San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

FEB 18 2016

Bert de Jong
D.J. Dairy, LLC
9231 Avenue 368
Dinuba, CA 93618

Re: Notice of Preliminary Decision - Authority to Construct
Facility Number: S-6998
Project Number: S-1151244

Dear Mr. de Jong:

Enclosed for your review and comment is the District's analysis of D.J. Dairy, LLC's application for an Authority to Construct for the installation of two natural gas-fired IC engines powering agricultural irrigation pumps (one engine is 469 bhp and the other is 400 bhp), at 4390 Avenue 352 in Kingsburg, CA.

The notice of preliminary decision for this project will be published approximately three days from the date of this letter. After addressing all comments made during the 30-day public notice period, the District intends to issue the Authority to Construct. Please submit your written comments on this project within the 30-day public comment period, as specified in the enclosed public notice.

Thank you for your cooperation in this matter. If you have any questions regarding this matter, please contact Ms. Sandra Lowe-Leseth of Permit Services at (559) 230-5834.

Sincerely,

Arnaud Marjollet
Director of Permit Services

AM:sl

Enclosures

cc: Tung Le, CARB (w/ enclosure) via email

San Joaquin Valley Air Pollution Control District
Authority to Construct Application Review

Natural Gas-Fired IC Engines Powering an Agricultural Irrigation Pumps

Facility Name:	D.J. Dairy, LLC	Date:	February 17, 2016
Mailing Address:	9231 Avenue 368 Dinuba, CA 93618	Engineer:	Sandra Lowe-Leseth
		Lead Engineer:	Joven Refuerzo
Contact Person:	Bert de Jong		
Telephone:	559-591-1987		
ATC Application #(s):	S-6998-7-0 and '-8-0		
ATC Project #:	S-1151244		
Deemed Complete:	October 6, 2015		

I. Proposal

D.J. Dairy, LLC has requested an Authority to Construct (ATC) permit to install two stationary natural gas-fired IC engines powering agricultural irrigation pumps.

Engine S-6998-7-0 is a 469 bhp Dresser Rand lean-burn natural gas-fired engine with an oxidizing catalyst for VOC control.

Engine S-6998-8-0 is a 400 bhp Caterpillar rich-burn natural gas-fired engine. The proposed emissions control system will be a MurCal SNGEC System and consist of the following components:

- Compliance Controls (FW Murphy) AFR 1R air/fuel ratio controller,
- Johnson Matthey Modulex CXX8 3-way catalyst system,
- Zirconia HEGO type oxygen sensors,
- Manifold Absolute Pressure (MAP) sensor, and
- two Type K thermocouples.

II. Applicable Rules

Rule 1070	Inspections (12/17/92)
Rule 1081	Source Sampling (12/16/93)
Rule 2010	Permits Required (12/17/92)
Rule 2020	Exemptions (12/18/14)
Rule 2201	New and Modified Stationary Source Review Rule (4/21/11)
Rule 2520	Federally Mandated Operating Permits (6/21/01)
Rule 4001	New Source Performance Standards (4/14/99)
Rule 4002	National Emissions Standards for Hazardous Air Pollutants (5/20/04)
Rule 4101	Visible Emissions (2/17/05)
Rule 4102	Nuisance (12/17/92)

Rule 4201 Particulate Matter Concentration (12/17/92)
Rule 4202 Particulate Matter Emission Rate (12/17/92)
Rule 4301 Fuel Burning Equipment (12/17/92)
Rule 4701 Internal Combustion Engines - Phase 1 (8/21/03)
Rule 4702 Internal Combustion Engines (11/14/13)
Rule 4801 Sulfur Compounds (12/17/92)
CH&SC 41700 Health Risk Assessment
CH&SC 42301.6 School Notice
California Code of Regulations (CCR), Title 17 (Public Health), Division 3 (Air Resources), Chapter 1 (Air Resources Board), Subchapter 7.5 (Air Toxic Control Measures), Measure 93115 (Stationary Diesel Engines)
Public Resources Code 21000-21177: California Environmental Quality Act (CEQA)
California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387: CEQA Guidelines

III. Project Location

The project is located 4390 Avenue 352 in Kingsburg, CA. The District has verified that the equipment is not located within 1,000 feet of the outer boundary of a K-12 school. Therefore, the public notification requirement of California Health and Safety Code 42301.6 is not applicable to this project.

IV. Process Description

The primary function of this facility is agricultural (growing of crops and/or raising of fowl or animals). The proposed stationary IC engines will power agricultural irrigation pumps.

No specific load information (e.g., water pressures, pump information, or engine loads) were available from the applicant; therefore, the load for the engines will be assumed at 80% (per District Guidance document FYI 275) for the purposes of calculating annual potential to emit (PE). Daily PE calculations will assume a 100% load factor.

V. Equipment Listing

Proposed Equipment Description:

S-6998-7-0: 469 BHP DRESSER RAND MODEL SFGLD 180 LEAN-BURN NATURAL GAS-FIRED IC ENGINE UTILIZING AN ADVANCED CATALYST SYSTEMS OXIDIZING CATALYST POWERING AN AGRICULTURAL IRRIGATION PUMP

S-6998-8-0 400 BHP CATERPILLAR MODEL 3408TA RICH-BURN NATURAL GAS-FIRED IC ENGINE WITH A CERTIFIED MURCAL SNGEC SYSTEM AND UTILIZING AN ADVANCED CATALYST SYSTEMS OXIDIZING CATALYST POWERING AN AGRICULTURAL IRRIGATION PUMP

VI. Emission Control Technology Evaluation

All five criteria pollutants (NOx, SOx, PM_{10}, CO, and VOC) are emitted from the IC engines located at this facility.

Engine S-6998-7-0
Engine S-6998-7-0 is a lean-burn IC engine. Lean burn technology increases the volume of air in the combustion process and therefore increases the heat capacity of the mixture. This technology also incorporates improved swirl patterns to promote thorough air/fuel mixing. This, in turn, lowers the combustion temperature and reduces NO_X formation.

Engine S-6998-7-0 will be equipped with an oxidizing catalyst in order to meet the BACT requirement for VOC emissions. The oxidizing catalyst is a 2-way catalytic reduction system and is expected to provide emission reductions for CO and VOC emissions, per the emission control system supplier. Per the supplier, this system is not expected to provide control for NOx emissions.

Engine S-6998-8-0
Engine S-6998-8-0 will be equipped with a certified MurCal SNGEC System for compliance with District Rule 4702 emission limits. This system consists of the following main components:

- 3-Way Catalyst (Non-Selective Catalytic Reduction)
- Air/Fuel Ratio Controller

Non-Selective Catalytic Reduction (NSCR) decreases NO_x, CO and VOC emissions by using a catalyst to promote the chemical reduction of NO_x into N_2 and O_2, and the chemical oxidation of VOC and CO into H_2O and CO_2.

The air/fuel ratio controller, (oxygen controller) is used in conjunction with the NSCR to maintain the amount of oxygen in the exhaust stream to optimize catalyst function.

VII. General Calculations

A. Assumptions

Operating schedule:	
S-6998-7-0	24 hrs/day, 5,600 hours/year (BACT)
S-6998-8-0	24 hrs/day, 8,760 hours/year (BACT)
EPA F-factor (adjusted to 60°F):	8,578 dscf/MMBtu (40 CFR 60 App. B)
Heating value:	1,000 Btu/scf (District Policy APR 1720)
NG sulfur content:	2.85 lb/MMscf (District Policy APR 1720)
BHP to Btu/hr conversion:	2,542.5 Btu/hp·hr
Thermal efficiency of engine:	commonly ≈ 30%
Ag engine load factor:	80% (FYI 275; Annual PE only)

To streamline emission calculations, $PM_{2.5}$ emissions are assumed to be equal to PM_{10} emissions.

The emission calculations and the annual load factor (use 80%) will be based on FYI 275 (*Use of Horsepower and Load Factor for IC Engines*).

Catalyst manufacturer's guarantee lists 50 ppmv for VOC referenced at 15% O_2. The District will use the molecular weight of methane (16.043 lb/lb-mol) to convert the ppmv factor to g/bhp-hr.

B. Emission Factors

Conversion of Rule 4702 Concentrations from ppmv at 15% O_2 to g/bhp-hr

The following equation is used to convert ppmv to g/bhp-hr.

ppmv	F-factor	$MW_{pollutant}$	20.9	1 Lb-mol	1 MMBtu	453.6 g	1
1,000,000	1	1	(20.9 - O_2%)	379.5 dscf	393.236 bhp-hr	1 lb	Engine Eff.

Pollutant	Rule 4702 EF ppmv@ 15% O2		MW		Conversion Factor (see equation above)		Rule 4702 EF g/bhp-hr
NO_x	90	×	46.01	×	0.000308	=	1.3
CO	2,000	×	28	×		=	17.2
VOC	750	×	16.043	×		=	3.7

S-6998-7-0:

The engine will be equipped with an oxidizing catalyst system for control of VOC emissions (per applicant) to satisfy BACT requirements. See Section VIII's Rule 2201 BACT discussion later in this analysis for more details. As a side benefit, CO will also be controlled, although the BACT requirement for CO is not triggered.

Catalyst manufacturer's guarantee lists 50 ppmv for VOC and 44 ppmv for CO (both referenced at 15% O2). However, the engine manufacturer's limit of 155 ppmv CO at 15% O2 will be used as the CO emission factor since control of CO is not required to meet BACT requirements.

Emission Factors for S-6996-7-0			
Pollutant	EF	EF (g/bhp-hr)	Source
NO_x	83.6 ppmv [2] At 15% O_2	1.0 [1]	Engine manufacturer's data
SO_x	2.85 Lb/MMscf	0.011	Mass Balance Equation [3]
PM_{10}	0.01 [4] Lb/MMBtu	0.038 [5]	AP-42 (7/00) Table 3.2-2
CO	155 ppmv [2] At 15% O_2	1.8 [1]	Engine manufacturer's data
VOC	50 ppmv [6] At 15% O_2	0.21 [7]	Catalyst manufacturer's guarantee

[1] Per engine manufacturer's "Statement of Exhaust Emissions" dated 11/15/14 rev. B

[2] The following equation is used to convert g/bhp-hr to ppmv:

X g	393.236 bhp-hr	MMBtu	1 lb	MW lb-mol	379.5 dscf	(20.9 - O2%)	Engine Eff
bhp-hr	MMBtu	8,578 dscf	453.6 g	1 lb	1 lb-mol	20.9	1

[3] Mass Balance Equation:

$$2.85 \quad \frac{lb-SOx}{MMscf} \times \frac{1\,MMscf}{1{,}000\,MMBtu} \times \frac{1\,MMBtu}{1{,}000{,}000\,Btu} \times \frac{2{,}542.5\,Btu}{bhp-hr} \times \frac{1\,bhp\,input}{0.30\,bhp\,out} \times \frac{453.6\,g}{lb} = \quad 0.011 \quad \frac{g-SO_x}{bhp-hr}$$

[4] PM_{10} value includes both filterable (7.71×10^{-5} lb/MMBtu) and condensable (9.91×10^{-3} lb/MMBtu) emissions.

[5] The following equation is used to convert lb/MMBtu to g/bhp-hr:

$$0.01 \quad \frac{lb-PM_{10}}{MMBtu} \times \frac{1\,MMBtu}{1{,}000{,}000\,Btu} \times \frac{2{,}542.5\,Btu}{bhp-hr} \times \frac{1\,bhp\,input}{0.30\,bhp\,out} \times \frac{453.6\,g}{lb} = \quad 0.038 \quad \frac{g-PM_{10}}{bhp-hr}$$

[6] Per catalyst manufacturer's output from "ICE Catalyst Sizing Program" for proposed engine.

[7] For VOC conversion, the molecular weight of methane is used (16.043 lb/lb-mol).

S-6998-8-0

Emission Factors for S-6996-8-0		
Pollutant	EF (g/bhp-hr)	Source
NO_x	1.3 (equivalent to 90 ppmvd @ 15% O_2)	SNGEC Certification
SO_x	0.011	Mass Balance Equation [1]
PM_{10}	0.073 [2, 3] (equivalent to 0.019 lb/MMBtu)	AP-42 (7/00) Table 3.2-3
CO	8.49 (equivalent to 1000 ppmvd @ 15% O_2)	SNGEC Certification
VOC	0.24 (equivalent to 50 ppmvd @ 15% O_2)	Catalyst Sizing Sheet

[1] Mass Balance Equation:

$$2.85 \quad \frac{lb-SOx}{MMscf} \times \frac{1 MMscf}{1{,}000 MMBtu} \times \frac{1 MMBtu}{1{,}000{,}000 Btu} \times \frac{2{,}542.5 Btu}{bhp-hr} \times \frac{1 bhp input}{0.30 bhp out} \times \frac{453.6 g}{lb} = \quad 0.011 \quad \frac{g-SO_x}{bhp-hr}$$

[2] PM_{10} value includes both filterable (9.50×10^{-3} lb/MMBtu) and condensable (9.91×10^{-3} lb/MMBtu) emissions.

[3] The following equation is used to convert lb/MMBtu to g/bhp-hr:

$$0.019 \quad \frac{lb-PM_{10}}{MMBtu} \times \frac{1 MMBtu}{1{,}000{,}000 Btu} \times \frac{2{,}542.5 Btu}{bhp-hr} \times \frac{1 bhp input}{0.30 bhp out} \times \frac{453.6 g}{lb} = \quad 0.073 \quad \frac{g-PM_{10}}{bhp-hr}$$

[4] Per catalyst manufacturer's output from "ICE Catalyst Sizing Program" for proposed engine.

[5] For VOC conversion, the molecular weight of methane is used (16.043 lb/lb-mol).

C. Calculations

1. Pre-Project Potential to Emit (PE1)

The engines are new emissions units, therefore, PE1 = 0 for all pollutants.

2. Post-Project Potential to Emit (PE2)

The engines' potential emissions are based on the following equations:

$PE2_{daily}$ = Continuous Rating (bhp) × EF (g/bhp-hr) × 24 hr/day × 1 lb/453.6 g

$PE2_{annual}$ = Continuous Rating (bhp) × load factor × EF (g/bhp-hr)
× Operating Schedule (hr/year) × 1 lb/453.6 g

S-6998-7-0

Daily PE2 – S-6998-7-0									
Pollutant	(g/bhp·hr)		bhp		hr/day		g/lb		lb/day
NO_x	1.0	×	469	×	24	÷	453.6	=	24.8
SO_x	0.011	×		×		÷		=	0.3
PM_{10}	0.038	×		×		÷		=	0.9
CO	1.8	×		×		÷		=	44.7
VOC	0.21	×		×		÷		=	5.2

Annual PE2 – S-6998-7-0										
Pollutant	(g/bhp·hr)		bhp		load factor		hr/yr		g/lb	lb/yr
NO_x	1.0	×	469	×	0.8	×	5,600	÷	453.6	= 4,632
SO_x	0.011	×		×		×		÷		= 51
PM_{10}	0.038	×		×		×		÷		= 176
CO	1.8	×		×		×		÷		= 8,338
VOC	0.21	×		×		×		÷		= 973

S-6998-8-0

Daily PE2 – S-6998-8-0									
Pollutant	(g/bhp·hr)		bhp		hr/day		g/lb		lb/day
NO_x	1.3	×	400	×	24	÷	453.6	=	27.5
SO_x	0.011	×		×		÷		=	0.2
PM_{10}	0.073	×		×		÷		=	1.5
CO	8.49	×		×		÷		=	179.7
VOC	0.21	×		×		÷		=	4.4

Annual PE2 – S-6998-8-0										
Pollutant	(g/bhp·hr)		bhp		load factor		hr/yr		g/lb	lb/yr
NO_x	1.3	×	400	×	0.8	×	8,760	÷	453.6	= 8,034
SO_x	0.011	×		×		×		÷		= 68
PM_{10}	0.073	×		×		×		÷		= 451
CO	8.49	×		×		×		÷		= 52,467
VOC	0.21	×		×		×		÷		= 1,298

3. Pre-Project Stationary Source Potential to Emit (SSPE1)

Pursuant to Section 4.9 of District Rule 2201, the Pre-Project Stationary Source Potential to Emit (SSPE1) is the Potential to Emit (PE) from all units with valid ATCs or PTOs at the Stationary Source and the quantity of Emission Reduction Credits (ERCs) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site.

Since this is an existing facility, SSPE1 is equal to the $PE1_{Total\ Pre\text{-}Project}$ for all criteria pollutants.

The emissions from dairy operations (milking parlor, cow housing, liquid and solid manure handling, and feed handling and storage) have been recalculated because the District has revised the dairy emission factors since the dairy first received its permits. The revised calculations are included in Appendix G.

Pre-Project Stationary Source Potential to Emit [SSPE1] (lb/year)					
Permit Unit	NO_X	SO_X	PM_{10}	CO	VOC
S-6998-1-2 through -4-2 & -6-1[1]	0	0	55,498	0	104,286
S-6998-5-0[1]	331	0	17	101	38
SSPE1	**331**	**0**	**55,515**	**101**	**104,324**

[1] See Appendix G for existing units' emissions calculations

4. Post-Project Stationary Source Potential to Emit (SSPE2)

Pursuant to Section 4.10 of District Rule 2201, the Post-project Stationary Source Potential to Emit (SSPE2) is the Potential to Emit (PE) from all units with valid ATCs or PTOs, except for emissions units proposed to be shut down as part of the Stationary Project, at the Stationary Source and the quantity of Emission Reduction Credits (ERCs) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site.

The emissions from dairy operations (milking parlor, cow housing, liquid and solid manure handling, and feed handling and storage) have been recalculated because the District has revised the dairy emission factors since the dairy first received its permits. The revised calculations are included in Appendix G.

Post-Project Stationary Source Potential to Emit [SSPE2] (lb/year)					
Permit Unit	NO_X	SO_X	PM_{10}	CO	VOC
S-6998-1-2 through -4-2 & -6-1[1]	0	0	55,498	0	104,286
S-6998-5-0[1]	331	0	17	101	38
S-6998-7-0	4,632	51	176	8,338	973
S-6998-8-0	8,034	68	451	52,467	1,298
SSPE2	**12,997**	**119**	**56,142**	**60,906**	**106,595**

[1] See Appendix G for existing units' emissions calculations.

5. Major Source Determination

Rule 2201 Major Source Determination

Pursuant to Section 3.25 of District Rule 2201, a major source is a stationary source with post-project emissions or a Post Project Stationary Source Potential to Emit (SSPE2), equal to or exceeding one or more of the following threshold values. However, Section 3.25.2 states, "for the purposes of determining major source status, the SSPE2 shall not include the quantity of emission reduction credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site.

In determining whether a facility is a major source, fugitive emissions are not counted unless the facility belongs to certain specified source categories. 40 CFR 71.2 (Definitions, Major Source (2)) states the following:

(2) *A major stationary source of air pollutants or any group of stationary sources as defined in section 302 of the Act, that directly emits, or has the potential to emit, 100 tpy or more of any air pollutant (including any major source of fugitive emissions of any such pollutant, as determined by rule by the Administrator). The fugitive emissions of a stationary source shall not be considered in determining whether it is a major stationary source for the purposes of section 302(j) of the Act, unless the source belongs to one of the following categories of stationary source: (i) Coal cleaning plants (with thermal dryers); (ii) Kraft pulp mills; (iii) Portland cement plants; (iv) Primary zinc smelters; (v) Iron and steel mills; (vi) Primary aluminum ore reduction plants; (vii) Primary copper smelters; (viii) Municipal incinerators capable of charging more than 250 tons of refuse per day; (ix) Hydrofluoric, sulfuric, or nitric acid plants; (x) Petroleum refineries; (xi) Lime plants; (xii) Phosphate rock processing plants; (xiii) Coke oven batteries; (xiv) Sulfur recovery plants; (xv) Carbon black plants (furnace process); (xvi) Primary lead smelters; (xvii) Fuel conversion plants; (xviii) Sintering plants; (xix) Secondary metal production plants; (xx) Chemical process plants; (xxi) Fossil-fuel boilers (or combination*

> *thereof) totaling more than 250 million British thermal units per hour heat input; (xxii) Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels; (xxiii) Taconite ore processing plants; (xxiv) Glass fiber processing plants; (xxv) Charcoal production plants; (xxvi) Fossil-fuel-fired steam electric plants of more than 250 million British thermal units per hour heat input; or (xxvii) Any other stationary source category which, as of August 7, 1980, is being regulated under section 111 or 112 of the Act.*

Since agricultural operations do not fall under any of the specific source categories listed above, fugitive emissions are not counted when determining if an agricultural operation is a major source. 40 CFR 71.2 defines fugitive emissions as "those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening."

Since emissions at the dairy are not actually collected, a determination of whether emissions could be reasonably collected must be made by the permitting authority. The California Air Pollution Control Association (CAPCOA) prepared guidance in 2005 for estimating potential to emit of Volatile Organic Compounds from dairy farms. The guidance states that *"VOC emissions from the milking centers, cow housing areas, corrals, common manure storage areas, and land application of manure are not physically contained and could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening. No collection technologies currently exist for VOC emissions from these emissions units. Therefore, the VOC emissions from these sources are considered fugitive."* The guidance also concludes that, because VOC collection technologies do exist for liquid waste systems at dairies, *"... the VOC emissions from waste lagoons and storage ponds are considered non-fugitive."* The District has researched this issue and concurs with the CAPCOA assessment, as discussed in more detail on the following page.

Milking Center

The mechanical system for the milking parlors can be utilized to capture the gases emitted from the milking parlors, however in order to capture all of the gases, and to keep an appropriate negative pressure throughout the system, the holding area would also need to be entirely enclosed. No facility currently encloses the holding area since cows are continuously going in and out of the barn throughout the day. The capital required to enclose this large area would also be significant. Since the holding area is primarily kept open, the District cannot reasonably demonstrate that emissions can pass through a stack, chimney, vent, or other functionally equivalent opening.

Cow Housing

Although there are smaller dairy farms that have enclosed freestall barns, these barns are not fully enclosed and none of the barns have been found to vent the exhaust through a collection device. The airflow requirements through dairy barns are extremely high, primarily for herd health purposes. The airflow

requirements will be even higher in the San Joaquin valley, where temperatures reach in excess of 110 degrees in the dry summer. Collection and control of the exhaust including the large amounts of airflow have not yet been achieved by any facility. Due to this difficultly, the District cannot reasonably demonstrate that emissions can pass through a stack, chimney, vent, or other functionally equivalent opening.

Manure Storage Areas

Many dairies have been found to cover dry manure piles. Covering dry manure piles is also a mitigation measure included in District Rule 4570. However, the District was not able to find any facility, which currently captures the emissions from the storage or handling of manure piles. Although many of these piles are covered, the emissions cannot easily be captured. Therefore, the District cannot reasonably demonstrate that these emissions can pass through a stack, chimney, vent, or other functionally equivalent opening. In addition, emissions from manure piles have been shown to be insignificant from recent studies.

Land Application

Emissions generated from the application of manure on land cannot reasonably be captured due to the extremely large areas, in some cases thousands of acres, of cropland at dairies. Therefore, the District cannot reasonably demonstrate that these emissions can pass through a stack, chimney, vent, or other functionally equivalent opening.

Feed Handling and Storage

The majority of dairies store the silage piles underneath a tarp or in an agbag. The entire pile is covered except for the face of the pile. The face of the pile is kept open due to the continual need to extract the silage for feed purposes. The silage pile is disturbed 2-3 times per day. Because of the ongoing disturbance to these piles, it makes it extremely difficult to design a system to capture the emissions from these piles. In fact, as far as the District is aware, no system has been designed to successfully extract the gases from the face of the pile to capture them, and, as important, no study has assessed the potential impacts on silage quality of a continuous air flow across the silage pile, as would be required by such a collection system. Therefore, the District cannot demonstrate that these emissions can be reasonably expected to pass through a stack, chimney, vent, or other functionally equivalent opening.

Therefore, the VOC emissions from these sources are considered fugitive. The District has determined that control technology to capture emissions from lagoons (biogas collection systems, for instance) is in use and these emissions can be reasonably collected and are not fugitive. Therefore, only emissions from lagoons, storage ponds, and IC engines will be used to determine if this facility is a major source.

Major Source Determination (lb/year)					
	NO_X	SO_X	PM_{10}	CO	VOC
S-6998-1-2 through -4-2 & -6-1 (Lagoon only) [1]	0	0	0	0	4,795
S-6998-5-0 (Emergency IC Engine) [1]	331	0	17	101	38
S-6998-7-0 (Irrigation IC Engine)	4,632	51	176	8,338	973
S-6998-8-0 (Irrigation IC Engine)	8,034	68	451	52,467	1,298
Stationary Source Potential to Emit	**12,997**	**119**	**644**	**60,906**	**7,104**
Major Source Threshold	20,000	140,000	140,000	200,000	20,000
Major Source?	No	No	No	No	No

[1] See Appendix G for existing units' emissions calculations.

As seen in the table above, the facility is **not** a Major Source.

Rule 2401 Major Source Determination

The facility or the equipment evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21 (b)(1)(iii). Therefore the PSD Major Source threshold is 250 tpy for any regulated NSR pollutant.

Fugitive emissions at dairies are excluded in determining if a source is a major source for PSD. Except for PM_{10} emissions from the IC engines located at the facility, all other PM_{10} emissions at the facility are fugitive, and are therefore excluded. Further, all VOC emissions except for non-fugitive VOC emissions from the lagoon and IC engines are also excluded from PSD calculations. Assume that the PM_{10} fraction of PM emissions is 100%.

PSD Major Source Determination (tons/year)						
	NO2	VOC	SO2	CO	PM	PM10
Estimated Facility PE before Project Increase	<1.0	2.4	0	<1.0	<1.0	<1.0
PSD Major Source Thresholds	250	250	250	250	250	250
PSD Major Source? (Y/N)	N	N	N	N	N	N

The facility is not an existing major source for PSD for at least one pollutant. Therefore the facility is not an existing major source for PSD.

6. Baseline Emissions (BE)

The BE calculation (in lb/year) is performed pollutant-by-pollutant for each unit within the project to calculate the QNEC, and if applicable, to determine the amount of offsets required.

