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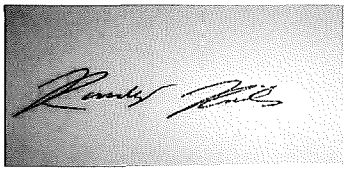
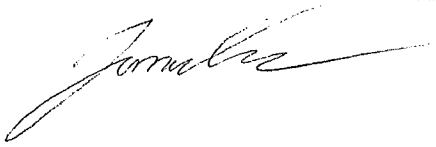
40 CFR 63 Subpart ZZZZ
Reciprocating Internal Combustion Engines
(RICE MACT)
Diversion Diesel Pump
Engine B (D-200B)

The Dow Chemical Company
Michigan Operations
Midland, MI

Quality Information

Prepared by	Checked by
	
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1. Introduction

1.1 Summary of Test Program

The Dow Chemical Company (Dow) in Midland, Michigan, is a large complex with manufacturing and utility plants. Dow's Michigan Operations (MiOps) is a major source of Hazardous Air Pollutants (HAPS).

AECOM was contracted to conducted compliance sampling on two 1,050 horsepower (HP) non-emergency diesel engines (called Engine A and Engine B) to demonstrate compliance with the RICE MACT, 40CFR63, Subpart ZZZZ. The engines are operated to divert influent wastewater and storm water away from the on-site wastewater treatment plant (WWTP) to wastewater storage tanks for a variety of reasons. The testing was conducted to demonstrate compliance with emissions and operating limits found in 63.6600(d), Table 2c of the RICE MACT, 40CFR63, Subpart ZZZZ. This report presents the results only for testing of Engine B since the results of the Engine A test was reported previously on July 1, 2022.

The following table summarizes the pertinent data for this compliance test:

Responsible Groups	• The Dow Chemical Company • Michigan Department of Energy, Great Lakes, and Environment. (EGLE) • Environmental Protection Agency (EPA)
Applicable Regulations	• ROP- MI-A4033-2017b • 40 CFR 63, Subpart ZZZZ (RICE MACT)
Industry / Plant	• Environmental Operations Plant (EVO)
Plant Location	• The Dow Chemical Company Midland, MI, 48667
Unit Installation Date	• Engine A 6/2/2021 • Engine B 3/17/2022
Unit Initial Compliance Date	• Engine A 11/18/2021 • Engine B 08/03/2022
Air Pollution Control Equipment	• All engines are equiped with dual single stage catalytic reduction and closed crankcase filtration emissions control systems
Emission Point Tested	• P200 Diesel Engine B
Pollutants/Diluent Measured	• Carbon Monoxide (CO) • Oxygen (O_2)
Test Date	• August 3, 2022 (Engine B only)

1.2 Key Personnel

Names and affiliations of personnel, including their roles in the test program, are summarized in the following table.

Role	Role Description	Name	Affiliation
Process Focal Point	• Coordinate plant operation during the test. • Ensure the unit is operating at the agreed upon conditions in the test plan. • Collect any process data required. • Provide all technical support related to process operation.	Morgan Raup	Dow Chemical
Environmental Focal Point	• Ensure all regulatory requirements and citations are reviewed and considered for the testing.	Becky Meyerholt	Dow Chemical
Air SME	• Leadership of the sampling program. • Develop the overall testing plan. • Determine the correct sample methods.	Chuck Glenn	Dow Chemical
Technical Reviewer	• Completes technical review of the test data.	Wayne Washburn	AECOM
Field Team Leader	• Ensures field sampling meets the quality assurance objectives of the plan.	Randy Reinke	AECOM
Sample Project Leader	• Ensures data generated meets the quality assurance objectives of the plan.	James Edmister	AECOM

