust Argon, Ar	lbmole/hr	982	939	815	817	781	678	822	817	819

HOBBS 501F4 Hourly GT Emission Rate Calculation (Reduced Load)

		75% CTG Load			50% CTG Load			40% CTG Load	20% CTG Load	1,800 rpm 0% CTG Load
GT EMISSIONS										
NOx (pre-SCR)	ppmvd @ 15% O2	25	25	25	40	40	40	70	70	80
NOx (pre-SCR)	ppmvd	27.6	27.4	26.2	39.7	39.3	37.4	59.5	40.4	24.2
NOx (pre-SCR as NO2)	lb/hr	123.1	117.3	97.5	148.1	141.0	116.5	222.8	152.5	92.2
CO (pre-Catalytic Oxidation)	ppmvd @ 15% O2	10	10	10	15	15	15	120	2,500	2,500
CO (pre-Catalytic Oxidation)	ppmvd	11	11	10	15	15	14	102	1,442	756
CO (pre-Catalytic Oxidation)	lb/hr	30	29	24	34	32	27	233	3,316	1,754
VOC (pre-Catalytic Oxidation)	ppmvd @ 15% O2	2.0	2.0	2.0	2.5	2.5	2.5	7.8	196	750
VOC (pre-Catalytic Oxidation)	ppmvd	2.2	2.2	2.1	2.5	2.5	2.3	6.6	113.1	226.9
VOC (pre-Catalytic Oxidation as CH4)	lb/hr	3.4	3.3	2.7	3.2	3.1	2.5	8.7	148.9	301.3
COLD STARTUP										
CO (post-Catalytic Oxidation)	ppmvd @ 15% O2	1.8	1.8	1.8	1.9	1.9	1.9	15.4	2500	2500
CO (post-Catalytic Oxidation)	ppmvd	2.0	2.0	1.9	1.9	1.9	1.8	13.1	717	711
CO (post-Catalytic Oxidation)	lb/hr	5.4	5.1	4.3	4.3	4.1	3.4	29.8	**1648**	**1648**
VOC (post-Catalytic Oxidation)	ppmvd @ 15% O2	0.7	0.7	0.7	0.9	0.9	0.9	2.7	196	750
VOC (post-Catalytic Oxidation)	ppmvd	0.8	0.8	0.7	0.9	0.9	0.8	2.3	113.1	226.9
VOC (post-Catalytic Oxidation as CH4)	lb/hr	1.2	1.1	1.0	1.2	1.1	0.9	3.0	148.9	301.3
WARM STARTUP										
CO (post-Catalytic Oxidation)	ppmvd @ 15% O2	1.8	1.8	1.8	1.9	1.9	1.9	15.2	322.5	340.0
CO (post-Catalytic Oxidation)	ppmvd	2.0	2.0	1.9	1.9	1.9	1.8	12.9	186.0	102.9
CO (post-Catalytic Oxidation)	lb/hr	5.4	5.1	4.3	4.3	4.1	3.4	29.5	427.7	238.5
VOC (post-Catalytic Oxidation)	ppmvd @ 15% O2	0.7	0.7	0.7	0.9	0.9	0.9	2.7	68.6	300
VOC (post-Catalytic Oxidation)	ppmvd	0.77	0.77	0.73	0.89	0.88	0.84	2.30	39.57	90.77
VOC (post-Catalytic Oxidation as CH4)	lb/hr	1.20	1.15	0.95	1.16	1.11	0.91	3.00	52.11	120.52
HOT STARTUP										
CO (post-Catalytic Oxidation)	ppmvd @ 15% O2	1.8	1.8	1.8	1.8	1.8	1.8	14.9	315.0	322.5
CO (post-Catalytic Oxidation)	ppmvd	2.0	2.0	1.9	1.8	1.8	1.7	12.7	181.7	97.6
CO (post-Catalytic Oxidation)	lb/hr	5.4	5.1	4.3	4.1	3.9	3.2	28.9	417.8	226.2
VOC (post-Catalytic Oxidation)	ppmvd @ 15% O2	0.7	0.7	0.7	0.9	0.9	0.9	2.7	68.6	300
VOC (post-Catalytic Oxidation)	ppmvd	0.77	0.77	0.73	0.89	0.88	0.84	2.30	39.57	90.77
VOC (post-Catalytic Oxidation as CH4)	lb/hr	1.20	1.15	0.95	1.16	1.11	0.91	3.00	52.11	120.52
SHUTDOWN										
CO (post-Catalytic Oxidation)	ppmvd @ 15% O2	1.7	1.7	1.7	1.7	1.7	1.7	13.9	285.0	285.0
CO (post-Catalytic Oxidation)	ppmvd	1.9	1.9	1.8	1.7	1.7	1.6	11.8	164.4	86.2
CO (post-Catalytic Oxidation)	lb/hr	5.1	4.9	4.0	3.8	3.6	3.0	26.9	378.0	199.9
VOC (post-Catalytic Oxidation)	ppmvd @ 15% O2	0.6	0.6	0.6	0.8	0.8	0.8	2.3	58.8	225
VOC (post-Catalytic Oxidation)	ppmvd	0.66	0.66	0.63	0.79	0.79	0.75	1.96	33.92	68.08
VOC (post-Catalytic Oxidation as CH4)	lb/hr	1.03	0.98	0.82	1.03	0.98	0.81	2.55	44.66	90.39
Sulfur Content	grains/100scf	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
SO2	lb/hr	6.32	6.09	5.28	4.77	4.60	3.99	4.12	2.84	1.54
PM10	mg/Nm3	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
PM10	lb/hr	9.28	8.95	7.78	7.72	7.44	6.47	7.68	7.62	7.55