Pursuant to District Rule 2201, BE = PE1 for:

- Any unit located at a non-Major Source,
- Any Highly-Utilized Emissions Unit, located at a Major Source,
- Any Fully-Offset Emissions Unit, located at a Major Source, or
- Any Clean Emissions Unit, located at a Major Source.

otherwise,

BE = Historic Actual Emissions (HAE), calculated pursuant to District Rule 2201.

As shown in Section VII.C.5 above, the facility is not a Major Source for any pollutant. Therefore BE = PE1 and, as calculated in Section VII.C.1 above, PE1 = 0 for the proposed engines.

7. SB 288 Major Modification

SB 288 Major Modification is defined in 40 CFR Part 51.165 as "any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under the Act."

Since this facility is not a major source for any of the pollutants addressed in this project, this project does not constitute an SB 288 major modification.

8. Federal Major Modification

District Rule 2201, Section 3.18 states that Federal Major Modifications are the same as "Major Modification" as defined in 40 CFR 51.165 and part D of Title I of the CAA.

Since this facility is not a Major Source for any pollutants, this project does not constitute a Federal Major Modification. Additionally, since the facility is not a major source for PM_{10} (140,000 lb/year), it is not a major source for PM2.5 (200,000 lb/year).

9. Rule 2410 - Prevention of Significant Deterioration (PSD) Applicability Determination

Rule 2410 applies to any pollutant regulated under the Clean Air Act, except those for which the District has been classified nonattainment. The pollutants which must be addressed in the PSD applicability determination for sources located in the SJV and which are emitted in this project are: (See 52.21 (b) (23) definition of significant)

- NO2 (as a primary pollutant)
- SO2 (as a primary pollutant)
- CO
- PM
- PM10

I. Project Emissions Increase - New Major Source Determination

The post-project potentials to emit from all new and modified units are compared to the PSD major source thresholds to determine if the project constitutes a new major source subject to PSD requirements.

The facility or the equipment evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21 (b)(1)(i). The PSD Major Source threshold is 250 tpy for any regulated NSR pollutant.

PSD Major Source Determination: Potential to Emit (tons/year)						
	NO2	VOC	SO2	CO	PM	PM10
Total PE from New and Modified Units	6.3	1.1	<1.0	30	<1.0	<1.0
PSD Major Source threshold	250	250	250	250	250	250
New PSD Major Source?	No	No	No	No	No	No

As shown in the table above, the potential to emit for the project, by itself, does not exceed any PSD major source threshold. Therefore, Rule 2410 is not applicable and no further analysis is required.

10. Quarterly Net Emissions Change (QNEC)

The QNEC is calculated solely to establish emissions that are used to complete the District's PAS emissions profile screen. Detailed QNEC calculations are included in Appendix E.

VIII. Compliance

Rule 1070 Inspections

This rule applies to any source operation, which emits or may emit air contaminants.

This rule allows the District to perform inspections for the purpose of obtaining information necessary to determine whether air pollution sources are in compliance with applicable rules and regulations. The rule also allows the District to require record keeping, to make inspections, and to conduct tests of air pollution sources. Therefore, the following conditions will be included on the permit.

- {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
- {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]

Rule 1081 Source Sampling

The purpose of this rule is to ensure that any source operation, which emits or may emit air contaminants, provides adequate and safe facilities for use in sampling to determine compliance. This rule also specifies methods and procedures for source testing, sample collection, and compliance determination. Therefore, the following conditions will be listed the ATC to ensure compliance:

- {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]
- {110} The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

Rule 2010 Permits Required

The provisions of this rule apply to any person who plans to or does operate, construct, alter, or replace any source operation, which may emit air contaminants or may reduce the emission of air contaminants.

Pursuant to Section 4.0, a written permit shall be obtained from the APCO. No Permit to Operate shall be granted either by the APCO or the Hearing Board for any source operation described in Section 3.0 constructed or installed without authorization as required by Section 3.0 until the information required is presented to the APCO and such

source operation is altered, if necessary, and made to conform to the standards set forth in Rule 2070 (Standards for Granting Applications) and elsewhere in these rules and regulations.

The proposed engines may emit air contaminants; therefore, the facility is subject to the permitting requirements of this Rule for the engines in this project. By submitting the ATC applications, the facility is in compliance with the requirements of this rule. No further discussion is required.

Rule 2020 Exemptions

This rule specifies emissions units that are not required to obtain an Authority to Construct (ATC) or Permit to Operate (PTO). This rule is applicable to any source that emits or may emit air contaminants.

The emissions from dairy operations (milking parlor, cow housing, liquid and solid manure handling, and feed handling and storage) have been recalculated because the District has revised the dairy emission factors since the dairy first received its permits. The revised calculations are included in Appendix G. The emissions from the emergency standby engine, S-6998-5-0, will not be recalculated, since the emission factors, annual load factor, and allowed hours of operation have not changed since the engine was permitted.

Per Section 6.20, no permit is required for agricultural sources at a stationary source that, in aggregate, produce actual emissions less than one-half of the major source thresholds. For the purposes of determining permitting applicability, fugitive emissions, except fugitive dust emissions, are included in determining aggregate emissions. As shown below, facility emissions exceed ½ the major source threshold for one or more pollutant; therefore, this facility is not exempt from permitting requirements.

SSPE2 (lb/year)					
Permit Unit	NO_X	SO_X	PM_{10}	CO	VOC
S-6998-1-2 through -4-2 & -6-1[1]	0	0	55,498	0	104,286
S-6998-5-0[1]	331	0	17	101	38
S-6998-7-0	4,632	51	176	8,338	973
S-6998-8-0	8,034	68	451	52,467	1,298
SSPE2	**12,997**	**119**	**56,142**	**60,906**	**106,595**
½ Major Source Threshold	**10,000**	**70,000**	**70,000**	**100,000**	**10,000**

[1] See Appendix G for existing units' emission calculations.

Rule 2201 New and Modified Stationary Source Review Rule

A. Best Available Control Technology (BACT)

1. BACT Applicability

BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis for the following*:

a. Any new emissions unit with a potential to emit exceeding two pounds per day,
b. The relocation from one Stationary Source to another of an existing emissions unit with a potential to emit exceeding two pounds per day,
c. Modifications to an existing emissions unit with a valid Permit to Operate resulting in an AIPE exceeding two pounds per day, and/or
d. Any new or modified emissions unit, in a stationary source project, which results in an SB 288 Major Modification or a Federal Major Modification, as defined by the rule.

*Except for CO emissions from a new or modified emissions unit at a Stationary Source with an SSPE2 of less than 200,000 pounds per year of CO.

a. New emissions units – PE > 2 lb/day

As seen in Section VII.C.2 of this evaluation, the applicant is proposing to install two new natural gas-fired IC engines with PE greater than 2 lb/day for NO_x, CO, and VOC. BACT is triggered for NO_x and VOC since the PEs are greater than 2 lbs/day. BACT is not triggered for CO since the facility's SSPE2 for CO is less than 200,000 lbs/year, as demonstrated in Section VII.C.5 of this document.

b. Relocation of emissions units – PE > 2 lb/day

As discussed in Section I above, there are no emissions units being relocated from one stationary source to another; therefore, BACT is not triggered.

c. Modification of emissions units – AIPE > 2 lb/day

As discussed in Section I above, there are no modified emissions units associated with this project. Therefore, BACT is not triggered.

d. SB 288/Federal Major Modification

As discussed in Sections VII.C.7 and VII.C.8 above, this project does not constitute an SB 288 and/or Federal Major Modification; therefore, BACT is not triggered for any pollutant.

2. BACT Guideline

The BACT Guideline attached in Appendix B, applies to new stationary AO spark-ignited IC engines less than 1,000 bhp.

3. Top-Down BACT Analysis

Per Permit Services Policies and Procedures for BACT, a Top-Down BACT analysis shall be performed as a part of the application review for the application subject to the BACT requirements pursuant to the District's NSR Rule.

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Pursuant to the attached Top-Down BACT Analyses (see Appendix B), BACT has been satisfied with the following:

NO_x: 90 ppmvd @ 15% O_2
VOC: 50 ppmvd @ 15% O_2, as methane

Annual operating hours are limited to 5,600 hr/yr; therefore, the installation of SCR for NOx control is not cost-effective.

The engine manufacturer has guaranteed 83.6 ppmvd NOx @ 15% O2 and the catalyst manufacturer has guaranteed 50 ppmvd VOC @ 15% O2, as methane; therefore, BACT is satisfied for this engine with oxidizing catalyst.

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Pursuant to the attached Top-Down BACT Analyses (see Appendix B), BACT has been satisfied with the following:

NO_x: 90 ppmvd @ 15% O_2
VOC: 50 ppmvd @ 15% O_2, as methane

The SNGEC system is certified to 90 ppmvd NOx @ 15% O2 and the catalyst manufacturer has guaranteed 50 ppmvd VOC @ 15% O2, as methane; therefore, BACT is satisfied for this engine with NSCR and oxidizing catalyst.

B. Offsets

Pursuant to Section 4.6.9 of this rule, offsets are not required for agricultural sources as long as the facility is not a major source for any criteria pollutant for which the offset exemption is sought. This facility is not a major source for any criteria pollutant; therefore, this facility is not subject to the offset requirements of this rule for this project.

C. Public Notification

1. Public Notice Applicability

Public noticing is required for:

a. New Major Sources, Federal Major Modifications, and SB 288 Major Modifications,
b. Any new emissions unit with a Potential to Emit greater than 100 pounds during any one day for any one pollutant,
c. Any project which results in the offset thresholds being surpassed,
d. Any project with an SSIPE of greater than 20,000 lb/year for any pollutant and/or
e. Any project which results in a Title V significant permit modification

a. New Major Sources, Federal Major Modifications, and SB 288 Major Modifications

New Major Sources are new facilities, which are also Major Sources. Since this is not a new facility, public noticing is not required for this project for New Major Source purposes.

As demonstrated in Sections VII.C.7 and VII.C.8, this project does not constitute an SB 288 or Federal Major Modification; therefore, public noticing for SB 288 or Federal Major Modification purposes is not required.

b. PE > 100 lb/day

Applications which include a new emissions unit with a PE greater than 100 pounds during any one day for any pollutant will trigger public noticing requirements. As seen in Section VII.C.2 above, this project does not include a new emissions unit which has daily emissions greater than 100 lb/day for any pollutant; therefore public noticing for PE greater than 100 lb/day purposes is not required.

c. Offset Threshold

The SSPE1 and SSPE2 are compared to the offset thresholds in the following table.

Offset Thresholds				
Pollutant	SSPE1 (lb/year)	SSPE2 (lb/year)	Offset Threshold	Public Notice Required?
NO_X	331	12,997	20,000 lb/year	No
SO_X	0	119	54,750 lb/year	No
PM_{10}	55,515	56,142	29,200 lb/year	No
CO	101	60,906	200,000 lb/year	No
VOC	104,324	106,595	20,000 lb/year	No

As detailed above, there were no thresholds surpassed with this project; therefore public noticing is not required for offset purposes.

d. SSIPE > 20,000 lb/year

Public notification is required for any permitting action that results in a SSIPE of more than 20,000 lb/year of any affected pollutant. According to District policy, the SSIPE = SSPE2 – SSPE1. The SSIPE is compared to the SSIPE Public Notice thresholds in the following table.

SSIPE Public Notice Thresholds					
Pollutant	SSPE2 (lb/year)	SSPE1 (lb/year)	SSIPE (lb/year)	SSIPE Public Notice Threshold	Public Notice Required?
NO_X	12,997	331	12,666	20,000 lb/year	No
SO_X	119	0	119	20,000 lb/year	No
PM_{10}	56,142	55,515	627	20,000 lb/year	No
CO	60,906	101	60,805	20,000 lb/year	Yes
VOC	106,595	104,324	2,271	20,000 lb/year	No

As demonstrated above, the SSIPE for CO is greater than 20,000 lb/year; therefore public noticing for SSIPE purposes is required.

e. Title V Significant Permit Modification

Since this facility does not have a Title V operating permit, this project is not a Title V Significant Modification, and therefore public noticing is not required.

2. Public Notice Action

As discussed above, public noticing is required for this project for SSIPE greater than 20,000 lb/year. Therefore, public notice documents will be submitted to the California Air Resources Board (CARB) and a public notice will be published in a local newspaper of general circulation prior to the issuance of the ATC for this equipment.

D. Daily Emissions Limits (DEL)

Daily Emissions Limitations (DELs) and other enforceable conditions are required by Section 3.15 to restrict a unit's maximum daily emissions, to a level at or below the emissions associated with the maximum design capacity. Per Sections 3.15.1 and 3.15.2, the DEL must be contained in the latest ATC and contained in or enforced by the latest PTO and enforceable, in a practicable manner, on a daily basis. DELs are also required to enforce the applicability of BACT. For these IC engines, the DELs are stated in the form of emission factors, the maximum engine horsepower rating, and the maximum operational time of 24 hours per day. Therefore, the following conditions will be listed on the ATCs to ensure compliance:

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- {modified 3491} This IC engine shall be fired on Public Utility Commission (PUC) quality natural gas only. [District Rules 2201, 4702, and 4801]
- This engine shall be equipped with a functional oxidizing catalyst unit for reduction of VOC emissions, which is maintained and operated per the manufacturer's recommendations. [District Rules 2201 and 4702]
- Emissions from this IC engine shall not exceed any of the following limits: 83.6 ppmv NOx @ 15% O2 (equivalent to 1.0 g-NOx/bhp-hr), 155 ppmvd CO @ 15% O2 (equivalent to 1.8 g-CO/bhp-hr), 0.033 g-PM10/bhp-hr, or 50 ppmvd VOC @ 15% O2 (equivalent to 0.21 g-VOC/bhp-hr). [District Rules 2201, 4102, and 4702]
- {4662} The engine shall be operated in a lean-burn configuration (greater than or equal to 4% O2 exhaust concentration). [District Rule 4702]
- Operation of the engine shall not exceed 5,600 hours per calendar year. [District Rule 2201]

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- This IC engine shall be fired exclusively on Public Utility Commission (PUC) regulated natural gas. [District Rules 4702 and 4801]
- {modified 4844} NOx emissions from this IC engine shall not exceed 90 ppmvd-NOx @ 15% O2 (equivalent to 1.3 g-NOx/bhp-hr). [District Rules 2201 and 4702]
- PM10 emissions from this IC engine shall not exceed 0.063 g-PM10/bhp-hr. [District Rule 2201]
- Emissions from this IC engine shall not exceed any of the following limits: 1,000 ppmvd-CO @ 15% O2 (equivalent to 8.49 g-CO/bhp-hr) or 50 ppmvd-VOC @ 15% O2 (equivalent to 0.21 g-VOC/bhp-hr). [District Rules 2201 and 4702]

E. Compliance Assurance

The following measures shall be taken to ensure continued compliance with District Rules:

1. Source Testing

In order to verify compliance with the VOC DEL, an initial source test will be required. The following condition will be included in the permit.

- Source testing to measure VOC emissions from this unit shall be conducted within 60 days of start-up. [District Rules 2201 and 4702]

2. Monitoring

No monitoring is required to demonstrate compliance with Rule 2201.

3. Recordkeeping

Recordkeeping is required to demonstrate compliance with the offset, public notification, and daily emission limit requirements of Rule 2201. As required by District Rule 4702, *Stationary Internal Combustion Engines*, these IC engines are subject to recordkeeping requirements. Recordkeeping requirements, in accordance with District Rule 4702, will be discussed in Section VIII, *District Rule 4702*, of this evaluation.

- {4051} The permittee shall record the total time the engine operates, in hours per calendar year. [District Rule 2201]
- {modified 3497} All records shall be maintained and retained for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rules 2201 and 4702] N

4. Reporting

No reporting is required to ensure compliance with Rule 2201.

F. Ambient Air Quality Analysis (AAQA)

An AAQA shall be conducted for the purpose of determining whether a new or modified Stationary Source will cause or make worse a violation of an air quality standard. The District's Technical Services Division conducted the required analysis. Refer to **Appendix C** of this document for the AAQA summary sheet.

The proposed location is in an attainment area for NO_X, CO, and SO_X. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for NO_X, CO, or SO_X.

The proposed location is in a non-attainment area for the state's PM_{10} as well as federal and state $PM_{2.5}$ thresholds. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for PM_{10} and $PM_{2.5}$.

Rule 2410 Prevention of Significant Deterioration

As shown in Section VII.C.9 above, this project does not result in a new PSD major source or PSD major modification. No further discussion is required.

Rule 2520 Federally Mandated Operating Permits

Since this facility's potential emissions do not exceed any major source thresholds of Rule 2201, as shown previously in the Major Source Determination table in Section VII.C.5, this facility is not a major source, and Rule 2520 does not apply.

Rule 4001 New Source Performance Standards (NSPS)

This rule incorporates NSPS from Part 60, Chapter 1, Title 40, Code of Federal Regulations (CFR); and applies to all new sources of air pollution and modifications of existing sources of air pollution listed in 40 CFR Part 60.

The requirements of 40 CFR Part 60, Subpart JJJJ (Standards of Performance for Stationary Spark Ignited Internal Combustion Engines) covers stationary engines at agricultural and non-agricultural facilities.

The District has not been delegated the authority to implement NSPS regulations for Area Source requirements for non-Major Sources; therefore, no requirements shall be included on the permits.

There are no other applicable subparts.

Rule 4002 National Emission Standards for Hazardous Air Pollutants (NESHAPs)

This rule incorporates NESHAPs from Part 61, Chapter I, Subchapter C, Title 40, CFR and the NESHAPs from Part 63, Chapter I, Subchapter C, Title 40, CFR; and applies to all sources of hazardous air pollution listed in 40 CFR Part 61 or 40 CFR Part 63.

The requirements of 40 CFR Part 63, Subpart ZZZZ (*National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*) covers stationary engines at agricultural and non-agricultural facilities.

The District has not been delegated the authority to implement NESHAP regulations for Area Source requirements for non-Major Sources; therefore, no requirements shall be included on the permits.

There are no other applicable subparts.

Rule 4101 Visible Emissions

Rule 4101 states that no air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity.

As long as the equipment is properly maintained and operated, compliance with visible emissions limits is expected under normal operating conditions. Therefore, the following condition will be listed on the proposed ATCs to ensure compliance:

- {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

Rule 4102 Nuisance

Rule 4102 states that no air contaminant shall be released into the atmosphere that causes a public nuisance. Therefore, the following condition will be listed on permit to ensure compliance:

- {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

California Health & Safety Code 41700 (Health Risk Assessment)

District Policy APR 1905 - Risk Management Policy for Permitting New and Modified Sources specifies that for an increase in emissions associated with a proposed new source or modification, the District perform an analysis to determine the possible impact to the nearest resident or worksite. Therefore pursuant to the policy, a risk management review has been performed for this project to analyze the impact of toxic emissions

An HRA is not required for a project with a total facility prioritization score of less than one. According to the Technical Services Memo for this project **(Appendix C)**, the total facility prioritization score including this project was greater than one. Therefore, an HRA was required to determine the short-term acute and long-term chronic exposure from this project. The cancer risk for this project is shown below:

RMR Summary				
Categories	**469 BHP NG ICE (Unit 7-0)**	**400 BHP NG ICE (Unit 8-0)**	**Project Totals**	**Facility Totals**
Prioritization Score	0.04*	0.05*	0.09	<1.0
Acute Hazard Index	N/A	N/A	N/A	N/A
Chronic Hazard Index	N/A	N/A	N/A	N/A
Maximum Individual Cancer Risk	N/A	N/A	N/A	N/A
T-BACT Required?	**No**	**No**		
Special Permit Conditions?	**No**	**No**		

* The project passed on prioritization with a score less than 1; therefore, no further analysis was required.

Discussion of T-BACT

BACT for toxic emission control (T-BACT) is required if the cancer risk exceeds one in one million. As demonstrated above, T-BACT is not required for this project because the HRA indicates that the risk is not above the District's thresholds for triggering T-BACT requirements; therefore, compliance with the District's Risk Management Policy is expected.

District policy APR 1905 also specifies that the increase in emissions associated with a proposed new source or modification not have acute or chronic indices, or a cancer risk greater than the District's significance levels (i.e. acute and/or chronic indices greater than 1 and a cancer risk greater than 20 in a million). As outlined by the HRA Summary in Appendix C of this report, the emissions increases for this project was determined to be less than significant.

Rule 4201 Particulate Matter Concentration

The purpose of this rule is to protect the ambient air quality by establishing a particulate matter emission standard. This rule applies to any source operation, which emits or may emit dust, fumes, or total suspended particulate matter. This rule states that a person shall not release or discharge into the atmosphere from any single source operation, dust, fumes, or total suspended particulate matter emissions in excess of 0.1 grain/dscf, as determined by the test methods in Section 4.0.

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$$0.038 \quad \frac{g-PM_{10}}{bhp-hr} \times \frac{1g-PM}{0.96g-PM_{10}} \times \frac{1\,bhp-hr}{2{,}542.5\,Btu} \times \frac{10^6\,Btu}{8{,}578\,dscf} \times \frac{0.30\,Btu_{out}}{1\,Btu_{in}} \times \frac{15.43\,grain}{g} = \quad 0.008 \quad \frac{grain-PM}{dscf}$$

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$$0.073 \quad \frac{g-PM_{10}}{bhp-hr} \times \frac{1g-PM}{0.96g-PM_{10}} \times \frac{1\,bhp-hr}{2{,}542.5\,Btu} \times \frac{10^6\,Btu}{8{,}578\,dscf} \times \frac{0.30\,Btu_{out}}{1\,Btu_{in}} \times \frac{15.43\,grain}{g} = \quad 0.016 \quad \frac{grain-PM}{dscf}$$

Since the calculated PM emissions are each less than 0.1 grain/dscf, compliance with Rule 4201 is expected. The following condition will be placed on the permits to ensure compliance.

- {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

Rule 4202 Particulate Matter - Emission Rate

This rule establishes PM emission limits as a function of process weight rate in tons/hr. Gas and liquid fuels are excluded from the definition of process weight. Therefore, Rule 4202 does not apply to the proposed IC engines.

Rule 4301 Fuel Burning Equipment

Pursuant to Section 2.0, the provisions of this rule apply to any piece of fuel burning equipment. Section 3.1 defines fuel burning equipment as "any furnace, boiler, apparatus, stack, and all appurtenances thereto, used in the process of burning fuel for the primary purpose of producing heat or power by indirect heat transfer".

IC engines produce power mechanically, not by indirect heat transfer. Therefore, the proposed IC engines do not meet the definition of fuel burning equipment. Therefore, Rule 4301 does not apply.

Rule 4701 Internal Combustion Engines – Phase 1

Pursuant to Section 2.0, this rule applies to any internal combustion engine with a rated horsepower (hp) greater than 50 hp; therefore, the IC engines located at this facility are subject to this rule. However, Section 4.1 of the rule specifically exempts IC engines in agricultural operations used for the growing of crops or raising of fowl or animals. Since the engines are used for the growing of crops or raising of fowl or animals, they are exempt from the requirements of this rule. Therefore, the following condition will be listed on the ATCs to ensure compliance.

- {4877} This IC engine shall only be used for the growing and harvesting of crops or the raising of fowl or animals for the primary purpose of making a profit, providing a livelihood, or conducting agricultural research or instruction by an educational institution. [District Rules 4701 and 4702]

Rule 4702 Internal Combustion Engines

The purpose of this rule is to limit the emissions of Nitrogen Oxides (NOx), Carbon Monoxide (CO), Volatile Organic Compounds (VOC), and sulfur oxides (SOx) from internal combustion engines. This rule applies to any internal combustion engine rated at 25 brake horsepower or greater.

Each engine in this project is a certified[1], spark-ignited, IC engine rated greater than 50 bhp used to power an irrigation pump at an agricultural facility.

Section 5.1 contains reporting requirements for engines rated at least 25 brake horsepower up to and including 50 brake horsepower and used in non-agricultural operations (non-AO). The engine in this project is rated at greater than 50 bhp and is used in an agricultural operation (AO); therefore, the requirements of this section are not applicable.

Section 5.2 contains requirements for engines rated greater than 50 bhp. Section 5.2.3 outlines the compliance options for engines meeting this category. The applicant has proposed to comply with Section 5.2.3.1 which requires the operator to comply with the emission limits in Table 3 of the rule.

Rule 4702 Table 3 Applicable Emission Limits			
Engine Type	NO_x	CO	VOC
Lean-Burn	150 ppmv or 70% Reduction	2,000 ppmv	750 ppmv
Rich-Burn	90 ppmv or 80% reduction	2,000 ppmv	250 ppmv

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For S-6998-7, the proposed emissions factors comply with the requirements of this section. The following conditions will be included on the permit to ensure compliance.