2. Plant and Sampling Location Description

2.1 Facility Description

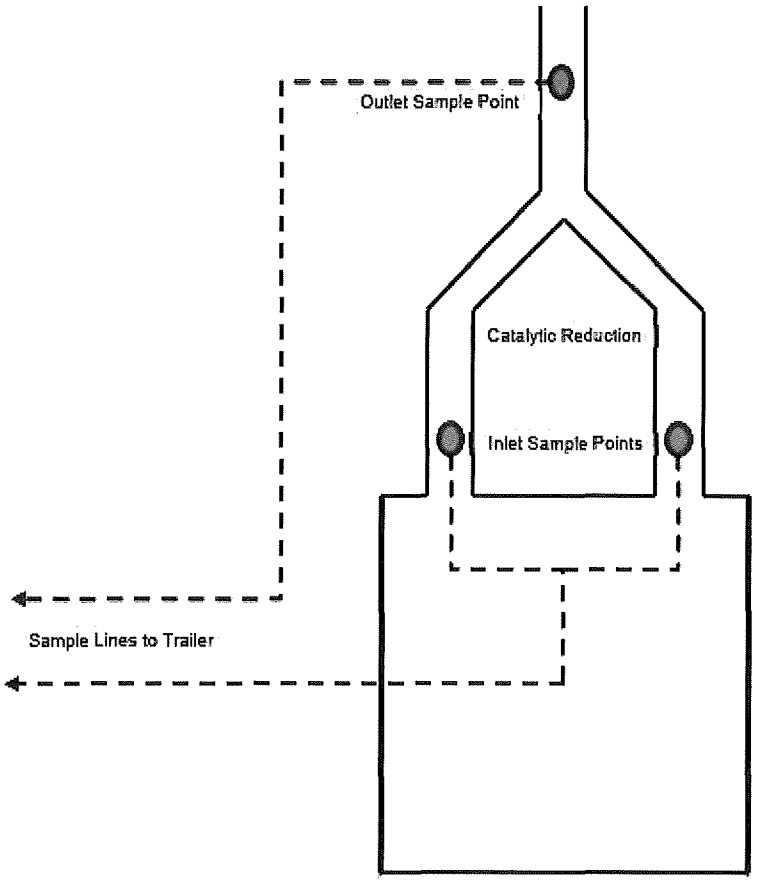
Dow operates a chemical manufacturing facility in Midland, Michigan. Environmental Operations (EVO) operates two diesel 1,050 hp engines to divert influent wastewater and storm water away from the on-site wastewater treatment plant (WWTP) to wastewater storage tanks for a variety of reasons.

Engine B completed its initial performance test on August 3, 2022. This report includes the results from the August 3, 2022 testing of Engine B only due to an equipment malfunction on Engine B that prevented it from being tested during the testing of Engine A which was conducted in May 2022.

The testing was conducted to demonstrate compliance with emissions and operating limits found in 63.6600(d), Table 2c of the RICE MACT, 40CFR63, Subpart ZZZZ.

2.2 Flue Gas Sampling Locations

Sampling was conducted on Engine B prior to and after the dual (in parallel) single stage catalytic reduction unit. Flue gas sample locations met the minimum guidelines for carbon monoxide (CO) and oxygen (O_2) sampling.



3. Summary and Discussion of Test Results

3.1 Objectives and Test Matrix

Under contract with Dow, Midland Operations, AECOM, Inc., conducted compliance sampling on the engines located at the Environmental Operations Plant (EVO) at Dow's Michigan Operations facility (MiOps). These engines are operated in non-emergency situations to manage wastewater and storm water at the MiOps site. The testing was conducted to demonstrate compliance with emissions and operating limits found in 63.6600(d), Table 2c. The specific objectives of this test were to:

- Verify the destruction and removal efficiency (DRE) for CO is greater than 70% or demonstrate the concentration of CO in the stationary RICE exhaust to be 23 ppmvd at 15 percent O_2, or less. Meeting only the least restrictive criterion is acceptable for compliance.

3.2 Facility Operations

For engines >500HP the facility must:

- Minimize idle time at startup to <30 minutes
- Maintain the catalyst so that the pressure drop across the catalyst does not change by more than 2 inches of water at 100 percent load plus or minus 10 percent from the pressure drop across the catalyst measured during the initial performance test; AND
- Exhaust maintained such that 450°F ≤ catalyst inlet temperature ≤ 1,350°F

The test on Engine B that occurred on August 3, 2022, was operated while the load speed was 100%.

3.3 Test Results

Table 3-1: P200 Engine B Test Summary

SAMPLE TYPE	TEST METHOD	*ACTUAL EMISSIONS or REDUCTION	REQUIRED EMISSIONS LIMIT or REDUCTION
CO Emissions (ppmvd @ 15%O_2)	EPA Method 10	0.70	23
CO Emissions Reduction (DRE %)	EPA Method 10	98 %	70 %

* Average over three one-hour runs.