HOBBS 501F4 Hourly GT Emission Rate Calculation (Reduced Load)

		75% CTG Load			50% CTG Load			40% CTG Load	20% CTG Load	1,800 rpm 0% CTG Load
CO2	lb/MMBtu (HHV)	118.8	118.8	118.8	118.8	118.8	118.8	118.8	118.8	118.8
N2O	lb/MMBtu (HHV)	2.2E-04	2.2E-04	2.2E-04	2.2E-04	2.2E-04	2.2E-04	2.2E-04	2.2E-04	2.2E-04
CH4	lb/MMBtu (HHV)	2.2E-03	2.2E-03	2.2E-03	2.2E-03	2.2E-03	2.2E-03	2.2E-03	2.2E-03	2.2E-03
Operating Hours at Each Load%	hr/yr	30	30	30	46	46	46	91	212	91
CO2	tpy	2,196	2,115	1,835	2,574	2,479	2,152	4,333	6,992	1,627
N2O	tpy	0.0041	0.0039	0.0034	0.0048	0.0046	0.0040	0.0080	0.013	0.0030
CH4	tpy	0.041	0.039	0.034	0.048	0.046	0.040	0.080	0.13	0.030
CO2 Global Warming Potential	-	1	1	1	1	1	1	1	1	1
N2O Global Warming Potential	-	298	298	298	298	298	298	298	298	298
CH4 Global Warming Potential	-	25	25	25	25	25	25	25	25	25
Total GHG	tpy	2,196	2,115	1,835	2,574	2,479	2,152	4,333	6,992	1,627
Total CO2e	tpy	2,198	2,117	1,837	2,577	2,482	2,154	4,337	6,999	1,628

Vendor Data

Process Input Data

Red and bolded text indicate information from actual emissions data. Please refer to the "*Summary Graphs*" tab.

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

Emission Rate at Each Load Level per Unit
COLD STARTUP

1 hour rolling between 0% Load and 20% Load

VOC Emissions Rate (lb/hr) = [Minutes @ 0% Load * Post Catalyst Emission Rate @ 0% Load (lb/hr) + (60 min - Minutes @ 0% Load) * Post Catalyst Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC (Cold SU) (0% to 20% load) = [17 min * 120.5 lb/hr + (60 min - 17 min) * 52.1 lb/hr] / 60 min = 71.8 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 0% Load * Pre Catalyst VOC @ 0% Load (ppmvd) + (60 min - Minutes @ 0% Load) * Pre Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Cold SU) Pre Catalyst (0% to 20% load) = [17 min * 750.0 ppmvd + (60 min - 17 min) * 196.0 ppmvd] / 60 min = 355.5 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 0% Load * Post Catalyst VOC @ 0% Load (ppmvd) + (60 min - Minutes @ 0% Load) * Post Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Cold SU) Post Catalyst (0% to 20% load) = [17 min * 300.0 ppmvd + (60 min - 17 min) * 68.6 ppmvd] / 60 min = 135.2 ppmvd

1 hour rolling at 20% Load

VOC Emissions at 20% Load (lb/hr) = Post Catalyst Emission Rate (lb/hr) @ 20% Load (lb/hr)

VOC (Cold SU) (at 20% load) = 52.1 lb/hr

VOC Emissions Pre Catalyst at 20% Load (lb/hr)

VOC (Cold SU) Pre Catalyst (at 20% load) = 196.0 ppmvd

VOC Emissions Post Catalyst at 20% Load (lb/hr)