- Emissions from this IC engine shall not exceed any of the following limits: 83.6 ppmv NOx @ 15% O2 (equivalent to 1.0 g-NOx/bhp-hr), 155 ppmvd CO @ 15% O2 (equivalent to 1.8 g-CO/bhp-hr), 0.033 g-PM10/bhp-hr, or 50 ppmvd VOC @ 15% O2 (equivalent to 0.21 g-VOC/bhp-hr). [District Rules 2201, 4102, and 4702]
- {4662} The engine shall be operated in a lean-burn configuration (greater than or equal to 4% O2 exhaust concentration). [District Rule 4702]

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The facility has proposed to install an natural gas-fired engine outfitted with a certified SNGEC emission control system that meets the applicable NOx, CO, and VOC limits for rich-burn engines used in exclusively agricultural operations. To

[1] The engines are EPA certified pursuant to the requirements of 40 CFR Part 60, Subpart JJJJ.

ensure compliance with Section 5.1 of District Rule 4702, the following conditions will be placed on the permits:

- The add-on emission control system (hereinafter referred to as the "SNGEC System") shall consist of a Compliance Controls (FW Murphy) Model AFR 1R, air/fuel ratio controller, a Johnson-Matthey Modulex C three-way catalyst system, two (one pre- and one post-catalyst) Type K thermocouples, a Manifold Absolute Pressure (MAP) sensor, and two (one pre- and one post-catalyst) Zirconia HEGO type oxygen sensors. [District Rule 4702]
- The SNGEC System shall be installed, maintained and operated according to the component manufacturer's recommendations and shall be in place and operating at all times during engine operation. [District Rule 4702]
- A person performing installation of or maintenance specific to the SNGEC System shall be certified by MurCal, or work under the direct and personal supervision of an individual physically present at the work site who is certified. [District Rule 4702]
- This engine shall be equipped with an operational non-resettable elapsed time meter or other APCO-approved alternative. [District Rule 4702]
- This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer, MurCal, or their certified installer. [District Rule 4702]
- During periods of operation, the permittee shall monitor the operational characteristics of the engine as recommended by the manufacturer or emission control system supplier (for example: check engine fluid levels, battery, cables and connections; change engine oil and filters; replace engine coolant; and/or other operational characteristics as recommended by the manufacturer or supplier). [District Rule 4702]
- This IC engine shall be fired on Public Utility Commission (PUC) regulated natural gas only. [District Rules 4702 and 4801]
- The oxygen sensors shall be replaced when the "health" percentage on the AFR controller shows 50% or less. Whenever the oxygen sensors are replaced, the SNGEC System shall be calibrated, prior to resuming normal engine operation, according to the procedures outlined by MurCal. [District Rule 4702]
- The catalyst module housing and elements shall be visually inspected at least once every calendar quarter. The catalyst shall be washed according to the manufacturer recommendations at least every 12-months and replaced at least every 36-months of operation. [District Rule 4702]
- The thermocouples shall be replaced every 36,000 hours of engine operation or every 48 calendar months, whichever comes first. Whenever the thermocouples are replaced, the SNGEC System shall be calibrated, prior to resuming normal engine operation, according to the procedures outlined by MurCal. [District Rule 4702]

- The MAP sensor shall be replaced every 16,000 hours of engine operation or every 36 calendar months, whichever comes first]. Whenever the MAP sensor is replaced, the SNGEC System shall be calibrated, prior to resuming normal engine operation, according to the procedures outlined by MurCal. [District Rule 4702]
- The pre- and post-catalyst exhaust temperatures shall be monitored and the temperature increase over the catalyst shall be recorded at initial system calibration. Both temperatures shall be monitored at least once in each calendar month that the engine operates. If the temperature increase over the catalyst becomes less than 50% of the initially determined value, the SNGEC System shall be calibrated or repaired, as necessary. [District Rule 4702]
- After the SNGEC System is calibrated or repaired in response to a catalyst temperature drop, a District-approved portable analyzer shall be used to determine that the NOx and CO emissions and O2 levels are at or below permitted levels. The pre- and post-catalyst exhaust temperatures shall be monitored and the temperature increase over the catalyst shall be recorded at that time and the temperature increase over the catalyst shall be re-established. Monthly monitoring of the pre- and post-catalyst exhaust temperature shall resume as required in the previous condition, based on the new temperature increase value. [District Rule 4702]
- Within 30 days after installation of the SNGEC System, a District-approved portable analyzer shall be used to determine NOx and CO emissions and O2 levels. All emission readings shall be taken with the unit operating at conditions representative of normal operations. The analyzer shall be calibrated, maintained, operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. Emission readings taken shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings, evenly spaced out over the 15 consecutive-minute period. [District Rule 4702]
- If the NOx or CO concentration corrected to 15% O2, as measured by the portable analyzer, exceeds the allowable emission concentration, the permittee shall return the emissions to within the acceptable range as soon as possible, but no longer than eight (8) hours after detection. If the portable analyzer readings continue to exceed the allowable emissions concentration after eight (8) hours, the permittee shall notify the District within the following one (1) hour, and conduct a certified source test within 60 days of the first exceedance. In lieu of conducting a source test, the permittee may stipulate a violation has occurred, subject to enforcement action. The permittee must then correct the violation, show compliance has been re-established, and resume monitoring procedures. If the excess emissions are the result of a qualifying breakdown condition pursuant to Rule 1100, the permittee may fully comply with Rule 1100 in

lieu of the performing the notification and testing required by this condition. [District Rule 4702]

- During the start-up inspection, the District shall be provided with written documentation that the emission control system is suitable for use on this engine and verify the engine's horsepower rating, exhaust flow rate, exhaust temperature, oil consumption, general mechanical condition, and the available fuel supply pressure will satisfy the criteria for proper operation of the SNGEC System, along with portable analyzer calibration records and results. [District Rule 4702]
- {modified 4844} NOx emissions from this IC engine shall not exceed 90 ppmvd-NOx @ 15% O2 (equivalent to 1.3 g-NOx/bhp-hr). [District Rules 2201 and 4702]
- PM10 emissions from this IC engine shall not exceed 0.063 g-PM10/bhp-hr. [District Rule 2201]
- Emissions from this IC engine shall not exceed any of the following limits: 1,000 ppmvd-CO @ 15% O2 (equivalent to 8.49 g-CO/bhp-hr) or 50 ppmvd-VOC @ 15% O2 (equivalent to 0.21 g-VOC/bhp-hr). [District Rules 2201 and 4702]
- The operator shall maintain engine operating log records of: 1) the monthly engine hour meter reading; 2) the date and the engine hour meter reading at each oxygen sensor change, MAP sensor change, and thermocouples change; 3) the monthly pre- and post-catalyst exhaust temperatures monitoring data including the initial temperature differential and any subsequently determined temperature differentials; 4) the date and engine hour meter reading of each catalyst module inspection, washing, and replacement; and 5) fuel purchase records. [District Rule 4702]
- All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 4702]
- The District may revise and/or add requirements in the future as necessary to ensure the SNGEC System operates according to its certification requirements. [District Rule 4702]

Section 5.3 outlines requirements for continuous emissions monitoring systems (CEMS). The engines in this project are not equipped with a CEMS; therefore, the requirements of this section are not applicable.

Section 5.4 and Section 5.5 outline requirements for complying with the percent emission reductions, if used to comply with the NOx emission limits of Section 5.2. The facility has not proposed to use the percent emission reduction to comply with the NOx limits in Section 5.2; therefore, the requirements of Section 5.4 and Section 5.5 are not applicable.

Section 5.6 outlines the requirements for the payment of an annual fee in lieu of complying with a NOx emission limit. The applicant has proposed to comply with a

NOx emission limit and will not be paying an annual fee; therefore, the requirements of this section are not applicable.

Section 5.7 outlines the sulfur oxide (SOx) emission control requirements and requires operators of non-AO spark-ignited and non-AO compression-ignited engines to comply with the Section 5.7.1 through Section 5.7.6. The engines in this project are AO engines; therefore, the requirements of this section are not applicable.

Section 5.8 outlines the monitoring requirements for non-AO spark-ignited engines and engines in an AECP (Section 8.0). The engines in this project are AO spark-ignited engines and are not in an AECP; therefore, the requirements of this section are not applicable.

Section 5.9 outlines the monitoring requirements for all engines other than non-AO spark-ignited engines and engines in an AECP and requires the operator of any of the engines identified in Section 5.9.1.1 through Section 5.9.1.3 to comply with the requirements of Section 5.9.2 through 5.9.5.

5.9.1.1 An AO spark-ignited engine subject to the requirements of Section 5.2;
5.9.1.2 A compression-ignited engine subject to the requirements of Section 5.2; or
5.9.1.3 An engine subject to Section 4.2.

The engines in this project are AO spark-ignited engines subject to the requirements of Section 5.2; therefore, the requirements of Section 5.9.2 through 5.9.5 are applicable.

Section 5.9.2 requires the operator to properly operate and maintain the engine as recommended by the engine manufacturer or emission control system supplier.

Section 5.9.3 requires the operator to monitor the operational characteristics of the engine as recommended by the engine manufacturer or emission control system supplier.

Section 5.9.4 requires the operator to install and operate a non-resettable elapsed time meter and properly maintain and operate the non-resettable elapsed time meter in accordance with the manufacturer's instructions. The operator is also allowed to use an alternative device, method, or technique in lieu of installing a non-resettable elapsed time meter provided that the alternative is approved by the APCO and EPA and is allowed by a Permit-to-Operate or Permit-Exempt Equipment Registration condition. The following conditions will be included on the permits.

- {3405} This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer or emissions control system supplier. [District Rule 4702]
- {4037} During periods of operation, the permittee shall monitor the operational characteristics of the engine as recommended by the

manufacturer or emission control system supplier (for example: check engine fluid levels, battery, cables and connections; change engine oil and filters; replace engine coolant; and/or other operational characteristics as recommended by the manufacturer or supplier). [District Rule 4702]

- This engine shall be equipped with an operational non-resettable elapsed time meter or other APCO approved alternative. [District Rule 4702]

Section 5.9.5 requires the owner of an agricultural spark-ignited engine that has been retrofitted with an exhaust control system that has not been certified in accordance with Section 9.0 to conduct periodic monitoring of the engine's NOx emissions using a District-approved portable emissions analyzer. Engine S-6998-7-0 has not been retrofitted with an exhaust control system to reduce NOx emissions; therefore, S-6998-7-0 is not subjuct to Section 5.9.5. Engine S-6998-8-0 will use an exhaust control system that has been certified by the District under Section 9.0. Therefore, the permit unit S-6998-8-0 is not subject to Section 5.9.5.

Section 5.10 outlines the SOx emissions monitoring requirements for a non-AO engine. The engines in this project are AO engines; therefore, the requirements of this section are not applicable.

Section 5.11 outlines the requirements for Permit-Exempt Equipment Registrations. The engines in this project are required to have a Permit-to-Operate; therefore, the requirements of this section are not applicable.

Section 6.1 requires the operator of an engine subject to the requirements of Section 5.2 to submit an approvable emission control plan. The requirement to submit an emission control plan shall apply to the engines specified in Section 6.1.1.1 through Section 6.1.1.4.

6.1.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;
6.1.1.2 Engines subject to Section 8.0;
6.1.1.3 An AO spark-ignited engine that is subject to the requirements of Section 8.0;
6.1.1.4 An AO spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0.

S-6998-7-0
Engine S-6998-7-0 is a lean burn AO spark-ignited engine that will be retrofitted with a catalytic emission control system for the reduction of VOC emissions; therefore, the requirements of this section are applicable to this engine.

Sections 6.1.2 through 6.1.4 outline the requirements for an emission control plan (ECP). By submitting the applications for Authority to Construct (ATC) permits, the applicant has provided all of the information required to be included

in the ECP. Therefore, compliance with the requirements of Sections 6.1.2 through 6.1.4 is satisfied.

S-6998-8-0
Engine S-6998-8-0 is an AO spark-ignited engine that has been retrofitted with a certified exhaust control device and is not subject to the requirements of Section 8.0. Therefore, the requirements of Section 6.1 are not applicable to this engine for NOx and CO.

Engine S-6998-8-0 will be retrofitted with additional catalyst for limiting VOC emissions; therefore, the requirements of Section 6.1 are applicable for VOC emissions. By submitting the applications for Authority to Construct (ATC) permits, the applicant has provided all of the information required to be included in the ECP. Therefore, compliance with the requirements of Sections 6.1.2 through 6.1.4 is satisfied.

Section 6.2 outlines the recordkeeping requirements for the operator of an engine subject to the requirements of Section 5.2 and requires the operator to maintain an engine operating log to demonstrate compliance with this rule. The information shall be retained for a period of at least five years, shall be readily available, and shall be made available to the APCO upon request. The engine operating log shall include, on a monthly basis, the information outlined in Section 6.2.1.1 through Section 6.2.1.7.

6.2.1.1 Total hours of operation,
6.2.1.2 Type of fuel used,
6.2.1.3 Maintenance or modifications performed,
6.2.1.4 Monitoring data,
6.2.1.5 Compliance source test results, and
6.2.1.6 Any other information necessary to demonstrate compliance with this rule.
6.2.1.7 For an engine subject to Section 8.0, the quantity (cubic feet of gas or gallons of liquid) of fuel used on a daily basis.

Section 6.2.2 requires all data collected pursuant to the requirements of Section 5.9 to be maintained for at least five years, be readily available, and made available to the APCO upon request.

The following conditions will be included on the permits to ensure compliance with the requirements of Section 6.2.2.

- {4050} The permittee shall maintain an engine operating log to demonstrate compliance. The engine operating log shall include, on a monthly basis, the following information: total hours of operation, type of fuel used, maintenance or modifications performed, monitoring data, documentation from the

manufacturer of the engine certification, and any other information necessary to demonstrate compliance. [District Rule 4702]

- {modified 3497} All records shall be maintained and retained for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rules 2201 and 4702]

Section 6.3 outlines the compliance testing requirements for the operator of an engine subject to the requirements of Section 5.2 or the requirements of Section 8.0 and requires the operator of an engine identified below in Sections 6.3.1.1 through Section 6.3.1.4 to comply with the requirements of Section 6.3.2 through Section 6.3.4.

6.3.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;
6.3.1.2 Engines subject to Section 8.0;
6.3.1.3 An AO spark-ignited engine that is subject to the requirements of Section 8.0;
6.3.1.4 An AO spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0.

S-6998-7-0
Engine S-6998-7-0 will be retrofitted with a catalytic exhaust control device for limiting VOC emissions; therefore, the requirements of Sections 6.3.2 through 6.3.4 are applicable. However, Section 6.3.5 states that engines that are limited by Permit-to-Operate condition to be fueled exclusively with PUC quality natural gas shall not be subject to the reccurring source test requirements of Section 6.3.2 for VOC emissions. Engine S-6998-7-0 will be fired on PUC-quality natural gas, thus recurring source testing is not required for this engine.

Rule 2201 and District Policy APR 1705 (Source Testing Frequency) also apply to the proposed engine. Per Rule 2201, BACT is triggered for VOC; however, there is no source testing frequency in Rule 2201. Except when mandated by an applicable requirement, District Policy APR 1705 Section IV states that annual source testing for VOC emissions should not be required if the uncontrolled emissions are less than 30 lb/day. In the case of this project, Rules 2201 and 4702 are applicable requirements. Rule 4702 does not require recurring VOC source testing, as discussed in the preceding paragraph. Using 0.7 g-VOC/bhp-hr as the uncontrolled emission factor (engine emissions without oxidizing catalyst), the daily emissions for the engine would be 17.4 lb-VOC/day, which is less than 30 lb-VOC/day; therefore, annual (recurring) source testing pursuant to APR 1705 is not required. No recurring source testing requirements for VOC will be included in the permit. In order to determine compliance with the VOC BACT emission limitation, an initial source test for VOC will be required. The following condition will be included on the permit.

- Source testing to measure VOC emissions from this unit shall be conducted within 60 days of initial start-up. [District Rules 2201 and 4702]

The oxidizing catalyst, required as VOC BACT (District Rule 2201), also controls CO emissions. However, for this project, BACT is not triggered for CO, so no CO limitation is mandated by Rule 2201 and emissions limitation is determined by Rule 4702. The engine manufacturer's guaranteed limit of 155 ppmv at 15% O_2 (1.8 lb-CO/bhp-hr) meets the Rule 4702 emission limit. This is the most stringent emission limitation for the proposed engine. Pursuant to District Policy APR 1705, the testing requirement that is associated with the most stringent emission limitation is presumed to be appropriate and will be incorporated into the permit.

- Source testing to measure CO emissions from this unit shall be conducted within 60 days of initial start-up and every 60 months thereafter. [District Rule 4702]

Section 6.3.3 requires that source testing be conducted with the engine operating either at conditons representative of normal operation or conditons specified in the Permit-to-Operate. The following condition will be included on the permit for S-6998-7-0:

- {3791} Emissions source testing shall be conducted with the engine operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. [District Rule 4702]
- For emissions source testing, the arithmetic average of three 30-consecutive-minute test runs shall apply. If two of three runs are above an applicable limit, the test cannot be used to demonstrate compliance with an applicable limit. VOC emissions shall be reported as methane. VOC concentration and CO concentration shall be reported in ppmv, corrected to 15% oxygen. [District Rule 4702]

S-6998-8-0
Engine S-6998-8-0 is an AO spark-ignited engine that has been retrofitted with a certified exhaust control system and is not subject to the requirements of Section 8.0. Therefore, the requirements of Sections 6.3.2 through 6.3.4 are not applicable to NOx or CO.

Engine S-6998-8-0 will be retrofitted with additional catalyst for limiting VOC emissions; therefore, the requirements of Sections 6.3.2 through 6.3.4 are applicable for VOC emissions. However, Section 6.3.5 states that engines that are limited by Permit-to-Operate condition to be fueled exclusively with PUC quality natural gas shall not be subject to the reccurring source test requirements of Section 6.3.2 for VOC emissions. Engine S-6998-8-0 will be fired on PUC-quality natural gas, thus recurring source testing is not required for this engine.

- Source testing to measure VOC emissions from this unit shall be conducted within 60 days of initial start-up. [District Rules 2201 and 4702]

Section 6.3.6 allows representative testing in lieu of compliance with the applicable requirements of Section 6.3.2. The applicant has not requested representative testing; therefore, the requirements of this section are not applicable.

Section 6.4 states that compliance with the requirements of Section 5.2 shall be determined, as required, in accordance with the following test procedures or any other method approved by EPA and the APCO:

6.4.1 Oxides of nitrogen - EPA Method 7E, or ARB Method 100

6.4.2 Carbon monoxide - EPA Method 10, or ARB Method 100

6.4.3 Stack gas oxygen - EPA Method 3 or 3A, or ARB Method 100

6.4.4 Volatile organic compounds - EPA Method 25A or 25B, or ARB Method 100

6.4.5 Operating horsepower determination - any method approved by EPA and the APCO

Both proposed engines are subject to initial VOC sourc testing and Engine S-6998-7-0 is subject to initial and recurring CO source testing; therefore, the following condition will be included on the permits.

- {3793} The following test methods shall be used: NOx (ppmv) - EPA Method 7E or ARB Method 100; CO (ppmv) - EPA Method 10 or ARB Method 100; stack gas oxygen - EPA Method 3 or 3A or ARB Method 100; and VOC (ppmv) - EPA Method 18, 25A or 25B, or ARB Method 100. [District Rules 1081 and 4702]

Section 6.5 outlines the requirement for an inspection and monitoring (I&M) plan and requires the operator of an engine subject to the requirements of Section 5.2 or the requirements of Section 8.0 to submit an I&M plan that specifies all actions to be taken to satisfy the requirements of Section 5.8. The requirements of Section 6.5.2 through Section 6.5.9 apply to the engines identified in sections 6.5.1.1 through 6.5.1.4.

6.5.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;
6.5.1.2 Engines subject to Section 8.0;
6.5.1.3 An AO spark-ignited engine that is subject to the requirements of Section 8.0;
6.5.1.4 An AO spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0.

S-6998-7-0

Engine S-6998-7-0 is a lean burn AO spark-ignited engine that will be retrofitted with an exhaust control device for reduction of VOC emissions and the engine is not subject to the requirements of Section 8.0; therefore, the requirements of Sections 6.5.2 through 6.5.9 are applicable. The actions to be identified in the I&M plan shall include, but are not limited to, the information specified in Sections 6.5.2 through 6.5.9, as outlined below.

6.5.2 Procedures requiring the operator to establish ranges for control equipment parameters, engine operating parameters, and engine exhaust oxygen concentrations that source testing has shown result in pollutant concentrations within the rule limits.

6.5.3 Procedures for monthly inspections as approved by the APCO. The applicable control equipment parameters and engine operating parameters will be inspected and monitored monthly in conformance with a regular inspection schedule listed in the I&M plan.

6.5.4 Procedures for the corrective actions on the noncompliant parameter(s) that the operator will take when an engine is found to be operating outside the acceptable range for control equipment parameters, engine operating parameters, and engine exhaust NOx, CO, VOC, or oxygen concentrations.

6.5.5 Procedures for the operator to notify the APCO when an engine is found to be operating outside the acceptable range for control equipment parameters, engine operating parameters, and engine exhaust NOx, CO, VOC, or oxygen concentrations.

6.5.6 Procedures for preventive and corrective maintenance performed for the purpose of maintaining an engine in proper operating condition.

6.5.7 Procedures and a schedule for using a portable NOx analyzer to take NOx emission readings pursuant to Section 5.8.9.

6.5.8 Procedures for collecting and recording required data and other information in a form approved by the APCO including, but not limited to, data collected through the I&M plan and the monitoring systems described in Sections 5.8.1 and 5.8.2. Data collected through the I&M plan shall have retrieval capabilities as approved by the APCO.

6.5.9 Procedures for revising the I&M plan. The I&M plan shall be updated to reflect any change in operation. The I&M plan shall be updated prior to any planned change in operation. An engine operator that changes significant I&M plan elements must notify the District no later than seven days after the change and must submit an updated I&M plan to the APCO no later than 14 days after the change for approval. The date and time of the change to the I&M plan shall be recorded in the engine operating log. For new engines and modifications to existing engines, the I&M plan shall be submitted to and approved by the APCO prior to issuance of the Permit-to-Operate or Permit-Exempt Equipment Registration. The operator of an engine may request a change to the I&M plan at any time.

The initial I&M Plan is attached as Appendix F. The following conditions will be included on permit.

- The engine shall be fitted with the necessary connections and ports to monitor the back pressure across the catalyst. [District Rule 4702]
- The operator shall inspect the catalyst and measure the back pressure at least once each calendar month. [District Rule 4702]
- If the back pressure across the catalyst is 2 psi or greater, the catalyst shall be removed and either washed/cleaned or replaced. The engine shall not be operated until an appropriate catalyst is re-installed and the back pressure across the catalyst is less than 2 psi. [District Rule 4702]
- {3212} The permittee shall update the I&M plan for this engine prior to any planned change in operation. The permittee must notify the District no later than seven days after changing the I&M plan and must submit an updated I&M plan to the APCO for approval no later than 14 days after the change. The date and time of the change to the I&M plan shall be recorded in the engine's operating log. For modifications, the revised I&M plan shall be submitted to and approved by the APCO prior to issuance of the Permit to Operate. The permittee may request a change to the I&M plan at any time. [District Rule 4702]

S-6998-8-0

Engine S-6998-8-0 is an AO spark-ignited engine that is equipped with a certified exhaust control system to control NOx and CO emissions and is not subject to the requirements of Section 8.0. Therefore, the requirements of sections 6.5.2 through 6.5.9 are not applicable for NOx and CO. Additional catalyst is required to meet the BACT VOC emission limits; therefore, the requirements of Sections 6.5.2 through 6.5.9 are applicable for the VOC emissions. As discussed for Engine S-6998-7-0, an I&M Plan has been included as Appendix F and the same conditions as for S-6998-7-0 will be included in the permit for this engine.

Section 7.3 outlines the compliance schedule for AO compression-ignited engines and Sections 7.4, 7.5, and 7.6 outline requirements for non-AO engine. The engines in this project are AO spark-ignited engines; therefore, the requirements of Sections 7.3 through 7.6 are not applicable.

Section 8.0 outlines the requirements for an Alternative Emission Control Plan (AECP). The engines in this project are not required to submit an AECP; therefore, the requirements of this section are not applicable.

Compliance with the requirements of this rule is expected. Conditions will be included on the permit, as previously presented, to ensure continued compliance with the applicable requirements of this rule. No further discussion is required.

Rule 4801 Sulfur Compounds

Rule 4801 requires that sulfur compound emissions (as SO_2) shall not exceed 0.2% by volume. Using the ideal gas equation, the sulfur compound emissions are calculated as follows:

Volume SO_2 = (n x R x T) ÷ P

Where:

n = moles SO_2

T (standard temperature) = 60 °F or 520 °R

R (universal gas constant) = $\frac{10.73\,\text{psi}\cdot\text{ft}^3}{\text{lb}\cdot\text{mol}\cdot{}^\circ\text{R}}$

2.85 $\frac{lb-S}{MMscf-gas}\times\frac{1\,scf-gas}{1{,}000\,Btu}\times\frac{1\,MMBtu}{8{,}578\,scf}\times\frac{1\,lb-mol}{64\,lb-S}\times\frac{10.73\,psi-ft^3}{lb-mol-{}^\circ R}\times\frac{520^\circ R}{14.7\,psi}\times 1{,}000{,}000=$ 1.97 ppmv

Since 1.97 ppmv is less than 2,000 ppmv, these engines are expected to comply with Rule 4801. Therefore, the following condition will be listed on the ATCs to ensure compliance:

- {3491} This IC engine shall be fired on Public Utility Commission (PUC) regulated natural gas only. [District Rules 2201 and 4801]

California Health & Safety Code 42301.6 (School Notice)

The District has verified that this site is not located within 1,000 feet of a school. Therefore, pursuant to California Health and Safety Code 42301.6, a school notice is not required.

California Environmental Quality Act (CEQA)

The California Environmental Quality Act (CEQA) requires each public agency to adopt objectives, criteria, and specific procedures consistent with CEQA Statutes and the CEQA Guidelines for administering its responsibilities under CEQA, including the orderly evaluation of projects and preparation of environmental documents. The San Joaquin Valley Unified Air Pollution Control District (District) adopted its *Environmental Review Guidelines* (ERG) in 2001.

The basic purposes of CEQA are to:

- Inform governmental decision-makers and the public about the potential, significant environmental effects of proposed activities.
- Identify the ways that environmental damage can be avoided or significantly reduced.

- Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.
- Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

The District is the Lead Agency for this project because there is no other agency with broader statutory authority over this project. The District performed an Engineering Evaluation (this document) for the proposed project and determined that the activity will occur at an existing facility and the project involves negligible expansion of the existing use. Furthermore, the District determined that the activity will not have a significant effect on the environment. The District finds that the activity is categorically exempt from the provisions of CEQA pursuant to CEQA Guideline § 15301 (Existing Facilities), and finds that the project is exempt per the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment (CEQA Guidelines §15061(b)(3)).

IX. Recommendation

Compliance with all applicable rules and regulations is expected. Pending a successful NSR Public Noticing period, issue Authority to Construct ATCs S-6998-7-0 and S-6998-8-0 subject to the permit conditions on the attached draft Authorities to Construct in Appendix A.

