

LINN OPERATING, LLC

PREVENTATIVE MAINTENANCE/ MALFUNCTION ABATEMENT PLAN AND EPA 40 CFR, Part 63 Subpart ZZZZ MAINTENANCE PLAN

For

**HAYES 29
CENTRAL PRODUCTION FACILITY
HAYES TOWNSHIP, OTSEGO COUNTY, MI
SRN 5831**

January 7, 2019

Compressor Engine Identification

Engines (make/model):	Caterpillar 3516 LE
Unit No.	3956
	Low Emission/ Lean Burn
Horsepower:	1085
Control	Oxidation Catalyst and AFRC

Purpose of Oxidation Catalyst

Oxidation catalysts used on lean burn engines reduce carbon monoxide (CO), volatile organic compounds (VOCs) and trace toxic air contaminants, which include hazardous air pollutants (HAPs) emissions.

Engine Operating Variables To Be Monitored

A copy of the normal field maintenance report and the compressor monthly operating reports are identified as Attachment 1a and 1b, respectively.

Malfunction Corrective Procedures

The engine will be shut down immediately if a malfunction event occurs. Repair work will be completed, the amount of time the engine is down, and the repairs performed will be recorded on the Field Maintenance Report. The catalyst (if impacted) will be inspected prior to engine start up. Note that new engines, or engines that have been recently overhauled or major repairs performed, should be run at the maximum available load for a period of at least 100 hours, before the catalyst element is installed. This allows the new engine components to break in and most major problems associated with engine start up to be resolved, protecting the catalyst element. If major engine work occurs, LINN should document the amount of time the engine is operated without the catalyst on the attached log in Attachment 2.

Major Parts Replacement Inventory

Major replacement parts (including a spare catalyst element) are kept in inventory for quick replacement in the event it is required. Parts inventory is maintained by a subcontractor.

Oxidation Catalyst Operating Variables to Be Monitored

Unit 3956

Operating Variable	Normal Range*	Method of inspections	Frequency
Catalyst Inlet Temperature	>750° F	Visual inspection (thermocouple reading)	Daily
Catalyst Outlet Temperature	>750° F <1,350° F	Visual inspection (thermocouple reading)	Daily
Pressure Differential across Catalyst	5.4” of water column#	Visual inspection (gauge reading)	Monthly

*Catalyst inlet and outlet temperature and calibrated pressure differential ranges have been substantiated by utilizing a portable analyzer on three separate occasions. Maintenance and analyzer data is available in Attachment 3. The analyzer will be utilized to verify (when applicable) the CO reduction is at least 80%.

#Currently, a new baseline is being established based upon observed readings. The current actionable pressure differential is 7.4” w.c., or 2” w.c. above the substantiated range.

Corrective Procedures in the Event of a Malfunction

If an operating variable listed above is out of the specified range the following steps will be taken:

1. Within 5 days check emissions reduction efficiencies for CO and NO_x with a portable emissions analyzer. If efficiencies are within manufacturer’s specifications (80% for CO 0% for NO_x) nothing more will be done. LINN may submit the Change in Oxidation Catalyst Operating Variable Notification Form (Attachment 4) to the MDEQ District Supervisor to revise the catalyst operating variable range, if applicable. If efficiencies are not within manufacturer’s specifications, proceed to step 2.
2. Within 5 days after step 1 above is completed, the catalyst will be removed and cleaned by vacuuming the catalyst face or using clean compressed air over the catalyst face. The catalyst gasket will also be replaced. The catalyst will be returned to service and emissions re-checked. If the catalyst still does not meet efficiency goals, remove the catalyst and send to vendor for cleaning. Install a replacement catalyst during vendor cleaning process.

AFRC O₂ Sensor Replacement Schedule

O₂ sensors for the AFRC will be replaced quarterly. Records shall be kept of the O₂ sensor replacements.