VOC (Cold SU) Post Catalyst (at 20% load) = 68.6 ppmvd

1 hour rolling between 20% Load and 40% Load

VOC Emissions in the 20% to 40% Load Ramp (lb/hr) = [Minutes @ 40% Load * Post Catalyst Emission Rate @ 40% Load (lb/hr)
+ (60 min - Minutes @ 40% Load) * Post Catalyst Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC (Cold SU) (20% to 40% load) = [14 min * 3.0 lb/hr + (60 min - 14 min) * 52.1 lb/hr] / 60 min = 40.2 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 40% Load * Pre Catalyst VOC @ 40% Load (ppmvd) + (60 min - Minutes @ 40% Load) * Pre Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Cold SU) Pre Catalyst (20% to 40% load) = [14 min * 7.8 ppmvd + (60 min - 14 min) * 196.0 ppmvd] / 60 min = 150.6 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 40% Load * Post Catalyst VOC @ 40% Load (ppmvd) + (60 min - Minutes @ 40% Load) * Post Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Cold SU) Post Catalyst (20% to 40% load) = [14 min * 2.7 ppmvd + (60 min - 14 min) * 68.6 ppmvd] / 60 min = 52.7 ppmvd

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

Emission Rate at Each Load Level per Unit

COLD STARTUP

1 hour rolling between 20% Load and 50% Load

VOC Emissions in the 20% to 50% Load Ramp (lb/hr) = [Minutes @ 50% Load * Post Catalyst Emission Rate @ 50% Load (lb/hr)

+ Minutes @ 40% Load * Post Catalyst Emission Rate @ 40% Load (lb/hr)

+ (60 min - Minutes @ 50% Load - Minutes @ 40% Load) * Post Catalyst Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC (Cold SU) (20% to 50% load) = [14 min * 1.2 lb/hr + 14 min * 3.0 lb/hr + (60 min - 14 min - 14 min) * 52.1 lb/hr)] / 60 min = 27.9 lb/hr

+ (60 min - Minutes @ 50% Load - Minutes @ 40% Load) * Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC Pre Catalyst (ppmvd) = [Minutes @ 50% Load * Pre Catalyst VOC @ 50% Load (ppmvd) + Minutes @ 40% Load * Pre Catalyst @ 40% Load (ppmvd)

+ (60 min - Minutes @ 50% Load - Minutes @ 40% Load) * Pre Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Cold SU) Pre Catalyst (20% to 50% load) = [14 min * 2.5 ppmvd + 14 min * 7.8 ppmvd + (60 min - 14 min - 14 min) * 196.0 ppmvd)] /60 min = 103.8 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 50% Load * Post Catalyst VOC @ 50% Load (ppmvd) + Minutes @ 40% Load * Post Catalyst @ 40% Load (ppmvd)

+ (60 min - Minutes @ 50% Load - Minutes @ 40% Load) * Post Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Cold SU) Post Catalyst (20% to 50% load) = [14 min * 0.9 ppmvd + 14 min * 2.7 ppmvd + (60 min - 14 min - 14 min) * 68.6 ppmvd)] / 60 min = 36.3 ppmvd

1 hour rolling between 20% Load and 75% Load

VOC Emissions in the 20% to 75% Load Ramp (lb/hr) = [Minutes @ 75% Load * Post Catalyst Emission Rate @ 75% Load (lb/hr)

+ Minutes @ 50% Load * Post Catalyst Emission Rate @ 50% Load (lb/hr)

+ Minutes @ 40% Load * Post Catalyst Emission Rate @ 40% Load (lb/hr)

+ (60 min - Minutes @ 75% Load - Minutes @ 50% Load - Minutes @ 40% Load) * Post Catalyst Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC (Cold SU) (20% to 75% load) = [6 min * 1.2 lb/hr + 14 min * 1.2 lb/hr + 14 min * 3.0 lb/hr + (60 min - 6 min - 14 min - 14 min) * 52.1 lb/hr)] / 60 min = 22.7 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 75% Load * Pre Catalyst VOC @ 75% Load (ppmvd)

+ Minutes @ 50% Load * Pre Catalyst VOC @ 50% Load (ppmvd) + Minutes @ 40% Load * Pre Catalyst VOC @ 40% Load (ppmvd)

+ (60 min - Minutes @ 75% Load - Minutes @ 50% Load - Minutes @ 40% Load) * Pre Catalyst VOC @ 20% Load ppmvd)] / 60 min

VOC (Cold SU) Pre Catalyst (20% to 75% load) = [6 min * 2.0 ppmvd + 14 min * 2.5 ppmvd + 14 min * 7.8 ppmvd + (60 min - 6 min - 14 min - 14 min) * 196.0 ppmvd)] / 60 min = 84.0 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 75% Load * Post Catalyst VOC @ 75% Load (ppmvd)

+ Minutes @ 50% Load * Post Catalyst VOC @ 50% Load (ppmvd) + Minutes @ 40% Load * Post Catalyst VOC @ 40% Load (ppmvd)

+ (60 min - Minutes @ 75% Load - Minutes @ 50% Load - Minutes @ 40% Load) * Post Catalyst VOC @ 20% Load (ppmvd)] / 60 min

VOC (Cold SU) Pre Catalyst (20% to 75% load) = [6 min * 0.7 ppmvd + 14 min * 0.9 ppmvd + 14 min * 2.7 ppmvd + (60 min - 6 min - 14 min - 14 min) * 68.6 ppmvd)] / 60 min = 29.4 ppmvd