Table 3-2: P200 Engine B Test Run Data

PARAMETER	RUN 1	RUN 2	RUN 3	AVERAGE
Sample Date	08/03/2022	08/03/2022	08/03/2022	--
Sample Times (start/end)	11:26 - 12:26	12:40 - 13:40	13:54 - 14:54	--
Outlet CO (ppmv @ 15% O_2)	0.74	0.68	0.67	0.70
Inlet CO (ppmv @ 15% O_2)	34.27	32.53	32.61	33.14
CO (DRE %)	**97.8**	**97.9**	**97.9**	**97.9**

Table 3-3: P200 Engine B Process Data

PARAMETER	RUN 1	RUN 2	RUN 3	AVERAGE
Sample Date	08/03/2022	08/03/2022	08/03/2022	--
Sample Times (start-end)	11:26 - 12:26	12:40 - 13:40	13:54 - 14:54	--
Engine RPM (RPM)	1,451	1,415	1,409	1,425
Engine Load Speed (%)	100.0	100.0	100.0	100.0
Fuel Consumed (% of Tank)	3.06	2.88	2.63	2.86
Outlet Temp (Deg F)	161.9	164.4	164.8	163.7
Catalyst A				
Catalyst Inlet Temp (Deg F)	715	713	718	715
Differential Pressure (IWC)	15.85	15.89	15.87	15.87
Catalyst B				
Catalyst Inlet Temp (Deg F)	723	721	726	723
Differential Pressure (IWC)	16.12	16.28	16.25	16.22

4. Sampling and Analytical Procedures

4.1 Test Methods

All sampling and analytical procedures are EPA published methods or methods allowed by the RICE MACT (63.6610). This compliance test utilized the following methods:

- EPA Method 3A for O_2 Concentration
- EPA Method 10 for CO Concentration

Procedures
The above methods were performed using continuous instrumental measurements analyzers provided by the AECOM internal testing team. Gas was withdrawn from the stack and transported to analyzers located in a mobile laboratory at ground level. A stainless-steel probe was inserted into the stack and used to collect sample gas. A Teflon sample line heated to 250°F transported sample gas from the probe to the analyzers. The analyzers were kept at a constant temperature inside the mobile laboratory.

Sample gas was collected continuously from the stack. At the mobile laboratory, the stack gas was routed to a condenser and then transported to the analyzers for analysis.

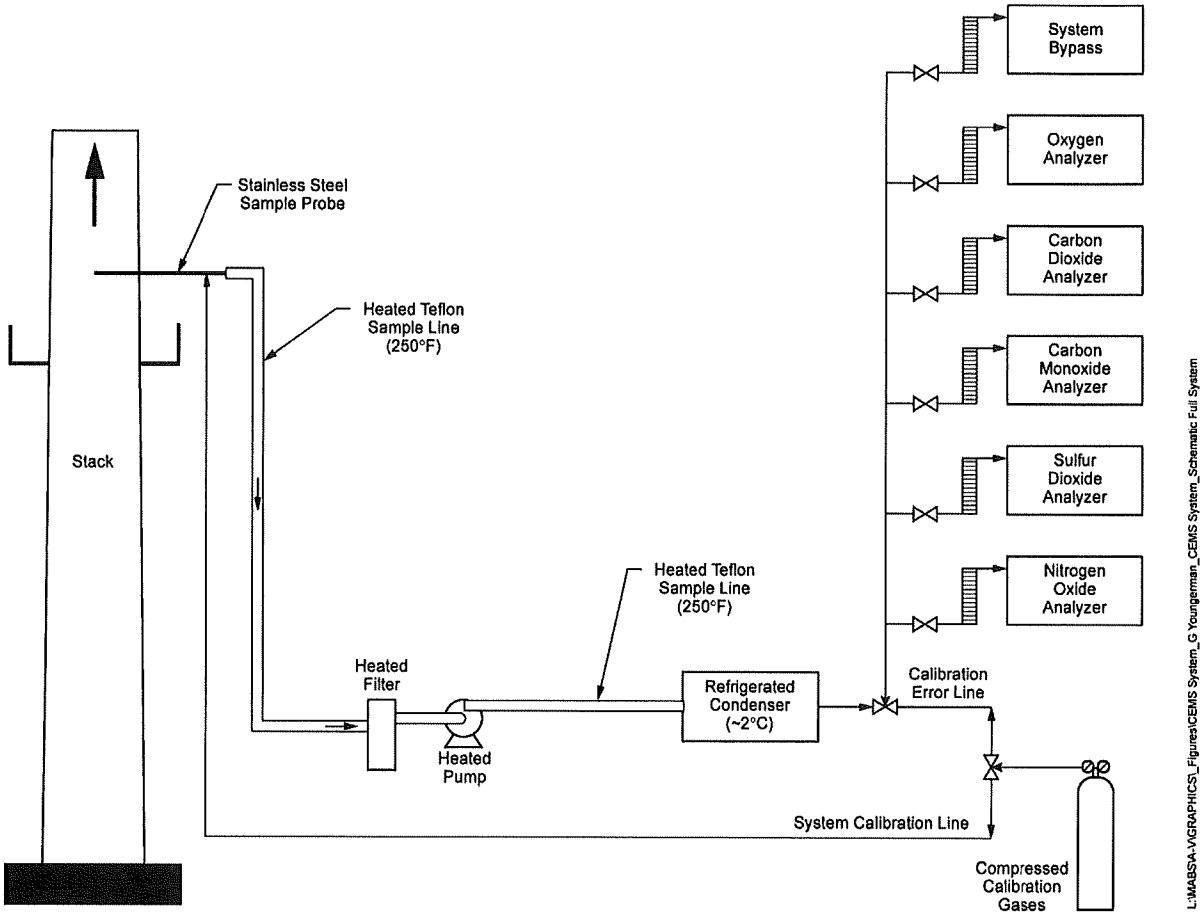
EPA Method 3A (Flue Gas Composition and Molecular Weight)
EPA Method 3A (Instrumental Method) was utilized to determine the diluent gas concentrations during each run on the inlet and outlet of the oxidation catalyst.