X. Billing

Annual Permit Fee			
Permit Number	**Fee Schedule**	**Fee Description**	**Fee Amount**
S-6998-7-0	3020-10-D	469 bhp IC engine	$479.00
S-6998-8-0	3020-10-D	400 bhp IC engine	$479.00

Appendices

A: Draft ATCs
B: BACT Guideline and Top-Down BACT Analyses
C: HRA Summary and AAQA Analysis
D: Engine Manufacturer's Emissions Guarantees and Catalyst Sizing Data Sheet
E: Quarterly Net Emissions Change (QNEC) Calculations
F: Inspection and Maintenance (I & M) Plan
G: Existing Units' Emissions Calculations

Appendix A
Draft ATCs

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: S-6998-7-0

ISSUANCE DATE: DRAFT

LEGAL OWNER OR OPERATOR: DJ DAIRY
MAILING ADDRESS: 9231 AVENUE 368
DINUBA, CA 93618

LOCATION: 4390 AVENUE 352
KINGSBURG, CA 93631

EQUIPMENT DESCRIPTION:
469 BHP DRESSER RAND MODEL SFGLD 180 LEAN-BURN NATURAL GAS-FIRED IC ENGINE UTILIZING AN ADVANCED CATALYST SYSTEMS OXIDIZING CATALYST POWERING AN AGRICULTURAL IRRIGATION PUMP

CONDITIONS

1. {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. {3658} This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]
4. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]
5. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]
6. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
7. {4877} This IC engine shall only be used for the growing and harvesting of crops or the raising of fowl or animals for the primary purpose of making a profit, providing a livelihood, or conducting agricultural research or instruction by an educational institution. [District Rules 4701 and 4702]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (661) 392-5500 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

Arnaud Marjollet, Director of Permit Services
S-6998-7-0 : Jan 26 2016 8:31AM -- LOWELES : Joint Inspection NOT Required

8. This engine shall be equipped with an operational non-resettable elapsed time meter or other APCO approved alternative. [District Rule 4702]

9. This engine shall be equipped with a functional oxidizing catalyst unit for reduction of VOC emissions, which is maintained and operated per the manufacturer's recommendations. [District Rules 2201 and 4702]

10. The engine shall be fitted with the necessary connections and ports to monitor the back pressure across the catalyst. [District Rule 4702]

11. {4662} The engine shall be operated in a lean-burn configuration (greater than or equal to 4% O2 exhaust concentration). [District Rule 4702]

12. {3491} This IC engine shall be fired on Public Utility Commission (PUC) regulated natural gas only. [District Rules 2201 and 4801]

13. {3405} This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer or emissions control system supplier. [District Rule 4702]

14. Operation of this engine shall not exceed 5,600 hours per year. [District Rule 2201]

15. {4037} During periods of operation, the permittee shall monitor the operational characteristics of the engine as recommended by the manufacturer or emission control system supplier (for example: check engine fluid levels, battery, cables and connections; change engine oil and filters; replace engine coolant; and/or other operational characteristics as recommended by the manufacturer or supplier). [District Rule 4702]

16. The operator shall inspect the catalyst and measure the back pressure at least once each calendar month. [District Rule 4702]

17. If the back pressure across the catalyst is 2 psi or greater, the catalyst shall be removed and either washed/cleaned or replaced. The engine shall not be operated until an appropriate catalyst is re-installed and the back pressure across the catalyst is less than 2 psi. [District Rule 4702]

18. Emissions from this IC engine shall not exceed any of the following limits: 83.6 ppmvd NOx @ 15% O2 (equivalent to 1.0 g-NOx/bhp-hr), 155 ppmvd CO @ 15% O2 (equivalent to 1.8 g-CO/bhp-hr), 0.033 g-PM10/bhp-hr, or 50 ppmvd VOC @ 15% O2 (equivalent to 0.21 g-VOC/hp-hr). [District Rules 2201 and 4702]

19. Source testing to measure VOC emissions from this unit shall be conducted within 60 days of initial start-up. [District Rules 2201 and 4702]

20. Source testing to measure CO emissions from this unit shall be conducted within 60 days of initial start-up and every 60 months thereafter. [District Rule 4702]

21. {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]

22. {110} The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

23. For emissions source testing, the arithmetic average of three 30-consecutive-minute test runs shall apply. If two of three runs are above an applicable limit, the test cannot be used to demonstrate compliance with an applicable limit. VOC emissions shall be reported as methane. VOC concentration and CO concentration shall be reported in ppmv, corrected to 15% oxygen. [District Rule 4702]

24. {3791} Emissions source testing shall be conducted with the engine operating either at conditions representative of normal operations or conditions specified in the Permit to Operate. [District Rule 4702]

25. {3793} The following test methods shall be used: NOx (ppmv) - EPA Method 7E or ARB Method 100, CO (ppmv) - EPA Method 10 or ARB Method 100, stack gas oxygen - EPA Method 3 or 3A or ARB Method 100, and VOC (ppmv) - EPA Method 18, 25A or 25B, or ARB Method 100. [District Rules 1081 and 4702]

CONDITIONS CONTINUE ON NEXT PAGE

26. {3212} The permittee shall update the I&M plan for this engine prior to any planned change in operation. The permittee must notify the District no later than seven days after changing the I&M plan and must submit an updated I&M plan to the APCO for approval no later than 14 days after the change. The date and time of the change to the I&M plan shall be recorded in the engine's operating log. For modifications, the revised I&M plan shall be submitted to and approved by the APCO prior to issuance of the Permit to Operate. The permittee may request a change to the I&M plan at any time. [District Rule 4702]

27. {4051} The permittee shall record the total time the engine operates, in hours per calendar year. [District Rule 2201]

28. {4050} The owner/operator shall maintain an engine operating log to demonstrate compliance. The engine operating log shall include, on a monthly basis, the following information: total hours of operation, type of fuel used, maintenance or modifications performed, monitoring data, and any other information necessary to demonstrate compliance. [District Rule 4702]

29. All records shall be maintained and retained for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rules 2201 and 4702]

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: S-6998-8-0

ISSUANCE DATE: DRAFT

DRAFT

LEGAL OWNER OR OPERATOR: DJ DAIRY
MAILING ADDRESS: 9231 AVENUE 368
DINUBA, CA 93618

LOCATION: 4390 AVENUE 352
KINGSBURG, CA 93631

EQUIPMENT DESCRIPTION:
400 BHP CATERPILLAR MODEL 3408TA RICH-BURN NATURAL GAS-FIRED IC ENGINE WITH A CERTIFIED MURCAL SNGEC SYSTEM AND UTILIZING AN ADVANCED CATALYST SYSTEMS OXIDIZING CATALYST POWERING AN AGRICULTURAL IRRIGATION PUMP

CONDITIONS

1. {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. {3658} This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]
4. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
5. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]
6. {14} Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (661) 392-5500 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

DRAFT

Arnaud Marjollet, Director of Permit Services
S-6998-8-0 : Jan 26 2016 8:31AM -- LOWELES : Joint Inspection NOT Required

7. {4877} This IC engine shall only be used for the growing and harvesting of crops or the raising of fowl or animals for the primary purpose of making a profit, providing a livelihood, or conducting agricultural research or instruction by an educational institution. [District Rules 4701 and 4702]

8. The add-on emission control system (hereinafter referred to as the "SNGEC System") shall consist of a Compliance Controls (FW Murphy) Model AFR (64R) air/fuel ratio controller, a Johnson-Matthey Modulex C three-way catalyst system, two (one pre- and one post-catalyst) Type K thermocouples, a Manifold Absolute Pressure (MAP) sensor, and two (one pre- and one post-catalyst) Zirconia HEGO type oxygen sensors. [District Rule 4702]

9. {4860} The SNGEC System shall be installed, maintained and operated according to the component manufacturer's recommendations and shall be in place and operating at all times during engine operation. [District Rule 4702]

10. {4861} A person performing installation of or maintenance specific to the SNGEC System shall be certified by MurCal, or work under the direct and personal supervision of an individual physically present at the work site who is certified. [District Rule 4702]

11. {3404} This engine shall be equipped with an operational non-resettable elapsed time meter or other APCO approved alternative. [District Rule 4702]

12. {4862} This engine shall be operated and maintained in proper operating condition as recommended by the engine manufacturer, MurCal, or their certified installer. [District Rule 4702]

13. {4037} During periods of operation, the permittee shall monitor the operational characteristics of the engine as recommended by the manufacturer or emission control system supplier (for example: check engine fluid levels, battery, cables and connections; change engine oil and filters; replace engine coolant; and/or other operational characteristics as recommended by the manufacturer or supplier). [District Rule 4702]

14. This IC engine shall be fired on Public Utility Commission (PUC) regulated natural gas only. [District Rules 2201, 4702 and 4801]

15. {4864} The oxygen sensors shall be replaced when the "health" percentage on the AFR controller shows 50% or less. Whenever the oxygen sensors are replaced, the SNGEC System shall be calibrated, prior to resuming normal engine operation, according to the procedures outlined by MurCal. [District Rule 4702]

16. {4865} The catalyst module housing and elements shall be visually inspected at least once every calendar quarter. The catalyst shall be washed according to the manufacturer recommendations at least every 12-months and replaced at least every 36-months of operation. [District Rule 4702]

17. {4866} The thermocouples shall be replaced every 36,000 hours of engine operation or every 48 calendar months, whichever comes first. Whenever the thermocouples are replaced, the SNGEC System shall be calibrated, prior to resuming normal engine operation, according to the procedures outlined by MurCal. [District Rule 4702]

18. {4867} The MAP sensor shall be replaced every 16,000 hours of engine operation or every 36 calendar months, whichever comes first. Whenever the MAP sensor is replaced, the SNGEC System shall be calibrated, prior to resuming normal engine operation, according to the procedures outlined by MurCal. [District Rule 4702]

19. {4868} The pre- and post-catalyst exhaust temperatures shall be monitored and the temperature increase over the catalyst shall be recorded at initial system calibration. Both temperatures shall be monitored at least once in each calendar month that the engine operates. If the temperature increase over the catalyst becomes less than 50% of the initially determined value, the SNGEC System shall be calibrated or repaired, as necessary. [District Rule 4702]

20. {4869} After the SNGEC System is calibrated or repaired in response to a catalyst temperature drop, a District-approved portable analyzer shall be used to determine that the NOx and CO emissions and O2 levels are at or below permitted levels. The pre- and post-catalyst exhaust temperatures shall be monitored and the temperature increase over the catalyst shall be recorded at that time and the temperature increase over the catalyst shall be re-established. Monthly monitoring of the pre- and post-catalyst exhaust temperature shall resume as required in the previous condition, based on the new temperature increase value. [District Rule 4702]

CONDITIONS CONTINUE ON NEXT PAGE

21. {4870} Within 30 days after installation of the SNGEC System, a District-approved portable analyzer shall be used to determine NOx and CO emissions and O2 levels. All emission readings shall be taken with the unit operating at conditions representative of normal operations. The analyzer shall be calibrated, maintained, operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. Emission readings taken shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings, evenly spaced out over the 15 consecutive-minute period. [District Rule 4702]

22. {3786} If either the NOx or CO concentrations corrected to 15% O2, as measured by the portable analyzer, exceed the allowable emission concentration, the permittee shall return the emissions to within the acceptable range as soon as possible, but no longer than eight (8) hours after detection. If the portable analyzer readings continue to exceed the allowable emissions concentration after eight (8) hours, the permittee shall notify the District within the following 1 hour, and conduct a certified source test within 60 days of the first exceedance. In lieu of conducting a source test, the permittee may stipulate a violation has occurred, subject to enforcement action. The permittee must then correct the violation, show compliance has been re-established, and resume monitoring procedures. If the deviations are the result of a qualifying breakdown condition pursuant to Rule 1100, the permittee may fully comply with Rule 1100 in lieu of performing the notification and testing required by this condition. [District Rule 4702]

23. {4871} During the start-up inspection, the District shall be provided with written documentation that the emission control system is suitable for use on this engine and verify the engine's horsepower rating, exhaust flow rate, exhaust temperature, oil consumption, general mechanical condition, and the available fuel supply pressure will satisfy the criteria for proper operation of the SNGEC System, along with portable analyzer calibration records and results. [District Rule 4702]

24. {4872} NOx emissions from this IC engine shall not exceed 90 ppmvd-NOx @ 15% O2 (equivalent to 1.3 g-NOx/bhp-hr). [District Rules 2201 and 4702]

25. PM10 emissions from this IC engine shall not exceed 0.063 g-PM10/bhp-hr. [District Rule 2201]

26. Emissions from this IC engine shall not exceed any of the following limits: 1,000 ppmvd CO @ 15% O2 (equivalent to 8.49 g-CO/bhp-hr) or 50 ppmvd-VOC @ 15% O2 (equivalent to 0.21 g-VOC/bhp-hr). [District Rules 2201 and 4702]

27. Source testing to measure VOC emissions from this unit shall be conducted within 60 days of startup. [District Rules 2201 and 4702]

28. {109} Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]

29. {3793} The following test methods shall be used: NOx (ppmv) - EPA Method 7E or ARB Method 100, CO (ppmv) - EPA Method 10 or ARB Method 100, stack gas oxygen - EPA Method 3 or 3A or ARB Method 100, and VOC (ppmv) - EPA Method 18, 25A or 25B, or ARB Method 100. [District Rules 1081 and 4702]

30. {110} The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]

31. {4875} The operator shall maintain engine operating log records of: 1) the monthly engine hour meter reading; 2) the date and the engine hour meter reading at each oxygen sensor change, MAP sensor change, and thermocouples change; 3) the monthly pre- and post-catalyst exhaust temperatures monitoring data including the initial temperature differential and any subsequently determined temperature differentials; 4) the date and engine hour meter reading of each catalyst module inspection, washing, and replacement; and 5) fuel purchase records. [District Rule 4702]

32. {4051} The permittee shall record the total time the engine operates, in hours per calendar year. [District Rule 2201]

33. All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rules 2201 and 4702]

34. {4876} The District may revise and/or add requirements in the future as necessary to ensure the SNGEC System operates according to its certification requirements. [District Rule 4702]

Appendix B
BACT Guideline and Top-Down BACT Analysis

San Joaquin Valley Unified Air Pollution Control District
Draft Best Available Control Technology (BACT) Guideline

Emission Unit: AO Stationary Spark-Ignited IC Engines serving Irrigation Pumps

Industry Type: Agriculture

Equipment Rating: ≤ 1,000 bhp

Last Update: September 26, 2011

Pollutant	Achieved in Practice	Technologically Feasible	Alternate Basic Equipment
VOC	50 ppmvd @ 15% O_2*		Electrification
NO_x	90 ppmvd @ 15% O_2*	5 ppmvd @ 15% O_2 (Lean Burn Engines only)	
CO	500 ppmvd @ 15% O_2*		
PM_{10}	0.063 g/bhp-hr		
SO_x	0.0094 g/bhp-hr		

*Achievable via Rich-Burn Engine w/3-way catalyst or Lean Burn Engine.

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. A cost effectiveness analysis is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

Top Down BACT Analysis for Irrigation Engines

1. BACT Analysis for NO_X Emissions:

Oxides of nitrogen (NO_X) are generated from the high temperature combustion of the natural gas fuel. A majority of the NO_X emissions are formed from the high temperature reaction of nitrogen and oxygen in the inlet air. The rest of the NO_X emissions are formed from the reaction of fuel-bound nitrogen with oxygen in the inlet air.

a. Step 1 - Identify all control technologies

The SJVUAPCD draft BACT Clearinghouse identifies three levels of BACT for NO_X emissions as follows:

1) Electrification (Alternate Basic Equipment (ABE));
2) 5 ppmvd at 15% O_2 (Technologically Feasible (TF) for lean burn engines only); and
3) 90 ppmvd at 15% O_2 (achievable via rich-burn engine and 3 way catalyst or lean burn engine) (Achieved in Practice)

b. Step 2 - Eliminate technologically infeasible options

S-6998-7-0 is a lean-burn engine; therefore, there are no technologically infeasible options to eliminate from step 1.

S-6998-8-0 is a rich-burn engine; therefore 5 ppmvd NOx @ 15% O_2 is not technologically feasible.

c. Step 3 - Rank remaining options by control effectiveness

1. Electrification
2. [For S-6998-7-0 only] 5 ppmvd at 15% O_2 (lean burn engine) [install SCR]
3. 90 ppmvd at 15% O_2 (achievable via rich-burn engine and 3 way catalyst or lean burn engine)

d. Step 4 - Cost Effectiveness Analysis

Electrification

The cost of installing an electrical motor in place of a natural gas-fired IC engine is calculated in the attached spreadsheet. The assumptions used in the calculations are identified in the spreadsheet.

The emission reductions from the installation of the electrical motor were calculated as the reduction from the proposed emissions (without BACT) to zero. Even though BACT is only triggered for NOx and VOC emissions, the calculation in the attached spreadsheet conservatively assumes BACT is triggered for all pollutants since an electrical motor will result in zero emissions of each criteria pollutant (not including power plant emissions). Calculations in the attached spreadsheet are performed pursuant to Section X.B of District Policy APR 1305. The cost calculation is an estimate and likely does not represent the exact cost of installing either the basic or alternate basic equipment options. Additional costs may be incurred.

However, since the cost effective determination shows that this option is not cost effective for the engines in this project, no further cost information was gathered.

5 ppmvd NOx @ 15% 0_2 (Technologically Feasible) [S-6998-7-0 only]

The technologically feasible option for this class and category of source is a lean burn engine that emits no more than 5 ppmvd NOx at 15% 02. The emissions concentration is achievable via the use of a selective catalytic reduction (SCR) system. The costs are from the spreadsheet recently published on the intranet.

As demonstrated in the cost effectiveness analysis attached at the end of this appendix, 5 ppmv at 15% O2 is not cost effective for the proposed 469 bhp lean-burn natural gas-fired IC engine.

90 ppmvd at 15% O2 (achievable via rich-burn engine and 3 way catalyst or lean burn engine)

The only remaining control technology alternative in the ranking list from Step 3 has been achieved in practice. Therefore, per the District's BACT Policy (dated 11/9/99) Section IX.D.2, the cost effectiveness analysis is not required.

e. Step 5 - Select BACT

BACT for NO_X emissions from both AO stationary spark-ignited IC engine serving an irrigation pump is NOx emission limit of 90 ppmvd at 15% O_2 (achievable via rich-burn engine and 3 way catalyst or lean burn engine). The applicant has proposed to install a 469 bhp lean-burn natural gas IC engine with a NOx emission limit of 72 ppmvd at 15% O_2 (equivalent to 1.0 g/bhp-hr) and a 400 bhp rich-burn natural gas IC engine with a NOx emission limit of 90 ppmv at 15% Ox (equivalent to 1.3 g/bhp-hr); therefore BACT for NO_X emissions is satisfied for both engines.

2. BACT Analysis for VOC Emissions:

Volatile organic compounds (VOC) emissions are generated from the incomplete combustion of the fuel.

a. Step 1 - Identify all control technologies

The SJVUAPCD draft BACT Clearinghouse identifies BACT for VOC emissions as follows:

1) 50 ppmvd @ 15% O_2 (achievable via rich-burn engine and 3 way catalyst or lean burn engine) (Achieved in Practice)
2) Electrification (Alternate Basic Equipment)

b. Step 2 - Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate from step 1.

c. Step 3 - Rank remaining options by control effectiveness

1) 50 ppmvd @ 15% O_2 (achievable via rich-burn engine and 3 way catalyst or lean burn engine) (Achieved in Practice)

Since electrification was shown to be not cost-effective for NOx for this particular project, it will not be considered for this VOC top-down BACT analysis.

d. Step 4 - Cost effectiveness analysis

A cost effective analysis must be performed for all control options in the list from Step 3 in the order of their ranking to determine the cost effective option with the lowest emissions

The only control technology alternative in the ranking list from Step 3 has been achieved in practice. Therefore, per SJVUAPCD BACT policy, the cost effectiveness analysis is not required.

e. Step 5 - Select BACT

BACT for VOC emissions from this natural gas IC engine is 50 ppmvd @ 15% O2 (achievable via rich-burn engine and 3 way catalyst or lean burn engine). The applicant has proposed to install a 469 bhp lean-burn natural gas IC engine and a 400 bhp rich-burn natural gas IC engine with VOC emission limit of 50 ppmv at 15% O_2 (equivalent to 0.24 g/bhp-hr); therefore BACT for VOC emissions is satisfied for both engines.

BACT Cost Effectiveness Calculation
Agricultural Irrigation Pump Spark-Ignition IC Engine S-6998-7-0

Project Information Sheet

INFO FOR THE PROPOSED BASIC EQUIPMENT

Proposed Basic Equipment: Natural Gas-fired IC Engine

Power Rating:	469	bhp (for reference only)
Combustion Type:	Lean Burn	<= Either "Lean Burn" or "Rich Burn"
Fuel Type:	Natural Gas	<= Either "Natural Gas" or "LPG"
Operating Schedule:	5,600	hr/year
Annual Load Factor:	80%	(per FYI 275)
Brake Specific Fuel Consumption (BSFC)[1]:	10,100	Btu/bhp-hr
Fuel Cost[2]:	$7.75	$/1,000 scf
Fuel Higher Heating Value (HHV):	1,000	Btu/scf (APR 1720)
Thermal Efficiency of Engine:	35%	
Natural Gas IC Engine Cost[3]:	$350	per horsepower (bhp)

MISCELLANEOUS PROJECT INFO

Capital recovery factor (10%, 10 yrs):	0.163	
Convert bhp to kW:	0.7457	kW/bhp

BACT Cost Effectiveness Thresholds: *(Select "Yes" or "No" below for each pollutant)*

Pollutant	Is BACT Triggered?	Cost Effective Threshold, $/ton[4]
NOx	Yes	$24,500
SOx	No	0
PM_{10}	No	0
CO	No	0
VOC	Yes	$17,500

INFO FOR BACT ALTERNATE BASIC EQUIPMENT (ABE) OPTION

ABE Option 1: Electrical Motor

Cost to Electrify[5]:	$300.00	per horsepower (bhp)
Power Line Extension Distance[6]:	2,670	ft
Power Line Extension Cost[6]:	$43.22	per foot (average)
Electric Rate[7]:	$0.13628	per kW-hr
Daily PG&E Customer Charges[7]:	$1.38	
Electric rates increase by 1.5%/yr over 10 yrs:	1.16	
Miscellaneous Costs[8]:	4.0%	

INFO FOR BACT TECHNOLOGICALLY FEASIBLE OPTION

Tech. Feasible Option 1: NOx - 5 ppmvd @ 15% O2 (Lean-Burn Engines Only)

SCR System Capital Cost[9]:	$100,000	
Control Efficiency:	85%	
Fuel Penalty[10]:	2.50%	
Catalyst Replacement Cost[1]:	$5,000.00	per catalyst element
Catalyst Replacement Frequency[11]:	1	catalyst replacement per 10 years
Reagent (Urea) Cost[12]:	$3.00	per gallon delivered
Reagent (Urea) Usage Rate[12]:	0.0036	gal/bhp-hr

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NOTES AND REFERENCES

1. The spark-ignition IC engine BSFC is from CAPCOA Portable IC Engine Tech. Ref. Document, : http://www.eia.gov/dnav/ng/ng_sum_lsum_dcu_SCA_m.htm
2. NG fuel costs are from the following web site:

   http://www.eia.gov/dnav/ng/ng_sum_lsum_dcu_SCA_m.htm

3. Total cost for a complete SI IC engine (w/out catalyst) on the ground and pumping water is a low-end average cost based on information gathered from Mitch Torp of TGP West (805-610-4170) and Mark Peterson, of Valley Power Systems (559-485-6900), Jan 2015
4. BACT Cost Effective Thresholds May 2008 Update G:\Intranet_files\PER\policies\bact\may_2008_updates_to_bact_cost_effectiveness_thresholds.pdf
5. Per District SI Dept., Sept 2014, using data from electrical motor installation projects which the District has helped to fund. The cost to electrify an agricultural well site is approximately $300 per horsepower. This cost includes an electrical motor, a variable frequency drive (VFD), r/v starter, head shaft, misc. equip., tax, and labor
6. Per District SI Dept., 1/14/2015. This is the average distance and cost per foot of utility line extensions over 73 electric utility line extension projects which the District helped to fund. Use applicant/site specific information when available.
7. Electricity rate and daily customer charges are from PG&E website listed below for large Ag (35 hp+), high use (1500 hr/yr+), rate schedule 'AG-5B & AG-5E', summer peak rate. The below address links to the PG&E website and opens the most current cost information. Update this cost for each determination.

   http://www.pge.com/nots/rates/tariffs/LgAgCurrent.xls

8. Property tax, insurance, and administrative charges (typically 4% of total capital investment annually; from OAQPS Control Cost Manual, 4th Edition, January 1990)
9. Selective Catalytic Reduction (SCR) system costs to retrofit a lean-burn spark-ignition IC engine were provided by Johnson Matthey for project S-1143086 and include catalyst element, catalyst housing, sensors, exhaust ductwork, urea injection system with urea storage tank and air compressor, installation, taxes, and freight.
10. The use of add-on controls results in additional load on the IC engine. The additional load results in higher fuel combustion of about 2.5% more fuel than an uncontrolled engine.
11. Catalyst element replacement cost and life is per Joey Mier of MurCal, 1/5/2015
12. Urea cost and usage rate is per Mark Peterson of Valley Power Systems, Nov 2014. At full power output, urea consumption would be approximately 1 gal/hr for a 322 bhp IC engine (S-11430

COST EFFECTIVE ANALYSIS FOR AO IRRIGATION PUMP, ABE OPTION: DIESEL ENGINE VS. ELECTRICAL MOTOR

Pursuant to Section X.B of District Policy APR 1305, the cost effectiveness of ABE options is calculated using the following formula:

$CE_{alt} = (COST_{alt} - COST_{basic}) \div (EMISSION_{basic} - EMISSION_{alt})$

Where:

CE_{alt} = the cost effectiveness of the alternate basic equipment expressed as dollars per ton of emissions reduced

$COST_{alt}$ = the equivalent annual capital cost of the alternate basic equipment plus its annual operating cost

$COST_{basic}$ = the equivalent annual capital cost of the proposed basic equipment, without BACT, plus its annual operating cost

$EMISSION_{basic}$ = the emissions from the proposed basic equipment, without BACT

$EMISSION_{alt}$ = the emissions from the alternate basic equipment

Calculations

Determine $COST_{alt}$:

The costs of the ABE option include the following capital and annual costs:

Capital Costs:	-Electrical motor	-Security measures[1]	-installation costs including taxes
	-Variable frequency drive (VFD)	-Utility line extension	
Annual Costs:	-Electricity	-Customer charges	
	-Miscellaneous costs		

[1] Per the District's SI Dept., an electrical motor at an agricultural well site is a remote installation and therefore susceptible to theft and vandalism. A security enclosure is a common addition for new electrical well sites to help prevent from copper wire theft. The calculation below does not include this cost due to lack of specific costs for possible security measures.