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

Emission Rate at Each Load Level per Unit

COLD STARTUP

Maximum 1 hour rolling during Cold Startup

Cold SU Emission Rate (lb/hr) = Max { Emission Rate @ 0%-20% Load; Emission Rate @ 20%; Emission Rate @ 20%-40% Load; Emission Rate @ 20%-50% Load; Emission Rate @ 20%-75% Load}

VOC Cold SU Emission Rate = Max {71.8; 52.1; 40.2; 27.9; 22.7} = 71.8 lb/hr

VOC Cold SU Pre Catalyst = Max {355.5; 196.0; 150.6; 103.8; 84.0} = 355.5 ppmvd

VOC Cold SU Post Catalyst = Max {135.2; 68.6; 52.7; 36.3; 29.4} = 135.2 ppmvd

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

Emission Rate at Each Load Level per Unit
WARM STARTUP

1 hour rolling between 0% Load and 20% Load

VOC Emissions Rate (lb/hr) = [Minutes @ 0% Load * Post Catalyst Emission Rate @ 0% Load (lb/hr) + (60 min - Minutes @ 0% Load) * Post Catalyst Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC (Warm SU) (0% to 20% load) = [23 min * 120.5 lb/hr + (60 min - 23 min) * 52.1 lb/hr] / 60 min = 77.8 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 0% Load * Pre Catalyst VOC @ 0% Load (ppmvd) + (60 min - Minutes @ 0% Load) * Pre Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Warm SU) Pre Catalyst (0% to 20% load) = [23 min * 750.0 ppmvd + (60 min - 23 min) * 196.0 ppmvd] / 60 min = 404.2 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 0% Load * Post Catalyst VOC @ 0% Load (ppmvd) + (60 min - Minutes @ 0% Load) * Post Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Warm SU) Post Catalyst (0% to 20% load) = [23 min * 300.0 ppmvd + (60 min - 23 min) * 68.6 ppmvd] / 60 min = 155.6 ppmvd

1 hour rolling at 20% Load

VOC Emissions at 20% Load (lb/hr) = Post Catalyst Emission Rate (lb/hr) @ 20% Load (lb/hr)

VOC (Warm SU) (at 20% load) = 52.1 lb/hr

VOC Emissions Pre Catalyst at 20% Load (lb/hr)

VOC (Warm SU) Pre Catalyst (at 20% load) = 196.0 ppmvd

VOC Emissions Post Catalyst at 20% Load (lb/hr)

VOC (Warm SU) Post Catalyst (at 20% load) = 68.6 ppmvd

1 hour rolling between 20% Load and 40% Load

VOC Emissions in the 20% to 40% Load Ramp (lb/hr) = [Minutes @ 40% Load * Post Catalyst Emission Rate @ 40% Load (lb/hr)
+ (60 min - Minutes @ 40% Load) * Post Catalyst Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC (Warm SU) (20% to 40% load) = [10 min * 3.0 lb/hr + (60 min - 10 min) * 52.1 lb/hr] / 60 min = 43.8 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 40% Load * Pre Catalyst VOC @ 40% Load (ppmvd) + (60 min - Minutes @ 40% Load) * Pre Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Warm SU) Pre Catalyst (20% to 40% load) = [10 min * 7.8 ppmvd + (60 min - 10 min) * 196.0 ppmvd] / 60 min = 164.1 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 40% Load * Post Catalyst VOC @ 40% Load (ppmvd) + (60 min - Minutes @ 40% Load) * Post Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Warm SU) Post Catalyst (20% to 40% load) = [10 min * 2.7 ppmvd + (60 min - 10 min) * 68.6 ppmvd] / 60 min = 57.4 ppmvd

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

Emission Rate at Each Load Level per Unit
WARM STARTUP

1 hour rolling between 20% Load and 50% Load

VOC Emissions in the 20% to 50% Load Ramp (lb/hr) = [Minutes @ 50% Load * Post Catalyst Emission Rate @ 50% Load (lb/hr)

+ Minutes @ 40% Load * Post Catalyst Emission Rate @ 40% Load (lb/hr)

+ (60 min - Minutes @ 50% Load - Minutes @ 40% Load) * Post Catalyst Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC (Warm SU) (20% to 50% load) = [12 min * 1.2 lb/hr + 10 min * 3.0 lb/hr + (60 min - 10 min - 12 min) * 52.1 lb/hr)] / 60 min = 33.9 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 50% Load * Pre Catalyst VOC @ 50% Load (ppmvd) + Minutes @ 40% Load * Pre Catalyst @ 40% Load (ppmvd)