The analyzer measured O_2 content on the basis of the strong paramagnetic properties of O_2 relative to other compounds present in combustion gases. In the presence of a magnetic field, O_2 molecules become temporary magnets. The analyzer determines the sample gas O_2 concentration by detecting the displacement torque of the sample test body in the presence of a magnetic field.

EPA Method 10 (CO Sampling and Analysis)
EPA Method 10 was utilized to determine carbon monoxide concentrations during each run on the outlet.

An analyzer measured CO based on its absorption of infrared radiation. The infrared unit uses a single beam, single wavelength technique, with wavelength selection being achieved by a carefully specified narrow band optical filter making it highly selective for CO measurement in the presence of other infrared-absorbing gases.

Figure 4-1: SAMPLING TRAIN USED FOR CO & O_2 (M10 & M3A)



5. Calculations

5.1 Calibration Error - Equation 7E-1

$$\mathbf{ACE} = \frac{\mathbf{C_{Dir} - C_V}}{\mathbf{CS}} \times \mathbf{100\%}$$

C_{dir} = Measured concentration of a calibration gas (low, mid, or high) when introduced in direct calibration mode

C_V = Manufacturer certified concentration of a calibration gas (low, mid, or high)

CS = Calibration span

For Outlet Oxygen, mid cal gas

C_{dir}	=	9.98	%
C_V	=	10.00	%
CS	=	19.71	%

ACE = $\frac{(\ 9.98\ -\ 10.00\ )}{19.71}$ X 100 %

ACE = -0.1 %

For Outlet Carbon Monoxide, mid cal gas

C_{dir}	=	15.39	ppmv
C_V	=	14.92	ppmv
CS	=	29.81	ppmv

ACE = $\frac{(\ 15.39\ -\ 14.92\ )}{29.81}$ X 100 %

ACE = 1.6 %

5.2 System Bias - Equation 7E-2

$$\mathbf{SB} = \frac{\mathbf{C_S - C_{Dir}}}{\mathbf{CS}} \times \mathbf{100\%}$$

C_{dir} = Measured concentration of a calibration gas (low, mid, or high) when introduced in direct calibration mode

C_V = Manufacturer certified concentration of a calibration gas (low, mid, or high)

CS = Calibration span

For Outlet Oxygen, mid cal gas

C_S	=	9.94	%
C_{dir}	=	9.98	%
CS	=	19.71	%

$$\mathbf{SB} = \frac{(\ 9.94\ -\ 9.98\ )}{19.71} \times 100\ \%$$

SB = -0.2 %

For Outlet Carbon Monoxide, mid cal gas

C_S	=	15.50	ppmv
C_{dir}	=	15.39	ppmv
CS	=	29.81	ppmv

$$\mathbf{SB} = \frac{(\ 15.50\ -\ 15.39\ )}{29.81} \times 100\ \%$$

SB = 0.4 %

5.3 System Drift - Equation 7E-4

$$\mathbf{D = |SB_{final} - SB_i|}$$

D = Drift assessment, percent of calibration span

SB_{final} = Post-run system bias, percent of calibration span

SB_i = Pre-run system bias, percent of calibration span

For Outlet Oxygen, mid cal gas

SB_{Final}	=	-0.5	%
Sb_i	=	-0.2	%

D = | -0.5 - -0.2 |

D = 0.3 %

For Outlet Carbon Monoxide, mid cal gas

SB_{Final}	=	0.4	%
Sb_i	=	1.5	%

D = | 0.4 - 1.5 |

D = 1.1 %

5.4 Effluent Concentration - Equation 7E-5b

$$C_{Gas} = (C_{avg} - C_0)\frac{C_{MA}}{C_M - C_0}$$

C_{Gas} = Average effluent gas concentration adjusted for bias

C_{Avg} = Average unadjusted gas concentration indicated by data recorder for the test run