The total annualized costs for the ABE option are calculated in the following table.

Power Rating (bhp)	Annualized Capital Cost of the Motor, $/year	Annualized Capital Cost for Line Extension, $/year	Annual Electricity Cost, $/year	Annual Misc. Costs, $/year	Annual Customer Charges, $/year	Total Capital and Annual Costs, ABE, $/year
50	$2,445	$18,809.78	$33,007.47	$5,215.90	$503.66	$59,981.80
100	$4,890	$18,809.78	$66,014.95	$5,815.90	$503.66	$96,034.28
150	$7,335	$18,809.78	$99,022.42	$6,415.90	$503.66	$132,086.75
200	$9,780	$18,809.78	$132,029.90	$7,015.90	$503.66	$168,139.22
250	$12,225	$18,809.78	$165,037.37	$7,615.90	$503.66	$204,191.70
300	$14,670	$18,809.78	$198,044.84	$8,215.90	$503.66	$240,244.17
400	$19,560	$18,809.78	$264,059.79	$9,415.90	$503.66	$312,349.12
500	$24,450	$18,809.78	$330,074.74	$10,615.90	$503.66	$384,454.07
600	$29,340	$18,809.78	$396,089.69	$11,815.90	$503.66	$456,559.02

S-6998-7-0

Determine $COST_{basic}$:

The cost of the proposed basic equipment includes the following capital and annual costs:

Capital Costs: Purchase of the diesel-fired IC engine

Annual Costs: Purchase of diesel fuel

The total annualized costs for the proposed basic equipment are calculated in the following table:

Power Rating (bhp)	Annualized SI IC Engine Capital Cost, $/year	Annual Fuel Cost, $/year	Total Cost of Proposed Basic Equip, $/year
50	$2,853	$17,534	$20,386
100	$5,705	$35,067	$40,772
150	$8,558	$52,601	$61,158
200	$11,410	$70,134	$81,544
250	$14,263	$87,668	$101,931
300	$17,115	$105,202	$122,317
400	$22,820	$140,269	$163,089
500	$28,525	$175,336	$203,861
600	$34,230	$210,403	$244,633

Determine $EMISSION_{basic}$:

The proposed basic equipment in this project is a spark-ignition IC engine.
Per APR 1305, EMISSIONbasic is the emissions from the proposed basic equipment, without BACT.
The emission factors in the table below are for the proposed engine, without BACT.

Category (Power Range)	NOx EF, (g/bhp-hr)	SOx EF, (g/bhp-hr)	PM_{10} EF, (g/bhp-hr)	CO EF, (g/bhp-hr)	VOC EF, (g/bhp-hr)
LB NG, 50 ≤ bhp < 100	1.3	0.0094	0.033	17.0	3.6
LB NG, 100 ≤ bhp < 500	1.0	0.0094	0.033	2.0	0.7
LB NG, 500 ≤ bhp < 1,350	1.0	0.0094	0.033	2.0	0.7

Determine $EMISSION_{alt}$:

An electrical motor is considered to result in no emissions of air contaminants (not considering power plant emissions).
Therefore, an electrical motor would result in reduction of all criteria pollutants vs. the proposed basic equipment.

Determine the Cost Effectiveness of the ABE Option

Per APR 1305, if a BACT option controls more than one type of air pollutant, calculate the Multi-Pollutant Cost Effectiveness Threshold (MCET) for the control option.
Since an electrical motor will result in no emissions for all pollutants (not including power plant emissions), the MCET will be calculated for this BACT option.

$$MCET = \Sigma(\text{Quantity of Emissions Reduced, ton/year x Cost Effective Threshold, \$/ton})_{\text{each pollutant}}$$

The quantity of emissions reduced and the MCET are calculated in the following table for each pollutant:

Power Rating (bhp)	NOx, ton/yr	SOx, ton/yr	PM_{10}, ton/yr	CO, ton/yr	VOC, ton/yr	MCET, $/year
50	0.3210	0.0023	0.0082	4.1975	0.8889	$23,420
100	0.4938	0.0046	0.0163	0.9877	0.3457	$18,148
150	0.7407	0.0070	0.0244	1.4815	0.5185	$27,222
200	0.9877	0.0093	0.0326	1.9753	0.6914	$36,296
250	1.2346	0.0116	0.0407	2.4691	0.8642	$45,370
300	1.4815	0.0139	0.0489	2.9630	1.0370	$54,444
400	1.9753	0.0186	0.0652	3.9506	1.3827	$72,593
500	2.4691	0.0232	0.0815	4.9383	1.7284	$90,741
600	2.9630	0.0279	0.0978	5.9259	2.0741	$108,889

Cost Effectiveness Determination

Determine whether the ABE option is cost effective:

Power Rating (bhp)	Total Capital and Annual Costs, ABE, $/year	Total Capital and Annual Costs, Proposed Basic Equip., $/year	Cost Difference (ABE - Basic Equipment), $/year	MCET, $/year	Is ABE Option Cost Effective?
50	$59,982	$20,386	$39,596	$23,420	No
100	$96,034	$40,772	$55,262	$18,148	No
150	$132,087	$61,158	$70,928	$27,222	No
200	$168,139	$81,544	$86,595	$36,296	No
250	$204,192	$101,931	$102,261	$45,370	No
300	$240,244	$122,317	$117,928	$54,444	No
400	$312,349	$163,089	$149,260	$72,593	No
500	$384,454	$203,861	$180,593	$90,741	No
600	$456,559	$244,633	$211,926	$108,889	No

COST EFFECTIVE ANALYSIS FOR STATIONARY AG IRRIGATION PUMP, TECH. FEAS. OPTION (NOx): SCR SYSTEM

Pursuant to Section X.A of District Policy APR 1305, the cost effectiveness of technologically feasible options is the control cost per ton of air pollutant reducec Cost effectiveness is calculated by dividing the total annual cost by the annual emission reduction for the air pollutant.

Calculations

Determine the Cost of the BACT Control Option:

The costs of the Technologically Feasible option include the following capital and annual costs:

Capital Costs:	-SCR System	-Miscellaneous Costs (installations, taxes, freight, etc.)
Annual Costs:	-Fuel Penalty	-Service/maintenance contract
	-Miscellaneous costs	-Catalyst element replacement
	-Urea (reaction agent) cost	

The total annualized costs for the technologically feasible option are calculated in the following table.

Power Rating (bhp)	Annualized Capital Cost of the SCR System, $/year	Annual Urea Cost, $/year	Fuel Penalty, $/year	Annualized Catalyst Replacement Cost, $/year	Total Capital and Annual Costs, Tech. Feas., $/year
50	$16,300	$3,024.00	$438	$815.00	$20,577.34
100	$16,300	$6,048.00	$877	$815.00	$24,039.68
150	$16,300	$9,072.00	$1,315	$815.00	$27,502.02
200	$16,300	$12,096.00	$1,753	$815.00	$30,964.36
250	$16,300	$15,120.00	$2,192	$815.00	$34,426.70
300	$16,300	$18,144.00	$2,630	$815.00	$37,889.04
400	$16,300	$24,192.00	$3,507	$815.00	$44,813.72
500	$16,300	$30,240.00	$4,383	$815.00	$51,738.40
600	$16,300	$36,288.00	$5,260	$815.00	$58,663.08

S-6998-7-0

Determine Emission Reductions from the Technologically Feasible Option:

The proposed basic equipment in this project is a spark-ignition IC engine.

Emission reductions for a range of power ratings are calculated below.

Industry standard emissions are assumed to be the most stringent emission standards from any Federal, State, or Local rule or regulation.

For a new spark-ignition IC engine with a power rating of less than 100 bhp, the NOx emission standard from District Rule 4702 is considered to be the industry standard.

For a new spark-ignition IC engine with a power rating of 100 bhp and greater, the NOx emission standard from 40 CFR Part 60, Subpart JJJJ is considered to be the industry standard.

Industry Standard NOx Emissions, New Spark-Ignition IC Engine

Category (Power Range)	NOx EF, (g/bhp-hr)
LB NG, 50 ≤ bhp < 100	1.3
LB NG, 100 ≤ bhp < 500	1.0
LB NG, 500 ≤ bhp < 1,350	1.0

Cost Effectiveness Determination

Determine whether the ABE option is cost effective.

Pursuant to District Policy APR 1305, the emission reduction for technologically feasible options is calculated as the difference between industry standard emissions and the technologically feasible emission concentration. If the control cost per ton exceeds the cost effectiveness threshold, the BACT control option is not required.

Power Rating (bhp)	Total Capital and Annual Costs, Tech. Feas. Option, $/year	NOx Emission Reductions, ton/year	Control Cost, $/ton-NOx reduced	NOx Cost Effective Threshold, $/ton	Is ABE Option Cost Effective?
50	$20,577	0.27	$76,212	$24,500	No
100	$24,040	0.42	$57,237	$24,500	No
150	$27,502	0.63	$43,654	$24,500	No
200	$30,964	0.84	$36,862	$24,500	No
250	$34,427	1.05	$32,787	$24,500	No
300	$37,889	1.26	$30,071	$24,500	No
400	$44,814	1.68	$26,675	$24,500	No
500	$51,738	2.10	$24,637	$24,500	No
600	$58,663	2.52	$23,279	$24,500	Yes

BACT Cost Effectiveness Calculation
Agricultural Irrigation Pump Spark-Ignition IC Engine

Project Information Sheet

S-6998-8-0

INFO FOR THE PROPOSED BASIC EQUIPMENT

Proposed Basic Equipment: Natural Gas-fired IC Engine

Power Rating:	400	bhp (for reference only)
Combustion Type:	Rich Burn	<= Either "Lean Burn" or "Rich Burn"
Fuel Type:	Natural Gas	<= Either "Natural Gas" or "LPG"
Operating Schedule:	8,760	hr/year
Annual Load Factor:	80%	(per FYI 275)
Brake Specific Fuel Consumption (BSFC)[1]:	10,100	Btu/bhp-hr
Fuel Cost[2]:	$7.75	$/1,000 scf
Fuel Higher Heating Value (HHV):	1,000	Btu/scf (APR 1720)
Thermal Efficiency of Engine:	35%	
Natural Gas IC Engine Cost[3]:	$350	per horsepower (bhp)

MISCELLANEOUS PROJECT INFO

Capital recovery factor (10%, 10 yrs):	0.163	
Convert bhp to kW:	0.7457	kW/bhp

BACT Cost Effectiveness Thresholds: *(Select "Yes" or "No" below for each pollutant)*

Pollutant	Is BACT Triggered?	Cost Effective Threshold, $/ton[4]
NOx	Yes	$24,500
SOx	No	0
PM_{10}	No	0
CO	No	0
VOC	Yes	$17,500

INFO FOR BACT ALTERNATE BASIC EQUIPMENT (ABE) OPTION

ABE Option 1: Electrical Motor

Cost to Electrify[5]:	$300.00	per horsepower (bhp)
Power Line Extension Distance[6]:	50	ft
Power Line Extension Cost[6]:	$43.22	per foot (average)
Electric Rate[7]:	$0.13628	per kW-hr
Daily PG&E Customer Charges[7]:	$1.38	
Electric rates increase by 1.5%/yr over 10 yrs:	1.16	
Miscellaneous Costs[8]:	4.0%	

INFO FOR BACT TECHNOLOGICALLY FEASIBLE OPTION

Tech. Feasible Option 1: NOx - 5 ppmvd @ 15% O2 (Lean-Burn Engines Only)

SCR System Capital Cost[9]:	$100,000	
Control Efficiency:	85%	
Fuel Penalty[10]:	2.50%	
Catalyst Replacement Cost[11]:	$5,000.00	per catalyst element
Catalyst Replacement Frequency[11]:	1	catalyst replacement per 10 years
Reagent (Urea) Cost[12]:	$3.00	per gallon delivered
Reagent (Urea) Usage Rate[12]:	0.0036	gal/bhp-hr

NOTES AND REFERENCES

1. The spark-ignition IC engine BSFC is from CAPCOA Portable IC Engine Tech. Ref. Document, : http://www.eia.gov/dnav/ng/ng_sum_lsum_dcu_SCA_m.htm
2. NG fuel costs are from the following web site:

   http://www.eia.gov/dnav/ng/ng_sum_lsum_dcu_SCA_m.htm
3. Total cost for a complete SI IC engine (w/out catalyst) on the ground and pumping water is a low-end average cost based on information gathered from Mitch Torp of TGP West (805-610-4170) and Mark Peterson, of Valley Power Systems (559-485-6900), Jan 2015
4. BACT Cost Effective Thresholds May 2008 Update G:\Intranet_files\PER\policies\bact\may_2008_updates_to_bact_cost_effectiveness_thresholds.pdf
5. Per District SI Dept., Sept 2014, using data from electrical motor installation projects which the District has helped to fund. The cost to electrify an agricultural well site is approximately $300 per horsepower. This cost includes an electrical motor, a variable frequency drive (VFD), r/v starter, head shaft, misc. equip., tax, and labor
6. Per District SI Dept., 1/14/2015. This is the average distance and cost per foot of utility line extensions over 73 electric utility line extension projects which the District helped to fund. Use applicant/site specific information when available.
7. Electricity rate and daily customer charges are from PG&E website listed below for large Ag (35 hp+), high use (1500 hr/yr+), rate schedule 'AG-5B & AG-5E', summer peak rate. The below address links to the PG&E website and opens the most current cost information. Update this cost for each determination.

   http://www.pge.com/nots/rates/tariffs/LgAgCurrent.xls
8. Property tax, insurance, and administrative charges (typically 4% of total capital investment annually; from OAQPS Control Cost Manual, 4th Edition, January 1990)
9. Selective Catalytic Reduction (SCR) system costs to retrofit a lean-burn spark-ignition IC engine were provided by Johnson Matthey for project S-1143086 and include catalyst element, catalyst housing, sensors, exhaust ductwork, urea injection system with urea storage tank and air compressor, installation, taxes, and freight.
10. The use of add-on controls results in additional load on the IC engine. The additional load results in higher fuel combustion of about 2.5% more fuel than an uncontrolled engine.
11. Catalyst element replacement cost and life is per Joey Mier of MurCal, 1/5/2015
12. Urea cost and usage rate is per Mark Peterson of Valley Power Systems, Nov 2014. At full power output, urea consumption would be approximately 1 gal/hr for a 322 bhp IC engine (S-11430

COST EFFECTIVE ANALYSIS FOR AO IRRIGATION PUMP, ABE OPTION: DIESEL ENGINE VS. ELECTRICAL MOTOR

Pursuant to Section X.B of District Policy APR 1305, the cost effectiveness of ABE options is calculated using the following formula:

$CE_{alt} = (COST_{alt} - COST_{basic}) \div (EMISSION_{basic} - EMISSION_{alt})$

Where:

CE_{alt} = the cost effectiveness of the alternate basic equipment expressed as dollars per ton of emissions reduced

$COST_{alt}$ = the equivalent annual capital cost of the alternate basic equipment plus its annual operating cost

$COST_{basic}$ = the equivalent annual capital cost of the proposed basic equipment, without BACT, plus its annual operating cost

$EMISSION_{basic}$ = the emissions from the proposed basic equipment, without BACT

$EMISSION_{alt}$ = the emissions from the alternate basic equipment

Calculations

Determine $COST_{alt}$:

The costs of the ABE option include the following capital and annual costs:

Capital Costs:	-Electrical motor	-Security measures[1]	-installation costs including taxes
	-Variable frequency drive (VFD)	-Utility line extension	
Annual Costs:	-Electricity	-Customer charges	
	-Miscellaneous costs		

[1] Per the District's SI Dept., an electrical motor at an agricultural well site is a remote installation and therefore susceptible to theft and vandalism. A security enclosure is a common addition for new electrical well sites to help prevent from copper wire theft. The calculation below does not include this cost due to lack of specific costs for possible security measures.

The total annualized costs for the ABE option are calculated in the following table.

Power Rating (bhp)	Annualized Capital Cost of the Motor, $/year	Annualized Capital Cost for Line Extension, $/year	Annual Electricity Cost, $/year	Annual Misc. Costs, $/year	Annual Customer Charges, $/year	Total Capital and Annual Costs, ABE, $/year
50	$2,445	$352.24	$51,633.12	$686.44	$503.66	$55,620.46
100	$4,890	$352.24	$103,266.24	$1,286.44	$503.66	$110,298.58
150	$7,335	$352.24	$154,899.36	$1,886.44	$503.66	$164,976.70
200	$9,780	$352.24	$206,532.48	$2,486.44	$503.66	$219,654.82
250	$12,225	$352.24	$258,165.60	$3,086.44	$503.66	$274,332.94
300	$14,670	$352.24	$309,798.72	$3,686.44	$503.66	$329,011.06
400	$19,560	$352.24	$413,064.96	$4,886.44	$503.66	$438,367.30
500	$24,450	$352.24	$516,331.20	$6,086.44	$503.66	$547,723.54
600	$29,340	$352.24	$619,597.44	$7,286.44	$503.66	$657,079.78

Determine $COST_{basic}$:

The cost of the proposed basic equipment includes the following capital and annual costs:

Capital Costs: Purchase of the diesel-fired IC engine

Annual Costs: Purchase of diesel fuel

The total annualized costs for the proposed basic equipment are calculated in the following table:

Power Rating (bhp)	Annualized SI IC Engine Capital Cost, $/year	Annual Fuel Cost, $/year	Total Cost of Proposed Basic Equip, $/year
50	$2,853	$27,428	$30,280
100	$5,705	$54,855	$60,560
150	$8,558	$82,283	$90,840
200	$11,410	$109,710	$121,120
250	$14,263	$137,138	$151,400
300	$17,115	$164,565	$181,680
400	$22,820	$219,420	$242,240
500	$28,525	$274,276	$302,801
600	$34,230	$329,131	$363,361

Determine $EMISSION_{basic}$:

The proposed basic equipment in this project is a spark-ignition IC engine.
Per APR 1305, EMISSIONbasic is the emissions from the proposed basic equipment, without BACT.
The emission factors in the table below are for the proposed engine, without BACT.

Category (Power Range)	NOx EF, (g/bhp-hr)	SOx EF, (g/bhp-hr)	PM_{10} EF, (g/bhp-hr)	CO EF, (g/bhp-hr)	VOC EF, (g/bhp-hr)
RB NG, 50 ≤ bhp < 100	1.3	0.0094	0.064	17.0	1.2
RB NG, 100 ≤ bhp < 500	1.3	0.0094	0.064	0.6	0.2
RB NG, bhp ≥ 500	2.0	0.0094	0.064	4.0	1.0

Determine $EMISSION_{alt}$:

An electrical motor is considered to result in no emissions of air contaminants (not considering power plant emissions).
Therefore, an electrical motor would result in reduction of all criteria pollutants vs. the proposed basic equipment.

Determine the Cost Effectiveness of the ABE Option

Per APR 1305, if a BACT option controls more than one type of air pollutant, calculate the Multi-Pollutant Cost Effectiveness Threshold (MCET) for the control option.
Since an electrical motor will result in no emissions for all pollutants (not including power plant emissions), the MCET will be calculated for this BACT option.

$$MCET = \Sigma(\text{Quantity of Emissions Reduced, ton/year} \times \text{Cost Effective Threshold, \$/ton})_{\text{each pollutant}}$$

The quantity of emissions reduced and the MCET are calculated in the following table for each pollutant:

Power Rating (bhp)	NOx, ton/yr	SOx, ton/yr	PM_{10}, ton/yr	CO, ton/yr	VOC, ton/yr	MCET, $/year
50	0.5021	0.0036	0.0247	6.5661	0.4635	$20,413
100	1.0042	0.0073	0.0494	0.4635	0.1622	$27,442
150	1.5064	0.0109	0.0742	0.6952	0.2433	$41,164
200	2.0085	0.0145	0.0989	0.9270	0.3244	$54,885
250	2.5106	0.0182	0.1236	1.1587	0.4056	$68,607
300	3.0127	0.0218	0.1483	1.3905	0.4867	$82,328
400	4.0169	0.0291	0.1978	1.8540	0.6489	$109,770
500	7.7249	0.0363	0.2472	15.4497	3.8624	$256,852
600	9.2698	0.0436	0.2966	18.5397	4.6349	$308,222

Cost Effectiveness Determination

Determine whether the ABE option is cost effective:

Power Rating (bhp)	Total Capital and Annual Costs, ABE, $/year	Total Capital and Annual Costs, Proposed Basic Equip., $/year	Cost Difference (ABE - Basic Equipment), $/year	MCET, $/year	Is ABE Option Cost Effective?
50	$55,620	$30,280	$25,340	$20,413	No
100	$110,299	$60,560	$49,738	$27,442	No
150	$164,977	$90,840	$74,137	$41,164	No
200	$219,655	$121,120	$98,535	$54,885	No
250	$274,333	$151,400	$122,933	$68,607	No
300	$329,011	$181,680	$147,331	$82,328	No
400	$438,367	$242,240	$196,127	$109,770	No
500	$547,724	$302,801	$244,923	$256,852	Yes
600	$657,080	$363,361	$293,719	$308,222	Yes

Appendix C
HRA Summary and AAQA Analysis

San Joaquin Valley Air Pollution Control District
Risk Management Review

To:	Sandra Lowe-Leseth – Permit Services
From:	Tadeh – Technical Services
Date:	January 15, 2016
Facility Name:	DJ Dairy, LLC
Location:	4390 Avenue 352, Kingsburg, CA
Application #(s):	S-6998-7-0 & -8-0
Project #:	S-1151244

A. RMR SUMMARY

RMR Summary				
Categories	**469 BHP NG ICE (Unit 7-0)**	**400 BHP NG ICE (Unit 8-0)**	**Project Totals**	**Facility Totals**
Prioritization Score	0.04*	0.05*	0.09	<1.0
Acute Hazard Index	N/A	N/A	N/A	N/A
Chronic Hazard Index	N/A	N/A	N/A	N/A
Maximum Individual Cancer Risk	N/A	N/A	N/A	N/A
T-BACT Required?	**No**	**No**		
Special Permit Conditions?	**No**	**No**		

*The project passed on prioritization with a score less than 1; therefore, no further analysis was required.

B. RMR REPORT

I. Project Description

Technical Services received a request on January 4, 2016 to perform an Ambient Air Quality Analysis and a Risk Management Review for a proposed installation of two stationary natural gas-fired IC engines with horizontal exhaust discharge, powering agricultural irrigation pumps. One unit is a 469 bhp Dresser Rand Model SFDLD180 engine with an oxidizing catalyst installed for VOC compliance. The other unit is a 400 bhp Caterpillar Model 3408 TA engine with a District-certified Mur-Cal SNGEC system and an oxidizing catalyst.

II. Analysis

Toxic emissions for this proposed unit were calculated using Ventura County's emission factors for Natural Gas Fired internal combustion (4 Stroke Lean Burn Engine & 4 Stroke Rich Burn Engine). In accordance with the District's *Risk Management Policy for Permitting New and Modified Sources* (APR 1905, March 2, 2001), risks from the proposed unit's toxic

emissions were prioritized using the procedure in the 1990 CAPCOA Facility Prioritization Guidelines and incorporated in the District's HEARTs database. The prioritization score for this proposed unit was less than 1.0 (see RMR Summary Table). Therefore, no further analysis was necessary.

The following parameters were used for the review:

Analysis Parameters Unit 7-0			
NG Usage Rates (mmscf/hr)	0.003	**Max Hours per Year**	5600
NG Usage Rates (mmscf/yr)	19.08	**Type of Closest Receptor**	Business
		Closest Receptor (m)	1722

Analysis Parameters Unit 8-0			
NG Usage Rates (mmscf/hr)	0.003	**Max Hours per Year**	8760
NG Usage Rates (mmscf/yr)	25.45	**Type of Closest Receptor**	Business
		Closest Receptor (m)	1318

Technical Services performed modeling for criteria pollutants CO, NOx, SOx and PM_{10}; as well as a RMR. The emission rates used for criteria pollutant modeling were 1.86(unit 7),7.49(unit 8) lb/hr CO, 1.03(unit7), 1.15 lb/hr NOx, 0.01(unit7), 0.01(unit8) lb/hr SOx, and 0.03(unit7), 0.03(unit8) lb/hr PM_{10}. The engineer supplied the maximum fuel rate for the IC engine used during the analysis.

The results from the Criteria Pollutant Modeling are as follows:

Criteria Pollutant Modeling Results*

Diesel ICE	1 Hour	3 Hours	8 Hours.	24 Hours	Annual
CO	Pass	X	Pass	X	X
NO_x	Pass[1]	X	X	X	Pass
SO_x	Pass	Pass	X	Pass	Pass
PM_{10}	X	X	X	Pass[2]	Pass[2]
$PM_{2.5}$	X	X	X	Pass[2]	Pass[2]

*Results were taken from the attached PSD spreadsheet.
[1]The project was compared to the 1-hour NO2 National Ambient Air Quality Standard that became effective on April 12, 2010 using the District's approved procedures.] The Ozone Limiting Method (OLM) or Plume Volume Molar Ratio Method (PVMRM) was used in accordance with the District's *Assessment of Non-Regulatory Options in AERMOD – Specifically OLM.* A completed AERMOD Non-Regulatory Option checklist is attached.
[2]The criteria pollutants are below EPA's level of significance as found in 40 CFR Part 51.165 (b)(2).