+ (60 min - Minutes @ 50% Load - Minutes @ 40% Load) * Pre Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Warm SU) Pre Catalyst (20% to 50% load) = [12 min * 2.5 ppmvd + 10 min * 7.8 ppmvd + (60 min - 10 min - 12 min) * 196.0 ppmvd)] /60 min = 126.5 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 50% Load * Post Catalyst VOC @ 50% Load (ppmvd) + Minutes @ 40% Load * Post Catalyst @ 40% Load (ppmvd)

+ (60 min - Minutes @ 50% Load - Minutes @ 40% Load) * Post Catalyst @ 20% Load (ppmvd)] / 60 min

VOC (Warm SU) Post Catalyst (20% to 50% load) = [12 min * 0.9 ppmvd + 10 min * 2.7 ppmvd + (60 min - 10 min - 12 min) * 68.6 ppmvd)] / 60 min = 44.3 ppmvd

1 hour rolling between 20% Load and 75% Load

VOC Emissions in the 20% to 75% Load Ramp (lb/hr) = [Minutes @ 75% Load * Post Catalyst Emission Rate @ 75% Load (lb/hr)

+ Minutes @ 50% Load * Post Catalyst Emission Rate @ 50% Load (lb/hr)

+ Minutes @ 40% Load * Post Catalyst Emission Rate @ 40% Load (lb/hr)

+ (60 min - Minutes @ 75% Load - Minutes @ 50% Load - Minutes @ 40% Load) * Post Catalyst Emission Rate @ 20% Load (lb/hr)] / 60 min

VOC (Warm SU) (20% to 75% load) = [7 min * 1.2 lb/hr + 12 min * 1.2 lb/hr + 10 min * 3.0 lb/hr + (60 min - 7 min - 12 min - 10 min) * 52.1 lb/hr)] / 60 min = 27.7 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 75% Load * Pre Catalyst VOC @ 75% Load (ppmvd)

+ Minutes @ 50% Load * Pre Catalyst VOC @ 50% Load (ppmvd) + Minutes @ 40% Load * Pre Catalyst VOC @ 40% Load (ppmvd)

+ (60 min - Minutes @ 75% Load - Minutes @ 50% Load - Minutes @ 40% Load) * Pre Catalyst VOC @ 20% Load ppmvd)] / 60 min

VOC (Warm SU) Pre Catalyst (20% to 75% load) = [7 min * 2.0 ppmvd + 12 min * 2.5 ppmvd + 10 min * 7.8 ppmvd + (60 min - 7 min - 12 min - 10 min) * 196.0 ppmvd)] / 60 min = 103.0 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 75% Load * Post Catalyst VOC @ 75% Load (ppmvd)

+ Minutes @ 50% Load * Post Catalyst VOC @ 50% Load (ppmvd) + Minutes @ 40% Load * Post Catalyst VOC @ 40% Load (ppmvd)

+ (60 min - Minutes @ 75% Load - Minutes @ 50% Load - Minutes @ 40% Load) * Post Catalyst VOC @ 20% Load (ppmvd)] / 60 min

VOC (Warm SU) Pre Catalyst (20% to 75% load) = [7 min * 0.7 ppmvd + 12 min * 0.9 ppmvd + 10 min * 2.7 ppmvd + (60 min - 7 min - 12 min - 10 min) * 68.6 ppmvd)] / 60 min = 36.1 ppmvd

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

Emission Rate at Each Load Level per Unit
WARM STARTUP

Maximum 1 hour rolling during Warm Startup

Warm SU Emission Rate (lb/hr) = Max { Emission Rate @ 0%-20% Load; Emission Rate @ 20%; Emission Rate @ 20%-40% Load; Emission Rate @ 20%-50% Load; Emission Rate @ 20%-75% Load}

VOC Warm SU Emission Rate = Max {77.8; 52.1; 43.8; 33.9; 27.7} = 77.8 lb/hr

VOC Warm SU Pre Catalyst = Max {404.2; 196.0; 164.1; 126.5; 103.0} = 404.2 ppmvd

VOC Warm SU Post Catalyst = Max {155.6; 68.6; 57.4; 44.3; 36.1} = 155.6 ppmvd

VOC Warm SU Post Catalyst = Max {155.6; 68.6; 57.4; 44.3; 36.1} * 1.2 *= 186.7 ppmvd

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

Emission Rate at Each Load Level per Unit
HOT STARTUP

1 hour rolling between 0% Load and 40% Load

VOC Emissions Rate (lb/hr) = [Minutes @ 0% Load * Post Catalyst Emission Rate @ 0% Load (lb/hr) + Minutes @ 20% Load * Post Catalyst Emission Rate @ 20% Load (lb/hr)
+ (60 min - Minutes @ 20% Load - Minutes @ 0% Load) * Post Catalyst Emission Rate @ 40% Load (lb/hr)] / 60 min