C_0 = Average of the initial and final system calibration bias check responses from the zero-calibration gas

C_{MA} = Actual concentration of the upscale calibration gas

C_M = Average of initial and final system calibration bias check responses for the upscale calibration gas

For Outlet Oxygen,

C_{avg}	=	9.96	%
C_0	=	0.06	%
C_{MA}	=	10.00	%
C_M	=	9.92	%

$$C_{gas} = (\ 9.96\ -\ 0.06\ )\ (\ \frac{10.00}{9.92\ -\ 0.06}\ )$$

C_{gas} = 10.05 %

For Outlet Carbon Monoxide,

C_{avg}	=	3.46	ppmv
C_0	=	0.34	ppmv
C_{MA}	=	14.92	ppmv
C_M	=	15.67	ppmv

$$C_{gas} = (\ 3.46\ -\ 0.34\ )\ (\ \frac{14.92}{15.67\ -\ 0.34}\ )$$

C_{gas} = 3.03 ppmv

5.5 Effluent Concentration Corrected for Oxygen Concentration

$$\mathbf{P_{Corr}} = \mathbf{P_{meas}} \times \frac{\mathbf{20.9 - O_{2\,std}}}{\mathbf{20.9 - O_{2\,meas}}}$$

P_{Corr} = Pollutant Concentration, corrected to the oxygen standard

P_{meas} = Measured concentration of Pollutant

$O_{2\,std}$ = Oxygen concentration to be used for a standard

$O_{2\,meas}$ = Oxygen concentration measured

For Outlet Carbon Monoxide,

P_{meas}	=	3.03	ppm
$O_{2\,std}$	=	15.00	%
$O_{2\,meas}$	=	10.05	%

$$\mathbf{P_{Corr}} = 3.03 \times \frac{(\ 20.90 - 15.00\ )}{(\ 20.90 - 10.05\ )}$$

$\mathbf{P_{Corr}} = 1.65$

For Inlet Carbon Monoxide,

P_{meas}	=	59.51	ppm
$O_{2\,std}$	=	15.00	%
$O_{2\,meas}$	=	10.16	%

$$\mathbf{P_{Corr}} = 59.51 \times \frac{(\ 20.90 - 15.00\ )}{(\ 20.90 - 10.16\ )}$$

$\mathbf{P_{Corr}} = 32.68$

6. Instrumental Analyzer Run Data

6.1 Outlet Oxygen Calibration Data Summary

Diesel Engine B RICE MACT

Oxygen Calibration Data Summary

Facility:	Dow EVO
Source:	Catalyst Outlet
Project Number:	60677762
Date:	3-Aug-22
Instrument Make/Model:	Servomex 1440
Instrument Name/ID	OXC-M1902
Calibration Span Value:	20.06
Analyzer Range:	25
Units:	%, dry
Technician(s):	Randy Reinke

Calibration Error Test Results

	Cylinder ID	Certified Value	Time	CEM Response	Absolute Difference	Cal Error (% of Span)
					0.5% Limit	2.0% Limit
zero gas	UHP N2 Out	0.00	9:22	-0.01	0.01	0.0%
span gas	CC447132	20.06	9:29	19.89	0.17	0.8%
mid-range	CC46550	9.93	9:34	9.94	0.01	0.0%

CEMS Calibration Bias and Drift Tests

Cylinder Value	Calibration Error CEMS Response	Time	Pre-Test CEMS Response	Bias (% of Span) 5.0% Limit	Time	Post-Test CEMS Response	Bias (% of Span) 5.0% Limit	Drift (% of Span) 3.0% Limit	Calculated Factors from Equation 7E-5	
0.00	-0.01	10:41	0.10	0.5%	12:31	0.02	0.1%	-0.4%	C_O	0.058
9.93	9.94	10:44	9.89	-0.2%	12:34	9.85	-0.4%	-0.2%	$C_{MA}/(C_M-C_O)$	1.012
0.00	-0.01	12:31	0.02	0.1%	13:44	0.02	0.1%	0.0%	C_O	0.018
9.93	9.94	12:34	9.85	-0.4%	13:47	9.85	-0.4%	0.0%	$C_{MA}/(C_M-C_O)$	1.010
0.00	-0.01	13:44	0.02	0.1%	14:57	0.02	0.1%	0.0%	C_O	0.020
9.93	9.94	13:47	9.85	-0.4%	14:59	9.84	-0.5%	0.0%	$C_{MA}/(C_M-C_O)$	1.011