III. Conclusion

The prioritization score is less than 1.0. **In accordance with the District's Risk Management Policy, the project is approved without Toxic Best Available Control Technology (T-BACT).**

These conclusions are based on the data provided by the applicant and the project engineer. Therefore, this analysis is valid only as long as the proposed data and parameters do not change.

The emissions from the proposed equipment will not cause or contribute significantly to a violation of the State and National AAQS.

IV. Attachments

A. RMR request from the project engineer
B. Additional information from the applicant/project engineer
C. Prioritization score
D. AAQA
E. Facility Summary

Appendix D
Engine Manufacturer's Emissions Guarantee
and
Catalyst Sizing Data Sheet

S-6998-7-0

DRESSER-RAND / Guascor	GROUP	PRODUCT INFORMATION	INDEX
	IC	GAS	IC-G-B-18-033	C
	POWER RATING	DATE 27/10/05	PAG. 2

ENGINE:	SFGLD 180	SPEED:	1800
JACKET WATER TEMPERATURE(ºF):	194	FUEL TYPE:	NATURAL GAS
INTERCOOLER WATER TEMP(ºF):	131		

APPLICATION:	CONTINUOUS	COMPRESSION RATIO:	11.6:1
COOLING SYSTEM:	TWO CIRCUITS	REGULATION:	Electronic
		IGNITION TIMING:	18º
EXHAUST MANIFOLD TYPE:	WATER COOLED	MAX. BACK PRESSURE:	18 "H2O (450 mmH2O)
EMISSIONS:			
NOX	g/bHPh 1	AMBIENT CONDITIONS ISO 3046/1:	
CO	g/bHPh <1,8	Atmospheric pressure ("Hg)=	30 (100)
NMHC	g/bHPh <0,7	Ambient temperature (ºF)=	77 (25)
		Relative humidity (%)=	30

POWER RATING (4)			NOMINAL	PARTIAL LOADS		
LOAD		%	100%	80%	60%	40%
MECHANICAL POWER	(3, 4, 5)	BHP (KWb)	469 (350)	375 (280)	282 (210)	188 (140)
BMEP		psi (bar)	189 (13.0)	151 (10.4)	113 (7.8)	75 (5.2)
FUEL CONSUMPTION	(1)	BTU/bHP-hr (KW)	6555 (901)	6852 (753)	7345 (607)	8259 (455)
THERMAL EFFICIENCY		%	38.8	37.2	34.6	30.8
HEAT IN MAIN WATER CIRCUIT	(1)	BTU/min (KW)	11830 (208)	10690 (188)	9610 (169)	8470 (149)
HEAT IN SECONDARY WATER CIRCUIT	(1)	BTU/min (KW)	5858 (103)	4606 (81)	3526 (62)	2388 (42)
HEAT IN CHARGE COOLER	(1)	BTU/min (KW)	3810 (67)	2673 (47)	1706 (30)	796 (14)
HEAT IN OIL COOLER	(1)	BTU/min (KW)	2047 (36)	1934 (34)	1820 (32)	1592 (28)
HEAT IN EXHAUST GASES (25 ºC)	(1)	BTU/min (KW)	12800 (225)	10860 (191)	8760 (154)	6540 (115)
HEAT IN EXHAUST GASES (120ºC)	(1)	BTU/min (KW)	9510 (167)	8140 (143)	6630 (117)	4990 (88)
EXHAUST GAS TEMPERATURE	(1)	ºF (ºC)	747 (397)	765 (407)	783 (417)	797 (425)
HEAT TO RADIATION	(1)	BTU/min (KW)	853 (15)	739 (13)	682 (12)	512 (9)
CARBURETION SETTINGS (2)						
O2 TO EXHAUST(DRY)(ONLY A REFERENCE)		%	9.0	8.8	8.7	8.5
MASS FLOWS						
INTAKE AIR FLOW	(1)	lb/h (Kg/h)	4010 (1820)	3320 (1500)	2610 (1180)	1910 (870)
EXHAUST GAS FLOW (WET)	(1)	lb/h (Kg/h)	4160 (1890)	3440 (1560)	2700 (1230)	1980 (900)

NOTES:

1. 100% LOAD TOLERANCES:
   FUEL CONSUMPTION +5%,
   COOLING CIRCUIT AND EXHAUST GASES ± 8%, RADIATION ±25%
   EXHAUST TEMPERATURE ±20ºC, MASS FLOWS ± 10%.
2. THE ENGINE PERFORMANCE DATA, TIMING ADVANCE AND CARBURETION SETTINGS ARE VALID FOR A GAS THAT FULFILS THE REQUIREMENTS DEFINED IN IC-G-D-30-001 AND IC-G-D-30-002
3. NET POWER, MECHANICAL PUMPS NOT INCLUDED.
4. POWERS ARE VALID FOR AMBIENT TEMP.=77ºF (25 ºC) AND AN ALTITUDE OF =1640ft (500 m). SEE OTHER CONDITIONS IN IC-G-B-00-001
5. OVERLOAD NOT ALLOWED
6. THE SPECIFICATIONS AND MATERIALS ARE SUBJECT TO CHANGE WITHOUT NOTIFICATION
7. A ENGINE WITH INLET OR OUTPUT RESTRICTION OVER PUBLISHED LIMITS, OR WITH INADEQUATE MAINTENANCE OR INSTALLATION CAN MODIFY POWER RATING DATA.
8. NMHC IN C1 BASE

S-6998-7-0

ADVANCED CATALYST SYSTEMS, LLC

GT EXHAUST

iac acoustics

ICE Catalyst Sizing Program

ENGINE INPUT - Guascor SFGLD 180 469HP @ 1800 RPM

Input Mass Flow Rate

	lbs/hr	"scfm"	"scfh"	"acfm"	"acfh"	Estimated Exhaust Gas Composition		
lb/hr(Estimated):	3,859	872	52,319	2024	121,440	N2	74.5	vol%
Brake Horse Power:	469					O2	10	vol%
			Maximum Pressure Drop (in)		10	H2O	10	vol%
Molecular weight:	28.50		0.032	Exhaust Density (lbs/ft3)		CO2	6	vol%

Inlet Temperature

Process Temperature (F): 747

Permit Requirements (g/bhp-hr)

NOx**	CO**	VOC(NMNE)**	H2CO**
	.5	.57	

Catalyst Type

NG/Diesel (Lean)

Catalyst Module Details

Module Shape	Round	Diam (inch)	Module/Layer	1	Layers	1
			18.5		cpsi	300
					Depth	3.5

Open area for gas flow (ft2):	1.15				
Linear Velocity(ft/min):	1,765	Calculated Space Velocity:	158,426	Safety Value	2
Foil thickness (inches):	0.002				

Pressure Drop

300	2.93

Catalyst Inlet Pollutants

	g/bhp-hr	lb/hr	tons/year	ppmv	ppmvd%O2*
NOx	1	1.03	4.53	163.09	88.28
CO	1.8	1.86	8.15	163.09	158.90
VOC	.7	0.72	3.17	114.17	61.80
H2CO	0	0.00	0.00	0.00	0.00

Target Conversions

NOx	0%
CO	72.2%
VOC(NMNE)	18.6%
H2CO	0%

Guaranteed Catalyst Output (* not to exceed)**

	g/bhp-hr	lb/hr	tons/year	ppmv	ppmvd%O2*
NOx	1	1.03	4.53	163.09	163.09
CO	.5	0.52	2.26	81.55	44.00
VOC	.57	0.59	2.58	92.97	50.00
H2CO	0	0.00	0.00	NaN	NaN

Conversions Catalyst Design

NOx	0.00%
CO	95.96%
VOC(NMNE)	79.62%
H2CO	94.86%

Expected Output Pollutants with Catalyst Sizing

	g/bhp-hr	lb/hr	tons/year	ppmv	ppmvd%O2*
NOx	1.00	1.03	4.53	163.09	88.28
CO	0.05	0.06	0.25	8.91	4.82
VOC	0.14	0.15	0.65	23.27	12.60
H2CO	0.00	0.00	0.00	0.00	0.00

Customer: Valley Power Systems
Sales Person: TH
Date: 4-2-15
Project: Tri-Bak Dairy
Contact: Mark Peterson

* Calculated ppm at 15% Oxygen. Estimated with O2 value provided in "Estimated Exhaust Gas Composition". For accurate value insert actual engine O2.

** Insert required conversion rates.

***Catalyst output pollutants subject to proper engine operation, inlet pollutants not to exceed manufacturers stated values

5-6998-8-0

G3408

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1800	RATING STRATEGY:	STANDARD
COMPRESSION RATIO:	8.5:1	APPLICATION:	GAS COMPRESSION
AFTERCOOLER TYPE:	SCAC	RATING LEVEL:	CONTINUOUS
AFTERCOOLER WATER INLET (°F):	130	FUEL:	NAT GAS
JACKET WATER OUTLET (°F):	210	FUEL SYSTEM:	HPG IMPCO
ASPIRATION:	TA	FUEL PRESSURE RANGE(psig):	20.0-25.0
COOLING SYSTEM:	JW+OC, AC	FUEL METHANE NUMBER:	80
CONTROL SYSTEM:	CDIS	FUEL LHV (Btu/scf):	905
EXHAUST MANIFOLD:	WC	ALTITUDE CAPABILITY AT 77°F INLET AIR TEMP. (ft):	5000
COMBUSTION:	STANDARD SETTING		
EXHAUST OXYGEN (% O2):	2.0		

RATING		NOTES	LOAD	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(1)	bhp	400	300	200
ENGINE EFFICIENCY	(ISO 3046/1)	(2)	%	36.0	34.3	31.7
ENGINE EFFICIENCY	(NOMINAL)	(2)	%	36.0	34.3	31.7
ENGINE DATA						
FUEL CONSUMPTION	(ISO 3046/1)	(3)	Btu/bhp-hr	7076	7423	8038
FUEL CONSUMPTION	(NOMINAL)	(3)	Btu/bhp-hr	7076	7423	8038
AIR FLOW (77°F, 14.7 psia)	(WET)	(4) (5)	ft3/min	558	442	324
AIR FLOW	(WET)	(4) (5)	lb/hr	2474	1958	1439
FUEL FLOW (60°F, 14.7 psia)			scfm	52	41	30
COMPRESSOR OUT PRESSURE			in Hg(abs)	56.0	51.6	41.4
COMPRESSOR OUT TEMPERATURE			°F	248	224	174
AFTERCOOLER AIR OUT TEMPERATURE			°F	134	132	129
INLET MAN. PRESSURE		(6)	in Hg(abs)	52.6	42.3	31.6
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(7)	°F	142	142	143
TIMING		(8)	°BTDC	32	32	32
EXHAUST TEMPERATURE - ENGINE OUTLET		(9)	°F	914	867	817
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(10) (5)	ft3/min	1590	1215	858
EXHAUST GAS MASS FLOW	(WET)	(10) (5)	lb/hr	2617	2070	1520
EMISSIONS DATA - ENGINE OUT						
NOx (as NO2)		(11)(12)	g/bhp-hr	26.25	22.78	16.57
CO		(11)(13)	g/bhp-hr	1.60	1.60	1.60
THC (mol. wt. of 15.84)		(11)(13)	g/bhp-hr	1.60	1.70	2.10
NMHC (mol. wt. of 15.84)		(11)(13)	g/bhp-hr	0.24	0.26	0.32
NMNEHC (VOCs) (mol. wt. of 15.84)		(11)(13)(14)	g/bhp-hr	0.16	0.17	0.21
HCHO (Formaldehyde)		(11)(13)	g/bhp-hr	0.19	0.21	0.26
CO2		(11)(13)	g/bhp-hr	459	482	522
EXHAUST OXYGEN		(11)(15)	% DRY	2.0	3.3	3.6
LAMBDA		(11)(15)		1.09	1.10	1.12
ENERGY BALANCE DATA						
LHV INPUT		(16)	Btu/min	47132	37080	26794
HEAT REJECTION TO JACKET WATER (JW)		(17)(23)	Btu/min	14367	12365	10023
HEAT REJECTION TO ATMOSPHERE		(18)	Btu/min	1885	1483	1072
HEAT REJECTION TO LUBE OIL (OC)		(19)(23)	Btu/min	2272	1955	1585
HEAT REJECTION TO EXHAUST (LHV TO 77°F)		(20)(21)	Btu/min	10371	7741	5340
HEAT REJECTION TO EXHAUST (LHV TO 350°F)		(20)	Btu/min	6820	4932	3255
HEAT REJECTION TO AFTERCOOLER (AC)		(22)(24)	Btu/min	1289	825	292

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1. (Standard reference conditions of 77°F, 29.60 in Hg barometric pressure.) No overload permitted at rating shown. Consult the altitude deration factor chart for applications that exceed the rated altitude or temperature.

Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions. Tolerances specified are dependent upon fuel quality. Fuel methane number cannot vary more than ± 3. Part load data may require engine adjustment.

For notes information consult page three.

FUEL USAGE GUIDE

CAT METHANE NUMBER	29	30	35	40	45	50	55	60	65	70	75	80	100
SET POINT TIMING	-	16	17	19	20	20	22	24	26	28	30	32	32
DERATION FACTOR	0	0.90	0.90	0.90	0.90	1	1	1	1	1	1	1	1

ALTITUDE DERATION FACTORS AT RATED SPEED

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1	1	1	0.98	0.95	0.91	0.88	0.84	0.81	0.78	0.75	0.72	0.69
120	1	1	1	1	0.96	0.93	0.89	0.86	0.82	0.79	0.76	0.73	0.70
110	1	1	1	1	0.98	0.94	0.91	0.87	0.84	0.80	0.77	0.74	0.71
100	1	1	1	1	1	0.96	0.92	0.89	0.85	0.82	0.79	0.75	0.72
90	1	1	1	1	1	0.98	0.94	0.90	0.87	0.83	0.80	0.77	0.74
80	1	1	1	1	1	0.99	0.96	0.92	0.88	0.85	0.81	0.78	0.75
70	1	1	1	1	1	1	0.97	0.94	0.90	0.86	0.83	0.80	0.76
60	1	1	1	1	1	1	0.99	0.95	0.92	0.88	0.85	0.81	0.78
50	1	1	1	1	1	1	1	0.97	0.94	0.90	0.86	0.83	0.79

ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1.55	1.65	1.75	1.85	1.96	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07
120	1.44	1.53	1.63	1.74	1.84	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
110	1.32	1.42	1.52	1.62	1.72	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82
100	1.21	1.31	1.40	1.50	1.60	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
90	1.10	1.19	1.29	1.38	1.48	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58
80	1	1.08	1.17	1.27	1.36	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46
70	1	1	1.06	1.15	1.25	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34
60	1	1	1	1.03	1.13	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
50	1	1	1	1	1.01	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10

ALTITUDE (FEET ABOVE SEA LEVEL)

MINIMUM SPEED CAPABILITY AT THE RATED SPEED'S SITE TORQUE (RPM)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1670	1720	1780	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
120	1640	1700	1750	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
110	1620	1670	1730	1780	1800	1800	1800	1800	1800	1800	1800	1800	1800
100	1540	1650	1700	1760	1800	1800	1800	1800	1800	1800	1800	1800	1800
90	1400	1620	1680	1730	1780	1800	1800	1800	1800	1800	1800	1800	1800
80	1400	1550	1650	1710	1760	1800	1800	1800	1800	1800	1800	1800	1800
70	1400	1400	1620	1680	1730	1790	1800	1800	1800	1800	1800	1800	1800
60	1400	1400	1550	1650	1710	1760	1800	1800	1800	1800	1800	1800	1800
50	1400	1400	1400	1620	1680	1730	1790	1800	1800	1800	1800	1800	1800

ALTITUDE (FEET ABOVE SEA LEVEL)

FUEL USAGE GUIDE:
This table shows the derate factor and full load set point timing required for a given fuel. Note that deration and set point timing reduction may be required as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar methane number calculation program.

ALTITUDE DERATION FACTORS:
This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site.

ACTUAL ENGINE RATING:
To determine the actual rating of the engine at site conditions, one must consider separately, limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/Temperature deration factors and RPC (reference the Caterpillar Methane Program) establish air system limitations. RPC comes into play when the Altitude/Temperature deration is less than 1.0 (100%). Under this condition, add the two factors together. When the site conditions do not require an Altitude/Temperature derate (factor is 1.0), it is assumed the turbocharger has sufficient capability to overcome the low fuel relative power, and RPC is ignored. To determine the actual power available, take the lowest rating between 1) and 2).

AFTERCOOLER HEAT REJECTION FACTORS(ACHRF):
To maintain a constant air inlet manifold temperature, as the inlet air temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor (ACHRF) to adjust for inlet air temp and altitude conditions. See note 24 for application of this factor in calculating the heat exchanger sizing criteria. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail.

MINIMUM SPEED CAPABILITY AT THE RATED SPEED'S SITE TORQUE (RPM):
This table shows the minimum allowable engine turndown speed where the engine will maintain the Rated Speed's Torque for the given ambient conditions.

NOTES:
1. Engine rating is with two engine driven water pumps. Tolerance is ± 3% of full load.
2. ISO 3046/1 engine efficiency tolerance is (+)0, (-)5% of full load % efficiency value. Nominal engine efficiency tolerance is ± 5.0% of full loac % efficiency value.
3. ISO 3046/1 fuel consumption tolerance is (+)5, (-)0% of full load data. Nominal fuel consumption tolerance is ± 5.0% of full load data.
4. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.
5. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.
6. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.
7. Inlet manifold temperature is a nominal value with a tolerance of ± 9°F.
8. Timing indicated is for use with the minimum fuel methane number specified. Consult the appropriate fuel usage guide for timing at other methane numbers.
9. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
10. Exhaust flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 6 %.
11. Emissions data is at engine exhaust flange prior to any after treatment.
12. NOx values are "Not to Exceed".
13. CO, CO2, THC, NMHC, NMNEHC, and HCHO values are "Not to Exceed" levels. THC, NMHC, and NMNEHC do not include aldehydes.
14. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
15. Exhaust Oxygen tolerance is ± 0.5.
16. LHV rate tolerance is ± 5.0%.
17. Heat rejection to jacket water value displayed includes heat to jacket water alone. Value is based on treated water. Tolerance is ± 10% of full load data.
18. Heat rejection to atmosphere based on treated water. Tolerance is ± 50% of full load data.
19. Lube oil heat rate based on treated water. Tolerance is ± 20% of full load data.
20. Exhaust heat rate based on treated water. Tolerance is ± 10% of full load data.
21. Heat rejection to exhaust (LHV to 77°F) value shown includes unburned fuel and is not intended to be used for sizing or recovery calculations.
22. Heat rejection to aftercooler based on treated water. Tolerance is ±5% of full load data.
23. Total Jacket Water Circuit heat rejection is calculated as: (JW x 1.1) + (OC x 1.2). Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.
24. Total Aftercooler Circuit heat rejection is calculated as: AC x ACHRF x 1.05. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.

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G3408

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE POWER (bhp):	400	COOLING SYSTEM:	JW+OC, AC
ENGINE SPEED (rpm):	1800	AFTERCOOLER WATER INLET (°F):	130
EXHAUST MANIFOLD:	WC	JACKET WATER OUTLET (°F):	210

Free Field Mechanical and Exhaust Noise

SOUND PRESSURE LEVEL (dB)										
			Octave Band Center Frequency (OBCF)							
100% Load Data			dB(A)	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Mechanical Sound	Distance from the Engine (ft)	3.3	94.5	82.4	85.4	84.4	87.4	91.4	87.4	82.4	83.4
		23.0	83.5	74.7	79.7	74.7	76.7	78.7	77.7	73.7	72.7
		49.2	77.5	69.4	74.4	68.4	70.4	73.4	71.4	67.4	64.4
Exhaust Sound	Distance from the Engine (ft)	4.9	109.9	107.1	109.5	108.8	105.8	101.3	101.8	102.8	101.1
		23.0	96.5	96	100.3	96	90.7	89.3	88.3	89.3	86
		49.2	89.9	89.3	93.6	89.3	84	82.6	81.6	82.6	79.4

SOUND PARAMETER DEFINITION:

Data Variability Statement:

Sound data presented by Caterpillar has been measured in accordance with ISO 6798 in a Grade 3 test environment. Measurements made inaccordance with ISO 6798 will result in some amount of uncertainty. The uncertainties depend not only on the accuracies with which sound pressurelevels and measurement surface areas are determined, but also on the 'near-field error' which increases for smaller measurement distances and lowerfrequencies. The uncertainty for a Grade 3 test environment, that has a source that produces sounds that are uniformly distributed in frequency over thefrequency range of interest, is equal to 4 dB (A-weighted). This uncertainty is expressed as the largest value of the standard deviation.

5-6998-8-0

Form Number: SEC-SA-1-026

Revision: 0

Johnson Matthey Stationary Emission Control LLC
600 Forge Ave, SUITE 100, Audubon, PA 19403-2305
T (484) 320-2136 F (484) 320-3152 www.jmsec.com

Johnson Matthey Catalysts

BASIC INSTRUCTION FOR SHEET COMPLETION

1. *All fields outlined in RED must be completed/addressed*
2. *Equipment Required Appears in Blue Box Below*
3. *Placing mouse pointer over any RED cell displays help for completing that field*
4. *Please refer to Pricing Sheets after required equipment has been identified*

ENGINE DATA	Rich Burn
Engine Mfg:	Caterpillar
Engine Model:	G3408TA
Bhp:	400
RPM:	1800
Load:	100%
Fuel:	Natural Gas
Temp into Catalyst, °F:	914
Temp into Catalyst, °C:	490
Operating Hours, hrs/yr:	8760

ENGINE PREFORMANCE		
Exhaust Flow, acfm:		1590
Exhaust Flow, scfm:	Standard = 60F, 14.696psi	602
Exhaust Flow, scfh:		36105
Exhaust Flow, lb/hr:		2722
Exhaust MW:		28.6

TYPICAL (Rich Burn)	MW		
Ar, vol %:	39.95		
N2, vol %:	28.01		79.70
O2, vol %:	32.00		0.30
H2O, vol%:	18.02		10.00
CO2, vol %:	44.01		10.00

EMISSIONS DATA				
Emission Standard;	0.15 / 0.6 / 0.15 g/Bhp-hr		POST	% Reduction
NOx, g/Bhp-hr:		26.25	0.15	99.4%
NOx, lb/hr:		23.15	0.13	
NOx, tons/yr:		101.41	0.58	
NOx, ppmv:		6,694.00	49.68	
NOx, ppmvd @ 15% O2:		2.00	15.84	
CO, g/Bhp-hr:		1.60	0.60	62.5%
CO, lb/hr:		1.41	0.53	
CO, tons/yr:		6.18	2.32	
CO, ppmv:		927.36	347.76	
CO, ppmvd @ 15% O2:		1.00	110.85	
VOCs, g/Bhp-hr:		0.40	0.15	62.5%
VOCs, lb/hr:		0.35	0.13	
VOCs, tons/yr.:		1.55	0.58	
VOCs as CH4, ppmv:		231.84	86.94	
VOCs as CH4, ppmvd @ 15% O2:		73.90	27.71	

PROCEDURE

1. Complete all yellow fields
2. Enter Horsepower of Engine in F14
3. Enter Exhaust Temperature in F18
4. Enter Exhaust Flow in F23
5. Select Emissions Requirement in D/E 37
6. Emissions Inlet Values **MUST** now be entered in F38, F43, and F48
   ! Failure to provide accurate inlet emissions will result in erroneous sizing !
7. Select Silencing Requirement in D/E 56
8. If ONLY Catalyst is Required, Change D58 to "YES", else Select "NO"
9. Press 'Calculate Sizing' Button
10. If Desired, Press 'Generate Quote' Button to Generate Quote in New Tab

Integrated Silencer? NO SILENCING

Catalyst Element ONLY? NO

OPTION #1 - Most Compact

EQUIPMENT NEEDED: MB20 with 2 Catalysts

OPTION #2 - Single Catalyst

MB50 with 1 Catalyst

Maximum continuous operating temperature 1250 degree F. Minimum operating temperature 900 degrees F.
Data above calculated from engine manufactures data corresponding to catalyst converter settings. A slightly rich to stoichiometric air fuel ratio is required (Oxygen content in exhaust of 0.2% - 0.7%) oxygen sensor millivolts approximately 700 to 800, or lambda of 0.97 to 0.99)

Appendix E
Quarterly Net Emissions Change

QNEC

The QNEC is entered into PAS database and subsequently reported to CARB. The QNEC is calculated for each pollutant, for each unit, as the difference between the post-project quarterly potential to emit (PE2) and the quarterly pre-project potential to emit (PE1).

The Quarterly Net Emissions Change is used to complete the emission profile screen for the District's PAS database. The QNEC is calculated as follows:

QNEC = (PE2 – PE1) ÷ 4 quarters/year, where:

QNEC = Quarterly Net Emissions Change for the emissions unit, lb/qtr.
PE2 = Post Project Potential to Emit for the emissions unit, lb/yr.
PE1 = 0 (since these are new units)

Using the values from Sections VII.C.2 in the equation above, the QNEC can be summarized as follows:

QNEC for S-6998-7-0		
Pollutant	PE2 (lb/year)	QNEC (lb/qtr)
NO_x	4,632	1,158
SO_x	51	13
PM_{10}	176	44
CO	8,338	2,085
VOC	973	243

QNEC for S-6998-8-0		
Pollutant	PE2 (lb/year)	QNEC (lb/qtr)
NO_x	8,064	2,016
SO_x	68	17
PM_{10}	451	113
CO	52,467	13,117
VOC	1,298	325

Appendix F
Inspection and Maintenance (I & M) Plan

3. MAINTENANCE PROGRAM

GUASCOR has developed this maintenance program to ensure optimum performance of your engine. Given that strict adherence to this program will benefit you, it is essential that you follow the instructions detailed in this manual. Failure to do so may not only jeopardize the manufacturer's warranty, but also restrict you from obtaining the best performance for equipment.