VOC (Hot SU) (0% to 40% load) = [28 min * 120.5 lb/hr + 3 min * 52.1 lb/hr + (60 min - 28 min - 3 min) * 3.0 lb/hr] / 60 min = 61.0 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 0% Load * Pre Catalyst VOC @ 0% Load (ppmvd) + Minutes @ 20% Load * Pre Catalyst VOC @ 20% Load (ppmvd)
+ (60 min - Minutes @ 20% Load - Minutes @ 0% Load) * Pre Catalyst VOC @ 40% Load (ppmvd)] / 60 min

VOC (Hot SU) Pre Catalyst (0% to 40% load) = [28 min * 750.0 ppmvd + 3 min * 196.0 ppmvd + (60 min - 28 min - 3 min) * 7.8 ppmvd] / 60 min = 368.6 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 0% Load * Post Catalyst VOC @ 0% Load (ppmvd) + Minutes @ 20% Load * Post Catalyst VOC @ 20% Load (ppmvd)
+ (60 min - Minutes @ 20% Load - Minutes @ 0% Load) * Post Catalyst VOC @ 40% Load (ppmvd)] / 60 min

VOC (Hot SU) Post Catalyst (0% to 40% load) = [28 min * 300.0 ppmvd + 3 min * 68.6 ppmvdr + (60 min - 28 min - 3 min) * 2.7 ppmvd] / 60 min = 146.8 ppmvd

1 hour rolling between 40% Load and 75% Load

VOC Emissions in the 40% to 75% Load Ramp (lb/hr) = [Minutes @ 20% Load * Post Catalyst Emission Rate @ 20% Load (lb/hr)
+ Minutes @ 40% Load * Post Catalyst Emission Rate @ 40% Load (lb/hr) + Minutes @ 50% Load * Post Catalyst Emission Rate @ 50% Load (lb/hr)
+ (60 min - Minutes @ 75% Load - Minutes @ 20% Load - Minutes @ 40% Load - Minutes @ 50% Load)
* Post Catalyst Emission Rate @ 75% Load (lb/hr)] / 60 min

VOC (Hot SU) (40% to 75% load) = [3 min * 52.1 lb/hr + 39 min * 3.0 lb/hr + 11 min * 1.2 lb/hr + (60 min - 3 min - 39 min - 11 min) * 1.2 lb/hr] / 60 min = 4.7 lb/hr

VOC Pre Catalyst (ppmvd) = [Minutes @ 20% Load * Pre Catalyst VOC @ 20% Load (ppmvd) + Minutes @ 40% Load * Pre Catalyst VOC @ 40% Load (ppmvd)
+ Minutes @ 50% Load * Pre Catalyst VOC @ 50% Load (ppmvd)
+ (60 min - Minutes @ 75% Load - Minutes @ 20% Load - Minutes @ 40% Load - Minutes @ 50% Load)
* Pre Catalyst VOC @ 75% Load (ppmvd)] / 60 min

VOC (Hot SU) Pre Catalyst (40% to 75% load) = [3 min * 196.0 ppmvd + 39 min * 7.8 ppmvd + 11 min * 2.5 ppmvd + (60 min - 3 min - 39 min - 11 min) * 2.0 ppmvd] / 60 min = 14.7 ppmvd

VOC Post Catalyst (ppmvd) = [Minutes @ 20% Load * Post Catalyst VOC @ 20% Load (ppmvd) + Minutes @ 40% Load * Post Catalyst VOC @ 40% Load (ppmvd)
+ Minutes @ 50% Load * Post Catalyst VOC @ 50% Load (ppmvd)
+ (60 min - Minutes @ 75% Load - Minutes @ 20% Load - Minutes @ 40% Load - Minutes @ 50% Load)
* Post Catalyst VOC @ 75% Load (ppmvd)] / 60 min

VOC (Hot SU) Post Catalyst (40% to 75% load) = [3 min * 68.6 ppmvd + 39 min * 2.7 ppmvd + 11 min * 0.9 ppmvd + (60 min - 3 min - 39 min - 11 min) * 0.7 ppmvd] / 60 min = 5.1 ppmvd

HOBBS CTG STARTUP & SHUTDOWN EMISSION RATE SUMMARY

Emission Rate at Each Load Level per Unit
HOT STARTUP

Maximum 1 hour rolling during Hot Startup

Hot SU Emission Rate (lb/hr) = Max { Emission Rate @ 0%-40% Load; Emission Rate @ 40%-75% Load}

VOC Hot SU Emission Rate = Max {61.0; 4.7} = 61.0 lb/hr

VOC Hot SU Pre Catalyst = Max {368.6; 14.7} = 368.6 ppmvd

VOC Hot SU Post Catalyst = Max {146.8; 5.1} = 146.8 ppmvd

Attachment D
Section 7

Section 7

Information Used To Determine Emissions

Information Used to Determine Emissions shall include the following:

- ☒ If manufacturer data are used, include specifications for emissions units and control equipment, including control efficiencies specifications and sufficient engineering data for verification of control equipment operation, including design drawings, test reports, and design parameters that affect normal operation.
- ☐ If test data are used, include a copy of the complete test report. If the test data are for an emissions unit other than the one being permitted, the emission units must be identical. Test data may not be used if any difference in operating conditions of the unit being permitted and the unit represented in the test report significantly effect emission rates.
- ☐ If the most current copy of AP-42 is used, reference the section and date located at the bottom of the page. Include a copy of the page containing the emissions factors, and clearly mark the factors used in the calculations.
- ☐ If an older version of AP-42 is used, include a complete copy of the section.
- ☐ If an EPA document or other material is referenced, include a complete copy.
- ☐ Fuel specifications sheet.
- ☐ If computer models are used to estimate emissions, include an input summary (if available) and a detailed report, and a disk containing the input file(s) used to run the model. For tank-flashing emissions, include a discussion of the method used to estimate tank-flashing emissions, relative thresholds (i.e., permit or major source (NSPS, PSD or Title V)), accuracy of the model, the input and output from simulation models and software, all calculations, documentation of any assumptions used, descriptions of sampling methods and conditions, copies of any lab sample analysis.

This permit application is being submitted to request the following changes for units HOBB-1 and HOBB-2:

- CO SSM mass emission rate limit change from 441 lbs/hr to 2,060 lbs/hr
- VOC SSM mass emission rate limit change from 77.8 lbs/hr to 591 lbs/hr
- VOC SSM BACT concentration limit change from 187 ppmvdc to 900 ppmvdc

Actual CO operational SSM data for calendar years 2013 through 2015 was used to calculate the proposed CO and VOC mass emission rate limits. Concentration limits for both CO and VOC are based on combustion turbine vendor representations for uncontrolled emissions with a 20% safety factor. Emission rate calculations are provided in Section 6 and the UA2 workbook. Raw operational data is provided in this Section.

Attachment E
Updated UA2 Tables

Table 2-F: Additional Emissions during Startup, Shutdown, and Routine Maintenance (SSM)

☐ This table is intentionally left blank as all SSM emissions at this facility do not require an increase in Requested Allowables greater than those listed in Table 2-E. If you are required to report GHG emissions as described in Section 21, include any GHG emissions due Startup, Shutdown, and/or Scheduled Maintenance in Table 2-P. Provide explanation in Section 6.

All applications, including NOI applications, must fill out this table, reporting Maximum Emissions during Startup, Shutdown and Scheduled Maintenance (20.2.7 NMAC, 20.2.72.203.A.3 NMAC, 20.2.73.200.D.2 NMAC).

Only report SSM emissions greater than the cooresponding Table 2-E emissions[1]. Not providing emissions for a unit indicates that SSM emissions for this unit are less than the Requested Allowables for that unit in Table 2-E. In Section 6, provide emissions calculations for any emissions listed in this table. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions. List all units and SSM fugitives, except GHGs, in this table. Refer to Table 2-E for instructions on use of the "-" symbol and on significant figures.

Unit No.	NOx		CO		VOC		SOx		TSP[2]		PM10[2]		PM2.5[2]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
HOBB-1	175.1	-	2,049.0	-	588.2	-	-	-	-	-	-	-	-	-				
HOBB-2	175.1		2,049.0		588.2		-		-		-		-					
Totals	350.1	-	4,098.0	-	1,176.3	-	-	-	-	-	-	-	-	-				

[1] **For instance**, if the short term steady-state Table 2-E emissions are 5 lb/hr and the SSM rate is 12 lb/hr, enter 7 lb/hr in the table below. If the annual steady-state Table 2-E emissions are 21.9 TPY, and the number of scheduled SSM events result in annual emissions of 31.9 TPY, enter 10.0 TPY in the table below.

[2] **Condensables**: Include condensable particulate matter emissions in particulate matter calculations.

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May 27, 2016

Dr. Kirby Olson
New Mexico Environment Department
Air Quality Bureau
525 Camino de los Marquez, Suite 1
Santa Fe, New Mexico, 87505-1816

RE: Air Permit Amendment Application
Permit No. PSD 3449-M3
Hobbs Generating Station
Hobbs, New Mexico

Dear Dr. Olson,

On behalf of Lea Power Partners, LLC (LPP), CAMS eSPARC is submitting for your review a proposed methodology for demonstrating compliance with the annual total VOC emission rate limit in Permit PSD 3449.

As outlined on our April 26, 2016 letter, the current SSM VOC BACT limit assumes that the oxidation catalyst is able to control VOC emission during the early phases of startup. Both VOC and CO emissions are controlled during normal operation by the oxidation catalyst in each unit. However, during the early phases of startup, the oxidation catalyst has been shown to not efficiently control CO emissions. It is expected that VOC emissions are similarly not fully controlled during SSM events. Compliance with the permitted annual VOC emission rate limit is currently demonstrated based on an emission factor developed from the initial demonstration of compliance stack test. Since this emission factor does not account for the elevated emissions that occur during SSM activities, an alternate method of compliance demonstration must be developed to account for SSM VOC emissions on an annual basis.