6.2 Outlet Carbon Monoxide Calibration Data Summary

Diesel Engine B RICE MACT

Carbon Monoxide Calibration Data Summary

Facility:	Dow EVO
Source:	Catalyst Outlet
Project Number:	60677762
Date:	3-Aug-22
Instrument Make/Model:	Thermo 48i
Instrument Name/ID	A1601
Calibration Span Value:	29.89
Analyzer Range:	50
Units:	ppmv dry
Technician(s):	Randy Reinke

Calibration Error Test Results

	Cylinder ID	Certified Value	Time	CEM Response	Absolute Difference	Cal Error (% of Span)
					0.5ppm Limit	2.0% Limit
zero gas	UHP N2 Out	0.00	9:22	0.02	0.02	0.1%
span gas	CC447132	29.89	9:29	29.91	0.02	0.1%
mid-range	CC46550	14.85	9:34	14.93	0.08	0.3%

CEMS Calibration Bias and Drift Tests

Cylinder Value	Calibration Error CEMS Response	Time	Pre-Test CEMS Response	Bias (% of Span) 5.0% Limit	Time	Post-Test CEMS Response	Bias (% of Span) 5.0% Limit	Drift (% of Span) 3.0% Limit	Calculated Factors from Equation 7E-5	
0.00	0.02	10:41	0.12	0.3%	12:31	0.10	0.2%	-0.1%	C_O	0.108
14.85	14.93	10:44	14.83	-0.3%	12:34	14.88	-0.2%	0.2%	$C_{MA}/(C_M-C_O)$	1.007
0.00	0.02	12:31	0.10	0.2%	13:44	0.10	0.3%	0.0%	C_O	0.100
14.85	14.93	12:34	14.88	-0.2%	13:47	14.86	-0.2%	-0.1%	$C_{MA}/(C_M-C_O)$	1.005
0.00	0.02	13:44	0.10	0.3%	14:57	0.07	0.1%	-0.1%	C_O	0.085
14.85	14.93	13:47	14.86	-0.2%	14:59	14.88	-0.2%	0.1%	$C_{MA}/(C_M-C_O)$	1.004

6.3 Inlet Oxygen Calibration Data Summary

Diesel Engine B RICE MACT

Oxygen Calibration Data Summary

Facility:	Dow EVO
Source:	Catalyst Inlet
Project Number:	60677762
Date:	3-Aug-22
Instrument Make/Model:	Servomex 4900 MultiGas
Instrument Name/ID	OCC-M1901
Calibration Span Value:	20.05
Analyzer Range:	25
Units:	%, dry
Technician(s):	Randy Reinke

Calibration Error Test Results

	Cylinder ID	Certified Value	Time	CEM Response	Absolute Difference	Cal Error (% of Span)
					0.5% Limit	2.0% Limit
zero gas	UHP N2 In	0.00	9:23	0.01	0.01	0.0%
span gas	CC469776	20.05	9:31	20.09	0.04	0.2%
mid-range	CC159788	10.12	9:33	10.18	0.06	0.3%

CEMS Calibration Bias and Drift Tests

Cylinder Value	Calibration Error CEMS Response	Time	Pre-Test CEMS Response	Bias (% of Span) 5.0% Limit	Time	Post-Test CEMS Response	Bias (% of Span) 5.0% Limit	Drift (% of Span) 3.0% Limit	Calculated Factors from Equation 7E-5	
0.00	0.01	9:51	0.04	0.2%	12:31	0.03	0.1%	-0.1%	C_O	0.037
10.12	10.18	9:48	10.09	-0.4%	12:33	10.09	-0.4%	0.0%	$C_{MA}/(C_M-C_O)$	1.007
0.00	0.01	12:31	0.03	0.1%	13:43	0.04	0.1%	0.0%	C_O	0.035
10.12	10.18	12:33	10.09	-0.4%	13:48	10.09	-0.4%	0.0%	$C_{MA}/(C_M-C_O)$	1.006
0.00	0.01	13:43	0.04	0.1%	14:57	0.04	0.2%	0.0%	C_O	0.042
10.12	10.18	13:48	10.09	-0.4%	15:00	10.09	-0.4%	0.0%	$C_{MA}/(C_M-C_O)$	1.007