Emission Checks- Use of a Portable Emissions Analyzer

- a. The analyzer will be calibrated as required by the manufacturer. Records of calibration will be kept on file and made available to the Air Quality District Supervisor upon request.
- b. The analyzer will be used only for CO and NO_x.
- c. The analyzer will be used monthly, and, to either (1) check the performance of a catalyst if a monitored parameter is out of range (as discussed above); or (2) when a cleaned catalyst is installed, typically every 12 to 18 months.
- d. LINN will conduct catalyst inlet and outlet checks to estimate destruction efficiency.
- e. Records shall be kept of destruction efficiency analysis.

Scheduled Maintenance

- a. The catalyst will be inspected and cleaned by vacuuming the catalyst face or blowing with clean compressed air every 12-18 months unless the operating variables specified above are out of their respective ranges.
- b. After inspection and cleaning, the catalyst shall be returned to service and emission reduction testing shall be performed. If the catalyst does not respond to the field cleaning, it will be sent to the manufacturer for a chemical cleaning. A replacement catalyst media will be used during the cleaning process in the interim.
- c. The oxidation catalyst gasket will be replaced when the catalyst is serviced (typically every 12-18 months).
- d. The catalyst will be replaced if it is demonstrated that it is not functioning properly after the vendor cleaning, or in lieu of vendor cleaning.

Scheduled Maintenance as indicated in Table 2d to Subpart ZZZZ:

8. Non-Emergency, non-black start 4SLB remote stationary RICE >500 HP	a. Change oil and filter every 2,160 hours of operation or annually, whichever comes first; ¹
	b. Inspect spark plugs every 2,160 hours of operation or annually, whichever comes first, and replace as necessary;
	c. Inspect all hoses and belts every 2,160 hours of operation or annually, whichever comes first, and replace as necessary;

§63.6625(i) If you own or operate a stationary engine that is subject to the work, operation or management practices in items 1, 2, or 4 of Table 2c to this subpart or in items 1 or 4 of Table 2d to this subpart, you have the option of utilizing an oil analysis program in order to extend the specified oil change requirement in Tables 2c and 2d to this subpart. **§63.6625(j)** If you own or operate a stationary SI engine that is subject to the work, operation or management practices in items 6, 7, or 8 of Table 2c to this subpart or in items 5, 6, 7, 9, or 11 of Table 2d to this subpart, you have the option of utilizing an oil analysis program in order to extend the specified oil change requirement in Tables 2c and 2d to this subpart. The oil analysis must be performed at the same frequency specified for changing the oil in Table 2c or 2d to this subpart. The analysis program must at a minimum analyze the following three parameters: Total Base Number, viscosity, and percent water content. The condemning limits for these parameters are as follows: Total Base Number is less than 30 percent of the Total Base Number of the oil when new; viscosity of the oil has changed by more than 20 percent from the viscosity of the oil when new; or percent water content (by volume) is greater than 0.5. If all of these condemning limits are not exceeded, the engine owner or operator is not required to change the oil. If any of the limits are exceeded, the engine owner or operator must change the oil before continuing to use the engine. The owner or operator must keep records of the parameters that are analyzed as part of the program, the results of the analysis, and the oil changes for the engine. The analysis program must be part of the maintenance plan for the engine.

¹ Sources have the option to utilize an oil analysis program as described in section 63.6625 (i) and (j) in order to extend the specified oil change requirement in Table 2d of this Subpart ZZZZ.

Supervisory Personnel Responsible for Maintenance of the Control Equipment

Christopher Zimmerman
Production Foreman
4890 Airport Road
Lewiston, MI 49756
Office Phone: 989.786.7592
Cell Phone: 989.370.7654

Retention of Records

Records shall be kept on file and retained as described in the permit.

Updates of PM/MAP

Updates of the plan will be submitted to the AQD District Supervisor for written approval. If an operating variable range is modified using the Change in Oxidation Catalyst Operating Variable Notification Form, the PM/MAP will be updated to reflect the new range, as necessary. See Attachment 4.