3.1. Basic Maintenance Operations:

NEW ENGINE OR MAJOR SERVICE WORK START-UP MAINTENANCE

Jobs to be done during the initial start-up of a new engine or during the break-in phases following major overhauls (change of cylinder liners, pistons, piston rings, cylinder heads,...). They must be carried out by GUASCOR authorized Repair Shop.

Job	Interval	Job Description
NA	0 h	**(Operation before starting up the engine))**
		- General inspection and set-up of the engine
N1	100 h	**(Operations after starting up or break-in phase)**
		- Change oil (oil sump and cooler)
		- Change oil filters
		- Analyze waste oil
		- Inspection of the gas ramp filter
		- Adjustment of rocker arms and valve lifters. Measure valve height
		- Check, and where appropriate, adjust air/fuel ratio (*)
		- Measure the exhaust back-pressure
		- Check damper temperature
		- Inspect for leaks in all liquid, oil, gas and exhaust gases system
		- Inspection and retightening of flanges and clamps. Inspection of battery terminals, flexible couplings, air filter supports, exhaust piping, oil pipes, etc.

Guascor Power

Chapter

5 *Maintenance instructions - Maintenance procedures*

Title IP

MAINTENANCE OF FG/FGLD NATURAL GAS ENGINE 1500 rpm

IMPORTANT

The maintenance jobs described below (identified with as an "E" type task) must be regarded as "additive" to each other. Accordingly, the performance of every "E_i" job implies that all previous "E_{i-1}" every time as the frequency indicates it.

This will require the availability of such materials and labour as may be necessary at each stage.

Minor Jobs

ROUTINE MAINTENANCE (Type "E")

Job	Interval	Job Description
EO	Daily	**(Operations to be performed with the engine stopped)**
		- Drain coolant circuits. Check automatic drain valves
		- Drain condensates out of the exhaust Y-pipe
		- Check oil pressure and temperature during the pre-lubrication phase
		- With the dipstick, check for a possible increase of the oil level in the oil pan due to water leaks
		- Verify oil heating with the pre-heater, if necessary
		- Check the oil level of the pneumatic starter lubricator, if necessary
		- Clean the engine and its surrounding
		(Operations to be performed with the engine idling)
		- Check oil level.
		(Operations to be carried out with the engine stabilized)
		- Check coolant level / pressure. Drain the circuit
		- Check oil pressure
		- Inspect the air filter plugging level (after resetting)
		- Check the temperature of oil, coolant and exhaust gases
		- Check the filter cleaning state pilot of the crankcase gases recirculation system. Control the crankcase pressure (*A*)
		- Record engine parameters on a regular basis
		- Control operational stability and unusual noise
		- Detect and repair gas, coolant, oil and exhaust gases leaks

MAINTENANCE OF FG/FGLD NATURAL GAS ENGINE 1500 rpm

Job	Interval	Job Description
E1	1.250 h	- Measure crankcase pressure
		- Clean the metallic sponge of the oil purifier
		- Inspect and if necessary replace the main air filters
		- Adjust the intake and exhaust rocker arms. Measure valve height
		- Test safety devices and connections: thermocontacts and pressure switches
		- Check battery acid level
		- Check battery and starter connections
		- Check, and where appropriate, adjust air/fuel ratio (*)
E2	2.500 h	- Change the filter of crankcase gases recirculation system and clean this circuit (*A*)
		- Analyze waste oil
		- Change oil (oil sump and cooler) **GUASCOR Motoroil 3040 Plus**
		- Change oil filters
		- Verify the ignition timing
		- Check vibration damper temperature
E3	5,000 h or once a year	- Change the main air filters.
		- Change gaskets in the rocker arm covers
		- Disassemble, clean and adjust all the speed and ignition pick-ups
		- Measure the exhaust back-pressure
		- Change coolant

MAINTENANCE OF FG/FGLD NATURAL GAS ENGINE 1500 rpm

NOTE	- The spark plugs change must be made attending the IO-G-M-33-007e product information.
	- Ask Guascor to use another oil that it is not Guascor Motoroil 3040 Plus.

Major overhauls

PERIODIC MAINTENANCE WORKS (Type "R")

Job	Interval	Job Description
R1	15,000 h	- Recondition cylinder heads – Check springs
		- Check valves driving system: valve lifters, rocker arms, push-rods, ball joints, roller rocker arms and cams
		- Measure cylinder liners wear
		- Change the high voltage wires of the ignition system.
		- Inspection of turbochargers and, if necessary, clean and replace of faulty components
		- Clean intake circuit, from outlet of air filters to intercooler inclusively (*A*)
		- Clean oil sump
		- Check and clean the cooling system. Clean pipe bundles and change gaskets on heat exchanger and coolers
		- Change the oil thermostat (only "V" engines)
		- Check and, where appropriate change, water temperature control thermostats
		- Test safety devices and connections: thermocontacts and pressure switches
		- Check the butterfly valve bearings and change it if necessary
		- Check lubrication and clearance of the joints on the actuator linkage. Change where appropriate
		- Retighten connections in anti-knocking system unit if necessary
		- Check-up of electric or pneumatic starting motor, battery charging alternator, etc.
		- Analyze the inside damper silicon
		- Change hoses and clamps, if necessary

NOTA	- When using the throttle reference 76.64.315 it is no necessary the valve bearings checking

MAINTENANCE OF FG/FGLD NATURAL GAS ENGINE 1500 rpm

Job	Interval	Job Description
R2	30,000 h	- Change pistons
		- Change piston rings
		- Change cylinder liners
		- Inspect flexible coupling condition and change it if necessary
		- Inspection of elastic suspensions and alignments
		- Check axial and Radial allowance of Crankshaft
		- Check connecting rods and change if necessary
		- Change big end bearings and small end bushing
		- Change the connecting rod bolts (maximum of 3 retightenings). Mark number of retightenings on the bolt
		- Change water temperature control thermostats
		- General overhaul of the cooling circuit water pumps
R3	60,000 h	- Engine Overhaul, including its major components and systems:
		Cylinder block
		Crankshaft
		- Inspection of camshafts and bushings
		- Inspection of timing gears and change ball-bearings
		- Inspection of oil pump (gears and bushings)
		- Change of counterweights fixing screws
		- Change damper
		- Overall inspection of coolant, oil, gas, intake air, exhaust gas and automation systems, and wiring, etc., and change where appropriate
		- Change turbochargers

This maintenance program is specified for dry natural gas. The natural gas specifications are detailed in the last version of document **IC-G-D-30-002e** : "**Fuel Specifications – Natural Gas**". Minimum methane number is specified in the Power Rating of the engine for this application. If methane number is less than the specified, consult with GUASCOR.

(*)	For installations where the gas composition is variable, it's recommended to reduce the periods between carburation adjustments.
(*A*)	Make this maintenance job only if the engine has crankcase gases recirculation system

4. ENGINE LONG TERM STORAGE

When a customer has specified in advance that the engine is going to be stored, the instructions contained in Product Information Sheets **IM-C-C-00-001e** (storage for less than 6 months) and **IO-C-M-00-001e** (storage for more than 6 months) apply.

Besides, the engine is supplied perfectly packed and sealed against external agents.

It is however very important that the temperature in the warehouse used for storing the engine should remain at all times above the outside temperature to prevent condensation.

ADVANCED CATALYST SYSTEMS, LLC

Operating and Maintenance Manual

ADVOCAT™ Oxidation Catalyst

For

BACT-AID

ZERO SLIP CATALYSTS

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Document Number: Oxidation-O&M-R1 8042015

TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose of this document is to provide an overview of how a precious metal catalyst system functions and provide installation, operating, and maintenance guidelines for users of Advanced Catalyst Systems' ADVOCAT™ Oxidation Catalyst. The ADVOCAT™ Oxidation Catalyst is designed for the control of carbon monoxide and volatile organic compounds for applications including and not limited to power generation, gas compression, and pumping stations.

2.0 SYSTEM DESCRIPTIONS

Process Description

The lean-burn combustion of hydrocarbon fuels typically produces small amounts of carbon monoxide (CO) and volatile organic compounds (VOCs). With ACS' ADVOCAT™ catalysts, the residual CO and VOCs are converted into carbon dioxide and water by a precious metal catalyst, which promotes the desired chemical reaction as follows:

$$CO + \tfrac{1}{2} O_2 \rightarrow CO_2$$

$$C_xH_y + \tfrac{1}{2} O_2 \rightarrow CO_2 + H_2O$$

A catalyst is a substance that increases the rate of a chemical reaction but emerges from the process unchanged. By increasing the rate of reaction we are able to make thermodynamically favorable reactions occur in a time frame that is suitable to our needs. A catalyst increases the rate of reaction by participating in the intermediate steps of a reaction and providing an alternative reaction path ("mechanism") for the reaction. This catalytic intervention results in a lowering of the overall activation energy requirements, thus permitting a reduction in the temperature at which the process can proceed favorably. The term catalyst, as typically used in this document, refers to the sum product of components that make the reactions occur. In reality the catalyst consists of a substrate, washcoat (or support), and precious metal.

The surface of a catalyst is comprised of numerous "active sites" which are simply sites onto which a molecule in the surrounding air may attach. This attaching affects the bond structure of the attached molecule in such a fashion as to make it much easier for bonds to be broken. The act of attaching may, by itself, be responsible for the initial bond breaking. Certainly the act of attaching

significantly alters the bond structure. Oxygen from the air stream is initially adsorbed onto the surface of the catalyst. The surface interaction of the catalyst with the oxygen greatly distorts the oxygen bond. In its distorted state, the oxygen is much more strongly oxidizing toward carbon monoxide.

To promote a high rate of gas contact with the catalyst surface while maintaining low system pressure drop, ACS uses a monolithic honeycomb structure, which consists of many parallel cells through which the exhaust gas passes. The high cell density per square inch of honeycomb, combined with its high surface area, assures a very efficient rate of gas contact with the catalyst surface and, therefore, a high conversion rate of CO and VOCs.

Factors Affecting Catalyst Performance

Temperature is a significant factor affecting conversion. The higher the temperature the more favorable are conditions for the oxidation reaction to occur. Another significant factor that affects conversion is the amount of gas that the catalyst is forced to process in a given time. Higher conversion will be achieved when the catalyst is forced to process a smaller volume of gas in a unit time. In the catalysis industry, the concept of space velocity is used to quantify this idea. Space velocity is defined as:

$$\text{Space Velocity} = \frac{\text{Gas volumetric flow rate/hr}}{\text{Catalyst volume in service}}$$

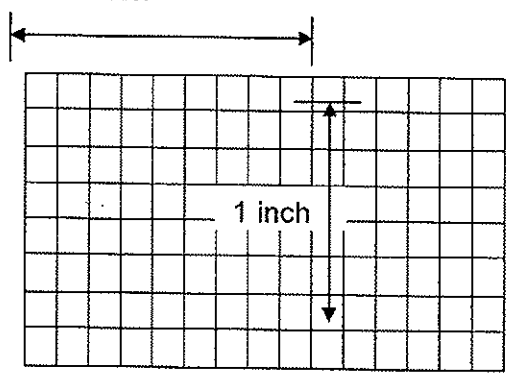
The gas volumetric flow rate is usually expressed in units such that when divided by the catalyst volume, the unit of space velocity is reciprocal hours (1/hr). One can think of space velocity as expressing the catalyst volume equivalents of gas that a catalyst processes in one hour. For example, a space velocity of 50,000/hr indicates that the catalyst is processing 50,000 times its own volume of gas every hour. Lower space velocity is associated with higher conversions.

Another important factor that affects overall conversion is catalyst support geometry. The support structure is almost always metal or ceramic and is constructed in such a manner as to give a high global surface area.

Honeycomb geometries are specified by their "cell count". Cell count is defined as the number of individual cells or cell equivalents contained within a given cross-sectional area (typically one square inch). If one describes a honeycomb structure as "100 cell" this means that the monolith in question has 100 individual

cells contained within an area of one square inch of the catalyst face (this also implies that there are ten cells per linear inch if the honeycomb is square). The following illustration visually presents the concept of cell count.

Illustration A



Cell count is the actual number of cells per unit area. Cell count may also be referred to as cell per square inch (cpsi).

Destruction Efficiency (percent conversion)

The effectiveness of a catalyst is stated by percent conversion. The percent conversion is determined by the equation:

$$\% \text{ Conversion} = \left(\frac{\text{Inlet Concentration - Outlet Concentration}}{\text{Inlet Concentration}} \right) \times 100$$

Equipment Description

The Advanced Catalyst Systems' ADVOCAT™ catalyst is supported by a high temperature stainless steel multi-cellular monolithic structure. The structure is coated with a high surface area alumina layer designed to distribute and disperse the catalytic component. The catalytic component is platinum.

The special stainless steel foil is corrugated and placed upon itself to make a honeycomb core. The structure has from 100 to 400 cells per square inch and has web thickness of about 0.002 inches. The "honeycomb" has a high global surface area and low porosity, thus giving excellent contacting of catalyst with the exhaust stream with minimum resistance to flow (i.e. low pressure drop).

The particles of Platinum are very small of the order of 2 to 50 angstroms (one angstrom is 0.00000001 centimeters). The small dimensions give rise to high metal surface area. This surface area is stabilized by supporting the Platinum crystallites on a high surface area alumina based coating, which in turn adheres to the walls of the stainless steel structure. This core and enclosure is called a "module".

Safety Considerations

The catalyst is designed to oxidize CO and VOCs in the gas exhaust. This occurs as the exhaust passes over the precious metal-coated catalyst at elevated temperatures. These high temperatures make it mandatory that personnel be protected against injury. Do not attempt to work around the converter modules if temperatures exceed 110° F.

Always use caution in working around the converter during a shutdown period. If the converter shuts down because of a high temperature or any other reason, pay particular attention to hot surfaces and make sure there is adequate area ventilation. This is especially important when inspecting, removing, or installing the converter. If necessary, use a ventilation fan to keep fresh air flowing in the converter during inspection, removal, or installation.

Any time the converter is not in operation because of the need to perform maintenance work take the appropriate equipment lockout measures.

Use proper personnel protection equipment (PPE) at all times when installing or removing catalyst modules. Read the recommendations below before starting any procedures:

- Provide adequate ventilation.
- Wear leather gloves when handling catalyst modules. Metal edges of the modules are sharp and can cut and bruise.

- Wear safety glasses with side shields or goggles when installing or removing modules from the frame. Protruding threading studs on the frames may often be at eye level.
- Wear safety shoes and a hard hat.
- Wear appropriate fall protection equipment as required during module loading.
- Modules should be lifted within a lifting fixture during loading.
- Precautions should be taken to prevent injury from falling objects while loading modules (nuts, clips, modules, tools).
- Follow OSHA standards for confined space entry and fall protection.

Review the operation of the converter with the plant safety officer before installing/removing catalysts. Any suggestions and additions should be added to those instructions.

All those involved in the operation of the catalyst should read and understand the complete operating instructions before starting the system. Safety meetings of all those involved with the converter should be held periodically in conjunction with housekeeping reviews.

3.0 OPERATING CONDITION

Over-temperature Protection

The catalyst can operate up to a maximum temperature of 1250°F. In the event of a malfunction, it is possible for the exhaust gas temperatures to exceed 1250°F. For this reason, over-temperature protection must be provided. This over-temperature protection should consist of thermocouples upstream and downstream of the catalyst, and a visible annunciation with audible alarm. The alarm should sound at 1200°F, and the reason for the over-temperature condition should be determined and corrected. If the exhaust temperature reaches 1200°F, the system should shutdown and corrective action taken. This over-temperature protection is not in Advanced Catalyst Systems' scope of supply.

Differential Pressure Protection

A differential pressure transmitter should be installed to determine the pressure drop (dP) across the catalyst. The maximum expected pressure drop at the maximum flow varies with each installation. Please consult engine specification sheet and ACS technicians for maximum dP. If the pressure drop exceeds a determined level of inches w.c. an alarm should sound, and the reason for the condition should be determined and corrected. The transmitter is not in Advanced Catalyst Systems' scope of supply.

It should be noted that a catastrophic failure of the duct liner could result in the deposition of insulation on the catalyst. If this occurs, a large pressure drop across the catalyst is expected, and major structural component failure could ensue.

Lubricating Oil

Catalyst durability is significantly affected by the type and consumption rate of lubricating oil. Low ash, phosphorous-free oils are recommended for prolonged catalyst durability. Lube oil should have sulfated ash <0.6 wt%, zinc <900 ppm, and phosphorus <400 ppm. The lube oil consumption should be minimal.

Housekeeping

Keep the area free from any hazards that would prevent easy movement around the converter or easy access into the casing interior. No flammable or otherwise hazardous materials should be stored in the immediate vicinity of the converter.

4.0 INSTALLATION

Before installing the catalytic modules, take these precautionary steps:

1. Thoroughly clean the upstream ducting and liner, removing all dirt, oil, grease, rags, etc.
2. Operate the engine before installation of the modules to ensure that all debris has been blown out of the system.
3. Seat module into frame/catalyst housing.
4. If gasket is used, make sure that the gasket is seated between the frame and the catalyst module and check to see that the gasket is in contact with the module.

There are numerous catalyst housing designs with various sealing mechanisms for preventing exhaust gas bypass. Please consult ACS technicians for questions on your specific catalyst/housing configuration. All efforts should be implemented to minimize exhaust gas bypass. After catalyst installation, leak testing should also be performed on all access doors. **This is critical and required for in-door applications.**

5.0 TESTING

On-site testing should be conducted in accordance with local air quality authority and/or federal guidelines.

6.0 OPERATING INSTRUCTIONS

For proper operation, the dP, temperature, and conversion efficiencies must be monitored. In addition, after the initial start-up has occurred and the engine has been run for some period of time, it will be necessary to enter the duct and inspect the seals, and structure. The following items will be checked:

1. Look for oil fouling or insulation on the catalyst structure.
2. Check the sealing mechanism for potential bypass.
3. Check the support structure for cracks or broken parts.

7.0 TROUBLE SHOOTING:

Problem Description	Potential Cause	Recommended Action
Reduction in DRE conversion.	Potential masking of catalyst.	Remove catalyst and send for performance evaluation.
Reduction in DRE conversion.	Change in Operating Conditions	Examine periodic performance history to determine if there is a change in operating conditions. Test catalyst inlet and outlet conditions for comparison.
Increase in pressure drop across catalyst bed.	Potential masking or blocking of catalyst.	Inspect catalyst for cell blockage. Remove material or blockage with light DM water spray.

8.0 CONSERVATION & STORAGE

It is best to store the catalyst in a dry area away from any corrosive (acid) or flammable chemicals. The catalyst will promote combustion of flammable vapors if they have ignited.

9.0 CATALYST MAINTENANCE/WASHING

Advanced Catalyst Systems' ADVOCAT™ catalyst is a platinum metal based catalyst and should not require regular catalyst maintenance if the exhaust gas remains clean of potential blocking (insulation) and/or masking agents (dirt, dust, iron oxides, excessive lubrication oil, etc.).

A build-up of blocking material (indicated by an increase in pressure drop across the catalyst or slight build-up of masking agents on the catalyst surface indicated by a reduction in destruction) can be removed with a light demineralized water spray across the catalyst. This washing can be performed while the catalyst remains installed. If excessive masking agents are present on the catalyst, removal and chemical washing of individual modules would be required to regain original performance. Catalyst washing services are available from Advanced Catalyst Systems, LLC.

Pressure drop and destruction measurements across the catalyst should be taken on a regular basis by Plant operators to monitor the catalyst performance and need for maintenance.

10.0 TESTING SERVICES

Advanced Catalyst Systems, LLC utilizes an MKS Fourier Transform Infrared Radiation detector (FTIR) to analyze catalyst destruction rate efficiencies.

For performance testing, the catalyst is placed in ACS's engine test cell. The exhaust gas passes through the catalyst at temperature increments and flow rate increments. The resulting gas mixture is fed through the FTIR and data is gathered at each temperature point generating a light off curve. The temp

at which the catalyst effects 50% (T-50%) destruction and 95% (T-95%) destruction are recorded and compared to a brand new catalyst and a thermally aged catalyst. Following this test, the catalyst is removed and washed (if required) according to standard procedure. The washed catalyst is refitted into the engine test cell and tested again. A report is then generated on the activity of the catalyst, as received, after washing, comparing T-50% and T-95% to new and thermally aged catalysts. In many cases, catalysts can be returned to active service life by a the washing procedure referenced.

Appendix G
Existing Units' Emissions Calculations

Emission Calculations for Existing Units

1. 150 bhp Emergency Standby Engine

a. Emission Factors

The following table is take from project C-1063790, the initial farm project for this facility, adjusting for the current sulfur content of ultra-low sulfur diesel.

Diesel-fired IC Engine Emission Factors			
	lb/hp-hr	g/hp·hr*	Source
NO_X	0.02205	10.00	Carl Moyer Program
SO_X	---	0.0051	Mass Balance Equation Below **
PM_{10}	0.0011	0.50	Rule 4201 Compliance
CO	0.0067	3.04	AP-42 (10/96) Table 3.3-1
VOC	0.0025	1.14	AP-42 (10/96) Table 3.3-1

* g/hp·hr is calculated using the lb/hp·hr value multiplied by 453.6 g/lb.

** Mass balance equation

$$\frac{0.000015\,lb-S}{lb-fuel}\times\frac{7.1\,lb-fuel}{gallon}\times\frac{2\,lb-SO_2}{1\,lb-S}\times\frac{1\,gal}{137{,}000\,Btu}\times\frac{1\,bhp\,input}{0.35\,bhp\,out}\times\frac{2{,}542.5\,Btu}{bhp-hr}\times\frac{453.6\,g}{lb}=0.0051\ \frac{g-SO_x}{bhp-hr}$$

b. Potential to Emit Calculations

The daily and annual PE are calculated as follows:

Daily PE (lb-pollutant/day) = EF (g-pollutant/bhp-hr) x rating (bhp) x operation (hr/day) / 453.6 g/lb

Annual PE (lb-pollutant/yr) = EF (g-pollutant/bhp-hr) x rating (bhp) x operation (hr/yr) / 453.6 g/lb

Project Emissions (PE)						
Pollutant	**Emissions Factor (g/bhp-hr)**	**Rating (bhp)**	**Daily Hours of Operation (hrs/day)**	**Annual Hours of Operation (hrs/yr)**	**Daily PE2 (lb/day)**	**Annual PE2 (lb/yr)**
NO_X	10	150	24	100	**79.4**	**331**
SO_X	0.0051	150	24	100	**0.0**	**0**
PM_{10}	0.5	150	24	100	**4.0**	**17**
CO	3.04	150	24	100	**24.1**	**101**
VOC	1.14	150	24	100	**9.0**	**38**

2. Dairy Operations Emission Calculations

The spreadsheets showing the calculations for the individual dairy operations are included at the end of this appendix.

Rev. September 24, 2015

Facility Information

1. Does this facility house Holstein or Jersey cows? Holstein
   Answering "Holstein" assumes worst case. Facilities receiving in-house PTOs should be grandfathered assuming they could house Holstein cows.
2. Does the facility land apply liquid manure? no
   Answering "yes" assumes worst case.
3. Does the facility land apply solid manure? no
   Answering "yes" assumes worst case.
4. Is any scraped manure sent to a lagoon? yes
   Answering "yes" assumes worst case.

Facility Herd Size					
Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals
Milk Cows				2,420	2,420
Dry Cows					0
Support Stock (Heifers, Calves, and Bulls)				4,008	4,008
Large Heifers					0
Medium Heifers					0
Small Heifers					0
Bulls					0

	Calf Hutches				Calf Corrals		
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	Scraped	Total # of Calves
Calves							0

Total Herd Summary	
Total Milk Cows	2,420
Total Mature Cows	2,420
Support Stock (Heifers, Calves, and Bulls)	4,008
Total Calves	0
Total Dairy Head	6,428

Silage Information			
Feed Type	Max # Open Piles	Max Height (ft)	Max Width (ft)
Corn	1	20	70
Alfalfa	1	20	70
Wheat	1	20	70

This spreadsheet serves only as a resource to calculate potential emissions from dairies, and may not reflect the final emissions used by the District due to parameters not addressed in this spreadsheet and/or omissions from the spreadsheet. Any other permittable equipment (e.g. IC engines, gasoline tanks, etc.) at a facility will need to be calculated separately. All final calculations used in permitting projects will be conducted by District staff.

VOC Mitigation Measures

Feed Mitigation Measures

Dairy owners/operators are required to implement the following four feed mitigation measures:

- Feed according to National Research Council (NRC) guidelines.
- Push feed so that it is within three (3) feet of feedlane fence within two hours of putting out the feed or use a feed trough or other feeding structure designed to maintain feed within reach of the cows.
- Begin feeding total mixed rations within two (2) hours of grinding and mixing rations.
- Store grain in a weatherproof storage structure or under a weather proof covering from October through May.

Dairy owners/operators must also select at least <u>one</u> of the following feed mitigation measures:

- ☑ Feed steam-flaked, dry rolled, cracked or ground corn or other ground cereal grains.
- ☐ Remove uneaten wet feed from feed bunks within twenty-four (24) hours after the end of a rain event.
- ☐ For total mixed rations that contain at least 30% by weight of silage, feed animals total mixed rations that contain at least 45% moisture.
- ☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures supplemental application form.*

Silage Mitigation Measures

Do not feed silage ☐ **Not Applicable**
Do not store silage ☐ **Not Applicable**

Dairy owners/operators must select at least <u>one</u> of the following silage mitigation measures:

- ☐ Utilize a sealed feed storage system (e.g., Ag-Bag) for silage.
- ☑ Silage Pile Management - Selection of this measure requires multiple measures to be selected as follows:

The following measure is required to be implemented.

- Cover the surface of silage piles, except for the area where feed is being removed from the pile, with a plastic tarp that is at least 5 mils thick (0.005 inches), multiple plastic tarps with a cumulative thickness of at least 5 mils (0.005 inches), or an oxygen barrier film covered with a UV resistant material within 72 hours of last delivery of material to the pile.