6.4 Inlet Carbon Monoxide Calibration Data Summary

Diesel Engine B RICE MACT

Carbon Monoxide Calibration Data Summary

Facility:	Dow EVO
Source:	Catalyst Inlet
Project Number:	60677762
Date:	3-Aug-22
Instrument Make/Model:	Thermo 48C
Instrument Name/ID	0
Calibration Span Value:	124.50
Analyzer Range:	200
Units:	ppmv dry
Technician(s):	Randy Reinke

Calibration Error Test Results

	Cylinder ID	Certified Value	Time	CEM Response	Absolute Difference	Cal Error (% of Span)
					0.5ppm Limit	2.0% Limit
zero gas	UHP N2 In	0.00	9:23	-0.61	0.61	0.5%
span gas	CC469776	124.50	9:31	123.34	1.16	0.9%
mid-range	CC159788	58.20	9:33	60.20	2.00	1.6%

CEMS Calibration Bias and Drift Tests

Cylinder Value	Calibration Error CEMS Response	Time	Pre-Test CEMS Response	Bias (% of Span) 5.0% Limit	Time	Post-Test CEMS Response	Bias (% of Span) 5.0% Limit	Drift (% of Span) 3.0% Limit	Calculated Factors from Equation 7E-5	
0.00	-0.61	9:51	-0.36	0.2%	12:31	-0.38	0.2%	0.0%	C_O	-0.372
58.20	60.20	9:48	60.09	-0.1%	12:33	60.11	-0.1%	0.0%	$C_{MA}/(C_M-C_O)$	0.962
0.00	-0.61	12:31	-0.38	0.2%	13:43	-0.38	0.2%	0.0%	C_O	-0.380
58.20	60.20	12:33	60.11	-0.1%	13:48	59.93	-0.2%	-0.1%	$C_{MA}/(C_M-C_O)$	0.964
0.00	-0.61	13:43	-0.38	0.2%	14:57	-0.37	0.2%	0.0%	C_O	-0.377
58.20	60.20	13:48	59.93	-0.2%	15:00	59.91	-0.2%	0.0%	$C_{MA}/(C_M-C_O)$	0.965

6.5 Response Time

Response Time Method 7E

Applicable to Performance of EPA Methods 3A, 6C, 7E and 10

Project Name	**Diesel Engine B RICE MACT**
Project Number	**60677762**
Date	**3-Aug-22**
Facility	**Dow EVO**

Parameter		Outlet Oxygen		Outlet Carbon Monoxide		Inlet Oxygen		Inlet Carbon Monoxide	
Analyzer Make and Model		Servomex 1440		Thermo 48i		Servomex 4900 MultiGas		Thermo 48C	
Analyzer Name		OXC-M1902		A1601		OCC-M1901		0	
Analyzer Range		25		50		25		200	
From		Zero	Upscale	Zero	Upscale	Zero	Upscale	Zero	Upscale
To		Upscale	Zero	Upscale	Zero	Upscale	Zero	Upscale	Zero
Start Time (hh:mm) [1]		10:48:52	10:52:02	10:48:52	10:52:02	9:46:22	9:49:22	9:46:22	9:49:22
Instrument Readings at individual Times	10 sec	0.08	9.88	0.05	14.76	0.04	10.1	-0.43	59.96
	20 sec	0.08	9.88	0.05	14.76	0.04	10.1	-0.49	60.41
	30 sec	3.85	7.11	0.07	14.78	0.04	10.09	-0.38	60.31
	40 sec	9.68	0.3	1.2	13.92	0.28	10	2.82	56.99
	50 sec	9.84	0.13	5.8	9.62	5.92	5.05	16.07	45.08
	60 sec	9.85	0.11	10.23	5.18	9.17	0.86	34.91	27.25
	70 sec	9.86	0.1	12.93	2.1	9.9	0.2	48.6	12.43
	80 sec	9.86	0.1	14.19	0.61	10.04	0.09	55.89	3.99
	90 sec	9.87	0.1	14.58	0.2	10.07	0.07	58.94	0.56
	100 sec	9.87	0.1	14.72	0.1	10.08	0.06	59.95	-0.28
	110 sec	9.87	0.09	14.79	0.08	10.09	0.05	60.16	-0.38
	120 sec	9.87	0.09	14.75	0.07	10.09	0.05	59.75	-0.38
	130 sec	9.87	0.09	14.76	0.07	10.09	0.05	59.8	-0.38
	140 sec	9.88	0.09	14.8	0.1	10.09	0.05	60.01	-0.38
	150 sec	9.88	0.09	14.84	0.08	10.09	0.05	60.16	-0.38
	160 sec	9.88	0.09	14.84	0.08	10.09	0.04	60.06	-0.38
	170 sec								
	180 sec								
	190 sec								
	200 sec								
	210 sec								
Response Time 2		40	40	80	80	70	70	90	90
Analyzer Response Time 3		40		80		70		90	

1 – Clock time when valve turned to change instrument.