Compressor Monthly Operating Report

UNIT# _____

LOCATION _____

OPERATOR _____

MONTH/YEAR _____

ENGINE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
RPM																															
Eng JW temp																															
Eng oil pres																															
Eng oil temp																															
Eng hours																															
Manifold pres																															
Turbo temp																															
Pre-catalyst temp																															
Post-catalyst temp																															
Compressor																															
Suction pres																															
1ST int pres																															
2ND int pres																															
3RD int pres																															
Disch pres																															
Suction temp																															
1st disch temp																															
2ND Suc temp																															
2ND dis temp																															
3RD Suc temp																															
3RD dis temp																															
4TH Suc temp																															
Disch temp																															
Comp oil pres																															
Comp oil temp																															
Fluid levels																															
Down time hrs																															

REASON FOR DOWNTIME

Hayes 29
Unit #3956

Year: _____

Record of Time Engine Operated Without the Catalytic Converter

Total allowable per unit is 200 hours in 12 month period (not calendar year).

Time/Date of Engine Malfunction	Time/Date of Engine Repair	Reason	Total Hours Down	Total Hours 12 Month Time Period

Only record time engine operated without catalytic converter, not amount of time engine was shut down

Operator Signature _____

Submit to Chris Zimmerman monthly.

CATALYST MONTHLY OPERATING REPORT

UNIT#	LOCATION	CUSTOMER	DATE OF SERVICE	PRE TEMP	POST TEMP	TEMP DIFF	DIFFERENTIAL PRESSURE IN W.C	SUCTION	DISCHARGE PRESSURE	RPM	COMMENTS
3956	Hayes 29	LINN									
ESTABLISHED BASELINE 8/20/13							ESTABLISHED BASELINE 1/14/13				
TEMP DIFF BASELINE		48	0				W/C DIFF	4.6			
			9/20/2013	837	814	-23	1.5	-1.4	990	1027	
			9/25/2013	881	855	-26	6.5	2.8	980	1177	
			9/30/2013	886	864	-22	6	-1.4	990	1167	
			10/2/2013	882	860	-22	6.5	-1.8	980	1170	
			10/8/2013	867	845	-22	6.4	-1.5	1000	1120	
			10/10/2013	870	848	-22	6.5	-1.3	985	1120	
			10/12/2013	870	848	-22	6.5	-1.3	985	1120	
			10/14/2013	880	856	-24	6.5	-1.9	985	1163	
			10/18/2013	870	848	32	11	-1.7	990	1165	
			10/22/2013	872	850	-22	6	-1.9	985	1167	
			10/24/2013	874	852	-22	6	-2	990	1158	
			10/28/2013	860	838	-22	6	-2.2	995	1168	
			10/29/2013	859	837	-22	6	-2.5	990	1170	
			10/31/2013	852	830	-22	6	2.5	1010	1163	
ESTABLISHED BASELINE 11/1/13							ESTABLISHED BASELINE 1/14/13				
TEMP DIFF BASELINE		-24	0				W/C DIFF	5.5			
			11/5/2013	851	831	-20	6	-2.5	995	1166	
			11/7/2013	858	839	-19	6	-0.1	990	1200	
			11/15/2013	834	813	-21	4.5	-2.2	995	1133	
			11/19/2013	819	796	-23	2.5	-3.9	990	1019	
			11/21/2013	829	810	-19	4.5	-2.5	985	1118	
			11/26/2013	821	800	-21	4	-2.3	995	1089	

Attachment 4

LINN Operating, LLC
CHANGE IN CATALYTIC CONVERTER OPERATING VARIABLE
NOTIFICATION FORM

FACILITY NAME _____

SRN No. _____

PERMIT No. _____

UNIT No. _____

DATE	CATALYST OPERATING VARIABLE	OLD RANGE	NEW RANGE

Description of why/how range was modified. Include testing data to document range modifications.

If a range is changed the PM/MAP will be updated and submitted to DEQ District Supervisor.