<u>Must also implement one from the following (a, b, or c):</u>

a. Build silage piles such that the average bulk density of silage piles is at least 44 lb/cu ft for corn silage and 40 lb/cu ft for other silage types, as measured in accordance with Section 7.10 of Rule 4570 (http://www.valleyair.org/rules/1ruleslist.htm#reg4).

b. When creating a silage pile, adjust filling parameters to assure a calculated average bulk density of at least 44 lb/cu ft for corn silage and at least 40 lb/cu ft for other silage types, using a spreadsheet approved by the District (one available on District website, http://www.valleyair.org/General_Info/AGLoader.htm).

c. Incorporate the following practices when creating silage piles:

- Harvest silage crop at ≥ 65% moisture for corn; and ≥ 60% moisture for alfalfa/grass and other silage crops, and
- Manage silage material delivery such that no more than six (6) inches of materials are un-compacted on top of the pile.
- Incorporate the following parameters for Theoretical Length of Chop (TLC) and roller opening, as applicable, for the crop being harvested:

Crop Harvested	TLC (inches)	Roller Opening(mm)
Corn with no processing	≤ 1/2 in	N/A
Processed Corn <35% dry matter	≤ 3/4 in	1 – 4 mm
Alfalfa/Grass	≤ 1.0 in	N/A
Wheat/Cereal Grains/Other	≤ 1/2 in	N/A

<u>Must select two measures from the following d, e, or f:</u>

d. ☑ Manage exposed silage (select only one of the following):

i. ☐ Manage silage piles such that only one silage pile has an uncovered face and the uncovered face has a total exposed surface area of less than 2,150 square feet.

ii. ☑ Manage multiple uncovered silage piles such that the total exposed surface area of all silage piles is less than 4,300 square feet.

e. ☑ Maintain silage working face: (Must implement one of the following):

i. Use a shaver/facer to remove silage from the silage pile.

ii. Maintain a smooth vertical surface on the working face of the silage pile.

f. ☐ Silage Additives (select only one of the following):

i. ☐ Inoculate silage with homolactic acid bacteria in accordance with manufacturer recommendations to achieve a concentration of at least 100,000 colony forming units per gram of wet forage.

or

Apply propionic acid, benzoic acid, sorbic acid, sodium benzoate, or potassium sorbate at a rate specified by the manufacturer to reduce yeast counts when forming silage pile.

ii. ☐ Apply other additives at specified rates that have been demonstrated to reduce alcohol concentrations in silage and/or VOC emissions from silage and have been approved by the District and EPA.

☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures supplemental application form.*

Milk Parlor Mitigation Measures

Dairy owners/operators must select at least <u>one</u> of the following milk parlor mitigation measures:

- ☑ Flush or hose milk parlor immediately prior to, immediately after, or during each milking.
- ☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures form.*

Freestall Barn Mitigation Measures	**Dairy owners/operators with freestall barns are required to implement the following freestall barn mitigation measures:** • Pave feedlanes, where present, for a width of at least 8 feet along the corral side of the feedlane fence for milk and dry cows and at least 6 feet along the corral side of the feedlane for heifers. • **Must select one of the following two mitigation measures:** ☐ Flush, scrape or vacuum freestall flush lanes immediately prior to or after, or during each milking. ☐ Flush or scrape freestall flush lanes at least three (3) times per day. **Dairy owners/operators with freestall barns must also select at least one of the following mitigation measures:** ☐ Use non-manure-based bedding and non-separated solids based bedding for at least 90% of the bedding material, by weight, for freestalls (e.g. rubber mats, almond shells, sand, or waterbeds). ☐ For a LARGE dairy only (1000 milk cows or larger) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every seven (7) days. ☐ For a MEDIUM dairy only (500 to 999 milk cows) – Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every fourteen (14) days. ☐ Have no animals in exercise pens or corrals at any time. ☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures supplemental application form.* ☑ **Not Applicable – No freestall barns**
Corral Mitigation Measures	**Dairy owners/operators with corrals are required to implement the following six mitigation measures for each corral where animals have been housed in the last 30 days:** • Pave feedlanes, where present, for a width of at least 8 feet along the corral side of the feedlane fence for milk and dry cows and at least 6 feed along the corral side of the feedlane for heifers. • Inspect water pipes and troughs and repair leaks at least once every seven (7) days. • **Must implement one of the following mitigation measures:** -Clean manure from corrals at least four (4) times per year with at least sixty (60) days between cleaning. -Clean corrals at least once between April and July and at least once between September and December. • ***Must* select one of the following two mitigation measures:** ☐ Scrape, vacuum or flush concrete lanes in corrals at least once every day for mature cows and every seven (7) days for support stock. ☑ Clean concreted lanes such that the depth of manure does not exceed twelve (12) inches at any point or time. • **Must implement one of the following three mitigation measures:** -Slope the surface of the corrals at least 3% where the available space for each animal is 400 square feet or less. Slope the surface of the corrals at least 1.5% where the available space for each animal is more than 400 square feet per animal. -Maintain corrals to ensure proper drainage preventing water from standing more than forty-eight hours. -Harrow, rake, or scrape pens sufficiently to maintain a dry surface. • **<u>If the facility has shade structures you must select from one of the following mitigation measures</u>:** ☐ Install shade structures such that they are constructed with a light permeable roofing material. ☐ Install all shade structures uphill of any slope in the corral. ☑ Clean manure from under corral shades at least once every fourteen (14) days, when weather permits access into the corral. ☐ Install shade structure so that the structure has a North/South orientation. **Dairy owners/operators with corrals must also select at least one of the following mitigation measures:** ☐ Manage corrals such that the manure depth in the corral does not exceed twelve (12) inches at any time or point, except for in-corral mounding. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. The facility must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible. ☑ Knockdown fence line manure build-up prior to it exceeding a height of twelve (12) inches at any time or point. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. The facility must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible. ☐ Use lime or a similar absorbent material in the corral according to the manufacturer's recommendation to minimize moisture in the corrals ☐ Apply thymol to the corral soil in accordance with the manufacturer's recommendation. ☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures supplemental application form.* ☐ **Not Applicable – No open corrals** If there are no open corrals, this box MUST be checked.

Land Application Mitigation Measures	**Dairy owners/operators which land apply solid or liquid manure must select the following mitigation measures:** **If the CAF applies solid manure, select one of the following:** ☑ Incorporate all solid manure within seventy-two (72) hours of land application. ☐ Only apply solid manure that has been treated with an anaerobic treatment lagoon, aerobic lagoon or digester system. ☐ Apply no solid manure with a moisture content of more than 50%. ☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures supplemental application form.* ☐ **Not Applicable – No application to land** **If the CAF applies liquid manure, select one of the following:** ☐ Only apply liquid manure that has been treated with an anaerobic or aerobic treatment lagoon, aerobic lagoon, or digester system. ☐ Allow liquid manure to stand in the fields for no more than twenty-four (24) hours after irrigation. ☐ Apply liquid/slurry manure via injection with drag hose or similar apparatus. ☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures supplemental application form.* ☑ **Not Applicable – No application to land**
Liquid Manure Mitigation Measures	**Dairy owners/operators which handle liquid manure must select at least <u>one</u> of the following liquid manure mitigation measures:** ☐ Use phototropic lagoon. (Please note: Testing per Section 7.10 of Rule 4570 will be required.) ☐ Use an anaerobic treatment lagoon designed according to NRCS Guideline No. 359. ☑ Remove solids from the waste system with a solid separator system, prior to the waste entering the lagoon. ☐ Maintain lagoon pH between 6.5 and 7.5. (Please note: Testing per Section 7.10 of Rule 4570 will be required.) ☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures supplemental application form.* ☐ **Not Applicable – No liquid manure handled**
Solid Manure Mitigation Measures (LARGE CAF ONLY)	THIS SECTION APPLIES TO ONLY LARGE CAF 1000 MILKING COWS OR MORE. **Dairy owners/operators which handle solid manure or separated solids stored outside the animal housing must select at least <u>one</u> of the following solid or separated solids mitigation measures:** **Solid Manure -** ☐ Within seventy-two (72) hours of removal from housing, either (must implement a or b): a. Remove dry manure from the facility b. Cover dry manure outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed twenty-four (24) hours per event. **Separated Solids -** ☐ Within seventy-two (72) hours of removal from the drying process, either (must implement a or b): a. Remove separated solids from the facility b. Cover separated solids outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed twenty-four (24) hours per event. ☐ Implement an alternative mitigation measure(s), not listed above. *Please provide details on an attached Alternate Mitigation Measures supplemental application form.* ☑ **Not Applicable – No solid manure handled outside the animal housing**

VOC Mitigation Measures and Control Efficiencies

Milking Parlor				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Enteric Emissions Mitigations		
TRUE	TRUE	Feed according to NRC guidelines	10%	10%
		Total Control Efficiency	10%	10%
		Milking Parlor Floor Mitigations		
TRUE	TRUE	Feed according to NRC guidelines	10%	10%
TRUE	TRUE	Flush or hose milk parlor immediately prior to, immediately after, or during each milking. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
		Total Control Efficiency	10%	10%

Cow Housing				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Enteric Emissions Mitigations		
☑	☑	Feed according to NRC guidelines	10%	10%
		Total Control Efficiency	10%	10%
		Corrals/Pens Mitigations		
☑	☑	Feed according to NRC guidelines	10%	10%
☑	Yes	Inspect water pipes and troughs and repair leaks at least once every seven days. Note: If selected for dairies > 999 milk cows, CE is already included in EF.	0%	0%
☑	Yes	Clean manure from corrals at least four times per year with at least 60 days between cleaning, or clean corrals at least once between April and July and at least once between September and December. Note: If selected for dairies > 999 milk cows, CE is already included in EF. Note: No additional control given for increased cleaning frequency (e.g. BACT requirement).	0%	0%
☑	Yes	Scrape, vacuum, or flush concrete lanes in corrals at least once every day for mature cows and every seven days for support stock, or clean concrete lanes such that the depth of manure does not exceed 12 inches at any point or time. Note: No additional control given for increased cleaning frequency (e.g. BACT requirement).	10%	10%
☑	Yes	Implement one of the following: 1) slope the surface of the corrals at least 3% where the available space for each animal is 400 sq ft or less and slope the surface of the corrals at least 1.5% where the available space for each animal is more than 400 sq ft; 2) maintain corrals to ensure proper drainage preventing water from standing more than 48 hrs; 3) harrow, rake, or scrape pens sufficiently to maintain a dry surface. Note: If selected for dairies > 999 milk cows, CE already included in EF.	0%	0%
☐	☐	Install shade structures such that they are constructed with a light permeable roofing material. Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.	5%	5%
☐	☐	Install all shade structures uphill of any slope in the corral. Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.		
☑	☑	Clean manure from under corral shades at least once every 14 days, when weather permits access into corral. Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.		
☐	☐	Install shade structure so that the structure has a North/South orientation. Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.		
☐	☐	Manage corrals such that the manure depth in the corral does not exceed 12 inches at any time or point, except for in-corral mounding. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. The manure facility must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
☑	☑	Knockdown fence line manure build-up prior to it exceeding a height of 12 inches at any time or point. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. The facility must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible.	10%	10%
☐	☐	Use lime or a similar absorbent material in the corral according to the manufacturer's recommendation to minimize moisture in the corrals.	0%	0%
☐	☐	Apply thymol to the corral soil in accordance with the manufacturer's recommendation.	0%	0%
		Total Control Efficiency	30.75%	30.75%

		Bedding Mitigations		
☑	☑	Feed according to NRC guidelines	10%	10%
☐	☐	Use non-manure-based bedding and non-separated solids based bedding for at least 90% of the bedding material, by weight, for freestalls (e.g. rubber mats, almond shells, sand, or waterbeds).	0%	0%
☐	☐	For a large dairy only (1,000 milk cows or larger) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 7 days.	0%	0%
☐	☐	For a medium dairy only (500 to 999 milk cows) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 14 days.	0%	0%
		Total Control Efficiency	10.00%	10.00%
		Lanes Mitigations		
☑	☑	Feed according to NRC guidelines	10%	10%
☑	☑	Pave feedlanes, where present, for a width of at least 8 feet along the corral side of the feedlane fence for milk and dry cows and at least 6 feet along the corral side of the feedlane for heifers. Note: No control efficiency at this time.	0%	0%
☐	☐	Flush, scrape, or vacuum freestall flush lanes immediately prior to or after, or during each milking.	0%	0%
☐	☐	Flush or scrape freestall flush lanes at least 3 times per day.		
☐	☐	Have no animals in exercise pens or corrals at any time.	0%	0%
		Total Control Efficiency	10.00%	10.00%

Liquid Manure Handling				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Lagoons/Storage Ponds Mitigations		
☑	Yes	Feed according to NRC guidelines	10%	10%
☐	☐	Use phototropic lagoon	0%	0%
☐	☐	Use an anaerobic treatment lagoon designed according to NRCS Guideline No. 359	0%	0%
☑	☑	Remove solids from the waste system with a solid separator system, prior to the waste entering the lagoon. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
☐	☐	Maintain lagoon pH between 6.5 and 7.5	0%	0%
		Total Control Efficiency	10.00%	10.00%
		Liquid Manure Land Application Mitigations		
☐	No	Feed according to NRC guidelines	0%	0%
☐	☐	Only apply liquid manure that has been treated with an anaerobic or aerobic treatment lagoon, aerobic lagoon, or digester system	0%	0%
☐	☐	Allow liquid manure to stand in the fields for no more than 24 hours after irrigation. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
☐	☐	Apply liquid/slurry manure via injection with drag hose or similar apparatus	0%	0%
		Total Control Efficiency	0.00%	0.00%

Solid Manure Handling				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Solid Manure Storage Mitigations		
☐	No	Feed according to NRC guidelines	0%	0%
☐	☐	Within 72 hours of removal from housing, either a) remove dry manure from the facility, or b) cover dry manure outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed 24 hours per event.	0%	0%
		Total Control Efficiency	0.00%	0.00%
		Separated Solids Piles Mitigations		
☐	No	Feed according to NRC guidelines	0%	0%
☐	☐	Within 72 hours of removal from the drying process, either a) remove separated solids from the facility, or b) cover separated solids outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed 24 hours per event.	0%	0%
		Total Control Efficiency	0.00%	0.00%
		Solid Manure Land Application Mitigations		
☑	Yes	Feed according to NRC guidelines	10%	10%
☑	☑	Incorporate all solid manure within 72 hours of land application. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF. Note: No additional control given for rapid manure incorporation (e.g. BACT requirement).	0%	0%
☐	☐	Only apply solid manure that has been treated with an anaerobic treatment lagoon, aerobic lagoon or digester system.	0%	0%
☐	☐	Apply no solid manure with a moisture content of more than 50%	0%	0%
		Total Control Efficiency	10.00%	10.00%

Silage and TMR				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Corn/Alfalfa/Wheat Silage Mitigations		
☑	Yes	1. Utilize a sealed feed storage system (e.g. Ag-Bag) for bagged silage, or 2. Cover the surface of silage piles, except for the area where feed is being removed from the pile, with a plastic tarp that is at least 5 mils thick (0.005 inches), multiple plastic tarps with a cumulative thickness of at least 5 mils (0.005 inches), or an oxygen barrier film covered with a UV resistant material within 72 hours of last delivery of material to the pile, and implement one of the following: a) build silage piles such that the average bulk density is at least 44 lb/cu-ft for corn silage and 40 lb/cu-ft for other silage types, as measured in accordance with Section 7.10 of Rule 4570, b) when creating a silage pile, adjust filling parameters to assure a calculated average bulk density of at least 44 lb/cu-ft for corn silage and at least 40 lb/cu-ft for other silage types, using a spreadsheet approved by the District, c) harvest silage crop at > or = 65% moisture for corn; and >= 60% moisture for alfalfa/grass and other silage crops; manage silage material delivery such that no more than 6 inches of materials are uncompacted on top of the pile; and incorporate the applicable Theoretical Length of Chop (TLC) and roller opening for the crop being harvested. Implement two of the following: Manage Exposed Silage. a) manage silage piles such that only one silage pile has an uncovered face and the uncovered face has a total exposed surface area of less than 2,150 sq. ft., or b) manage multiple uncovered silage piles such that the total exposed surface area of all silage piles is less than 4,300 sq ft. Maintain Silage Working Face. a) use a shaver/facer to remove silage from the silage pile, or b) maintain a smooth vertical surface on the working face of the silage pile Silage Additive: a) inoculate silage with homolactic acid bacteria in accordance with manufacturer recommendations to achieve a concentration of at least 100,000 colony forming units per gram of wet forage or apply proprionic acid, benzoic acid, sorbic acid, sodium benzoate, or potassium sorbate at a rate specified by the manufacturer to reduce yeast counts when forming silage pile; or b) apply other additives at specified rates that have been demonstrated to reduce alcohol concentrations in silage and/or VOC emissions from silage and have been approved by the District and EPA.	39%	39%
		Total Control Efficiency*	39.00%	39.00%

*Assumes 25% control for density mitigation measures and 10% each for the two optional measures, resulting in an overall control of 39%. The same conservative control efficiency will be applied to the sealed feed storage system (Ag-Bag).

		TMR Mitigations		
☑	☑	Push feed so that it is within 3 feet of feedlane fence within 2 hrs of putting out the feed or use a feed trough or other feeding structure designed to maintain feed within reach of the cows.	10%	10%
☑	☑	Begin feeding total mixed rations within 2 hrs of grinding and mixing rations. Note: If selected for dairies > 999 milk cows, control efficiency already included in EF.	0%	0%
☑	☑	Feed steam-flaked, dry rolled, cracked or ground corn or other ground cereal grains.	10%	10%
☐	☐	Remove uneaten wet feed from feed bunks within 24 hrs after then end of a rain event.	0%	0%
☐	☐	For total mixed rations that contain at least 30% by weight of silage, feed animals total mixed rations that contain at least 45% moisture.	0%	0%
		Total Control Efficiency	19.00%	19.00%

Ammonia Mitigation Measures and Control Efficiencies

Milking Parlor				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	NH3 Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Milking Parlor Floor Mitigations		
TRUE	TRUE	Feed according to NRC guidelines	28%	28%
		Total Control Efficiency	28%	28%

Cow Housing				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	NH3 Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Corrals/Pens Mitigations		
☑	☑	Feed according to NRC guidelines	28%	28%
☑	Yes	Clean manure from corrals at least four times per year with at least 60 days between cleaning, or clean corrals at least once between April and July and at least once between September and December. **OR** Use lime or a similar absorbent material in the corral according to the manufacturer's recommendation to minimize moisture in the corrals. **OR** Apply thymol to the corral soil in accordance with the manufacturer's recommendation.	50%	50%
		Total Control Efficiency	64%	64%
		Bedding Mitigations		
☑	☑	Feed according to NRC guidelines	28%	28%
☐	No	Use non-manure-based bedding and non-separated solids based bedding for at least 90% of the bedding material, by weight, for freestalls (e.g. rubber mats, almond shells, sand, or waterbeds). **OR** For a large dairy only (1,000 milk cows or larger) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 7 days. **OR** For a medium dairy only (500 to 999 milk cows) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 14 days.	0.0%	0.0%
		Total Control Efficiency	28.00%	28.00%
		Lanes Mitigations		
☑	☑	Feed according to NRC guidelines	28%	28%
		Total Control Efficiency	28%	28%

Liquid Manure Handling				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	NH3 Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Lagoons/Storage Ponds Mitigations		
☑	Yes	Feed according to NRC guidelines	28%	28%
☑	Yes	Use phototropic lagoon **OR** Remove solids from the waste system with a solid separator system, prior to the waste entering the lagoon.	80%	80%
		Total Control Efficiency	85.6%	85.6%
		Liquid Manure Land Application Mitigations		
☐	No	Feed according to NRC guidelines	0%	0%
☐	No	Only apply liquid manure that has been treated with an anaerobic treatment lagoon	0%	0%
		Total Control Efficiency	0.00%	0.00%

Solid Manure Handling				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	NH3 Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Solid Manure Land Application Mitigations		
☑	Yes	Feed according to NRC guidelines	28%	28%
☐	No	Incorporate all solid manure within 72 hours of land application. **AND** Only apply solid manure that has been treated with an anaerobic treatment lagoon, aerobic lagoon or digester system. **AND** Apply no solid manure with a moisture content of more than 50%	0%	0%
		Total Control Efficiency	28.00%	28.00%

Facility Herd Size					
Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals
Milk Cows	0	0	0	2,420	2,420
Dry Cows	0	0	0	0	0
Support Stock (Heifers, Calves, and Bulls)	0	0	0	4,008	4,008
Large Heifers	0	0	0	0	0
Medium Heifers	0	0	0	0	0
Small Heifers	0	0	0	0	0
Bulls	0	0	0	0	0

	Calf Hutches				Calf Corrals		
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	Scraped	Total # of Calves
Calves	0	0	0	0	0	0	0

Silage Information				
Feed Type	Maximum # Open Piles	Maximum Height (ft)	Maximum Width (ft)	Open Face Area (ft^2)
Corn	1	20	70	1,113
Alfalfa	1	20	70	1,113
Wheat	1	20	70	1,113

Milking Parlor				
Cow	VOC		NH3	
Milk Cows	lb/day	lb/yr	lb/day	lb/yr
	2.7	**968**	**0.9**	**331**

Cow Housing						
Cow	VOC		NH3		PM10	
	lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	63.1	23,014	154.4	56,367	36.2	13,213
Dry Cows	0.0	0	0.0	0	0.0	0
Support Stock (Heifers, Calves, and Bulls)	45.4	16,553	67.2	24,529	115.8	42,284
Large Heifers	0.0	0	0.0	0	0.0	0
Medium Heifers	0.0	0	0.0	0	0.0	0
Small Heifers	0.0	0	0.0	0	0.0	0
Calves	0.0	0	0.0	0	0.0	0
Bulls	0.0	0	0.0	0	0.0	0
Total	**108.4**	**39,567**	**221.6**	**80,896**	**152.0**	**55,498**

Liquid Manure Handling						
Cow	VOC		NH3		H2S	
	lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	7.8	2,831	7.8	2,856	57.1	20,836
Dry Cows	0.0	0	0.0	0	0.0	0
Support Stock (Heifers, Calves, and Bulls)	5.4	1,964	3.5	1,283	14.1	5,130
Large Heifers	0.0	0	0.0	0	0.0	0
Medium Heifers	0.0	0	0.0	0	0.0	0
Small Heifers	0.0	0	0.0	0	0.0	0
Calves	0.0	0	0.0	0	0.0	0
Bulls	0.0	0	0.0	0	0.0	0
Total	**13.2**	**4,795**	**11.3**	**4,138**	**71.2**	**25,966**

Solid Manure Handling				
Cow	VOC		NH3	
	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	1.4	508	8.8	3,219
Dry Cows	0.0	0	0.0	0
Support Stock (Heifers, Calves, and Bulls)	1.0	361	3.8	1,403
Large Heifers	0.0	0	0.0	0
Medium Heifers	0.0	0	0.0	0
Small Heifers	0.0	0	0.0	0
Calves	0.0	0	0.0	0
Bulls	0.0	0	0.0	0
Total	**2.4**	**869**	**12.6**	**4,621**

Calculations for milking parlor:

Annual PE = (# milk cows) x (EF1 lb-pollutant/hd-yr)

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calculations for cow housing:

See detailed calculations under Cow Housing Calculations worksheet.

Calculations for liquid manure and solid manure handling:

Annual PE = [(# milk cows) x (EF1 lb-pollutant/hd-yr)] + [(# dry cows) x (EF1 lb-pollutant/hd-yr)] + [(# large heifers) x (EF1 lb-pollutant/hd-yr)] + [(# medium heifers) x (EF1 lb-pollutant/hd-yr)] + [(# small heifers) x (EF1 lb-pollutant/hd-yr)] + [(# calves) x (EF1 lb-pollutant/hd-yr)] + [(# bulls) x (EF1 lb-pollutant/hd-yr)]

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

The H2S emission factor is assumed to be 10% of the NH3 lagoon/storage pond(s) emission factor, for each respective herd size.

Calculations for silage emissions:

Annual PE = (EF1) x (area ft^2) x (0.0929 m^2/ft^2) x (8,760 hr/yr) x (60 min/hr) x 2.20E-9 lb/µg

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calculation for TMR emissions:

Annual PE = (# cows) x (EF1) x (0.658 m^2) x (525,600 min/yr) x (2.20E-9 lb/µg)

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Feed Handling and Storage		
	Daily PE (lb-VOC/day)	Annual PE (lb-VOC/yr)
Corn Emissions	6.9	2,530
Alfalfa Emissions	1.7	637
Wheat Emissions	8.8	3,198
TMR	141.7	51,722
Total	**159.1**	**58,086**

Total Daily Pre-Project Potential to Emit (lb/day)							
Permit	**NOx**	**SOx**	**PM10**	**CO**	**VOC**	**NH3**	**H2S**
Milking Parlor	0.0	0.0	0.0	0.0	2.7	0.9	0.0
Cow Housing	0.0	0.0	152.0	0.0	108.4	221.6	0.0
Liquid Manure	0.0	0.0	0.0	0.0	13.2	11.3	71.2
Solid Manure	0.0	0.0	0.0	0.0	2.4	12.6	0.0
Feed Handling	0.0	0.0	0.0	0.0	159.1	0.0	0.0
Total	**0.0**	**0.0**	**152.0**	**0.0**	**285.8**	**246.4**	**71.2**

Major Source Emissions (lb/yr)					
Permit	**NOx**	**SOx**	**PM10**	**CO**	**VOC**
Milk Parlor	0	0	0	0	0
Cow Housing	0	0	0	0	0
Liquid Manure	0	0	0	0	4,795
Solid Manure	0	0	0	0	0
Feed Handling	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**4,795**

Total Annual Pre-Project Potential to Emit (lb/yr)							
Permit	**NOx**	**SOx**	**PM10**	**CO**	**VOC**	**NH3**	**H2S**
Milking Parlor	0	0	0	0	968	331	0
Cow Housing	0	0	55,498	0	39,567	80,896	0
Liquid Manure	0	0	0	0	4,795	4,138	25,966
Solid Manure	0	0	0	0	869	4,621	0
Feed Handling	0	0	0	0	58,086	0	0
Total	**0**	**0**	**55,498**	**0**	**104,286**	**89,986**	**25,966**