The annual VOC and CO emissions represented in the P-3449 Amendment application due to SSM were calculated based on a representative number of hot, cold, and warm starts per year multiplied by the vendor representation for pounds per event on an average annual basis. We have reviewed historical data and observed that the vendor-provided values for pounds CO per event have proven to be a good representations, on an annual average basis, of actual events in operation, as summarized in Table 1.

Table 1 Total Event CO Emissions for Calendar Years 2013 - 2015

Calendar Year	Startup Data	Total Event CO Emissions Based on Initial Catalysts Temperature			
		T < 300 °F	300°F ≤ T < 500 °F	T ≥ 500 °F	Shutdown
2013-2015[1]	Unit 1 Maximum lb/event	1,692	727	247	--
	Unit 2 Maximum lb/event	1,668	917	192	--
	Max. Both Units lb/event	1,692	917	247	--
Total Event CO Emissions (lb/event) [1]		1,723	1,056	375	93
Event Duration (min/event) [2]		180	120	90	25
Average SSM CO Emission Rate (lb/hr) [3]		574	528	250	223

(1) Current permit representation based on catalyst vendor performance data.
(2) Current permit representation based on historical operational knowledge on startup and shutdown events
(3) CO Emission Rate (lb/hr) = Vendor Performance Data (lb/event) / Event Duration (min/event) * 60 min/hr
The calculated hourly CO emission rate will not be used for compliance demonstration as units are equipped with CO CEMS. The average rate represents the average over the duration of a typical startup and is not representative of the maximum one-hour rate that may occur during the SSM event.

Based on this correlation between vendor data and actual monitored data for CO, it is assumed that the pound per event performance data for VOC provided by the catalyst vendor will similarly be valid. Thus, it is not necessary to change the current representation for the annual emissions of VOC.

SSM CO emissions are continuously monitored by the CEMS. We propose that compliance with the short term SSM VOC emission rate limits will be demonstrated via compliance with the continuously monitored CO emissions, as recorded by the CEMS. For the purpose of demonstrating compliance with the annual VOC mass emission rate limit, Hobbs proposes to apply emission factors based on the average pound per hour rate for three ranges of catalyst startup temperatures:

- Less than 300 °F;
- Greater than or equal to 300°F and less than 500 °F; and
- Greater than or equal to 500 °F.

Accordingly, SSM VOC emissions may be calculated for the purpose of demonstrating compliance with the annual emission rate limits using the following formulas:

1. **If Catalyst Temperature at the beginning of startup is less than 300 °F**

$$VOC\ \left(\frac{lb}{event}\right) = 165\,\frac{lb}{hr} \times Event\ Duration\ (\frac{hr}{event})$$

2. **If Catalyst Temperature at the beginning of startup is greater than or equal to 300°F and less than 500 °F**

$$VOC\ \left(\frac{lb}{event}\right) = 203\,\frac{lb}{hr} \times Event\ Duration\ (\frac{hr}{event})$$

3. **If Catalyst Temperature at the beginning of startup is greater than or equal to 500 °F**

$$VOC\ \left(\frac{lb}{event}\right) = 207\,\frac{lb}{hr} \times Event\ Duration\ (\frac{hr}{event})$$

4. **For shutdown**

$$VOC\ \left(\frac{lb}{event}\right) = 156\,\frac{lb}{hr} \times Event\ Duration\ (\frac{hr}{event})$$

Table 2 summarizes the data for VOC annual emission rate compliance demonstration.

Table 2 VOC Annual Emission Rate Compliance Demonstration

Parameter	Total Event VOC Emissions Based on Initial Catalysts Temperature			Shutdown
	T < 300 °F	300°F ≤ T < 500 °F	T ≥ 500 °F	
Total Event VOC Emissions (lb/event) (1)	494	405	311	65
Event Duration (min/event) (2)	180	120	90	25
Average SSM VOC Emission Rate (lb/hr) (4)	165	203	207	156

(1) Current permit representation based on catalyst vendor performance data.
(2) Current permit representation based on historical operational knowledge on startup and shutdown events
(3) VOC Emission Rate (lb/hr) = Vendor Performance Data (lb/event) / Event Duration (min/event) * 60 min/hr
The average rate represents the average over the duration of a typical startup and is not representative of the maximum one-hour rate that may occur during the SSM event.

Thank you for working with us to incorporate the changes necessary to update the VOC emission representations in this application. Please contact me at (281) 333-3339 ext 201 or via email at mjohnson@camsesparc.com or Michael Barnett at (575) 397-6731 or via email at mbarnett@camsops.com if you have any questions or need additional information.

Sincerely,

Mona Caesar Johnson, PE
CAMS eSPARC, LLC

cc:

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