2 – Time to reach 95% of final stable value (seconds)

3 – Greater of upscale and downscale response time

6.6 Stratification Determination

Stratification Determination – EPA Method 7E

Applicable to Performance of EPA Methods 3A, 6C, 7E and 10

Analyte: Outlet Carbon Monoxide
Facility: Dow EVO
Source: Catalyst Outlet
Project Number: 60677762
Date: 3-Aug-22
Instrument Make/Model: Thermo 48i
Instrument Name/ID A1601
Calibration Span Value: 29.89
Analyzer Range: 50
Units: ppmv dry
Technician(s): Randy Reinke

Traverse Points (3 are required)	Time of Day	Concentration	Difference from Mean	Percent Difference from Mean
1	11:17	1.68	0.02	1.20
2	11:21	1.66	0.00	0.00
3	11:25	1.64	0.02	1.20
4	--	--	--	--
5	--	--	--	--
6	--	--	--	--
7	--	--	--	--
8	--	--	--	--
9	--	--	--	--
10	--	--	--	--
11	--	--	--	--
12	--	--	--	--
Mean Concentration of all Traverse Points		1.66		
Maximum Deviation from Mean			0.02	
Maximum Percent Deviation from Mean				1.20

Stratification Test Criteria			
Do the concentrations at each traverse point differ from the mean concentration by no more than:	(a) ±5.0% of the mean or (b) ±0.5 ppm {0.3% O_2 or CO_2} *whichever is less restrictive*	YES	**Use 1 point**
If the criterion above is not met. Do the concentrations at each traverse point differ from the mean concentration by no more than:	(a) ±10.0% of the mean or (b) ±1.0 ppm {0.5% O_2 or CO_2} *whichever is less restrictive*	NO	
	If the criteria above are not met	NO	

6.7 Compliance Corrected Concentration

Project: Diesel Engine B RICE MACT
Facility: Dow EVO
Source: Catalyst Inlet and/or Catalyst Outlet
Project ID: 60677762

Corrected Oxygen Outlet Concentration					
3-Aug-22	Time	Uncorrected Concentration (%)	Eq. 7E-5 Factors		Bias Corrected Concentration (%)
			C_O	$C_{MA}/(C_M-C_O)$	
Engine B Run 1	11:26-12:26	9.27	0.058	1.012	9.32
Engine B Run 2	12:40-13:40	9.36	0.018	1.010	9.44
Engine B Run 3	13:54-14:54	9.32	0.020	1.011	9.40

Corrected Oxygen Inlet Concentration					
3-Aug-22	Time	Uncorrected Concentration (%)	Eq. 7E-5 Factors		Bias Corrected Concentration (%)
			C_O	$C_{MA}/(C_M-C_O)$	
Engine B Run 1	11:26-12:26	9.34	0.037	1.007	9.37
Engine B Run 2	12:40-13:40	9.44	0.035	1.006	9.47
Engine B Run 3	13:54-14:54	9.40	0.042	1.007	9.42

Corrected Carbon Monoxide Outlet Concentration					
3-Aug-22	Time	Uncorrected Concentration (ppmv)	Eq. 7E-5 Factors		Bias Corrected Concentration (ppmv)
			C_O	$C_{MA}/(C_M-C_O)$	
Engine B Run 1	11:26-12:26	1.55	0.108	1.007	1.45
Engine B Run 2	12:40-13:40	1.41	0.100	1.005	1.31
Engine B Run 3	13:54-14:54	1.39	0.085	1.004	1.31

Corrected Carbon Monoxide Inlet Concentration					
3-Aug-22	Time	Uncorrected Concentration (ppmv)	Eq. 7E-5 Factors		Bias Corrected Concentration (ppmv)
			C_O	$C_{MA}/(C_M-C_O)$	
Engine B Run 1	11:26-12:26	69.23	-0.372	0.962	66.99
Engine B Run 2	12:40-13:40	65.06	-0.380	0.964	63.05
Engine B Run 3	13:54-14:54	65.35	-0.377	0.965	63.44

6.8 Compliance Summary

Emission Summary Table
Diesel Engine B RICE MACT
Dow EVO
Catalyst Inlet and/or Catalyst Outlet

Run Identification	Engine B Run 1	Engine B Run 2	Engine B Run 3	Average
Run Date	8/3/22	8/3/22	8/3/22	
Run Time	11:26-12:26	12:40-13:40	13:54-14:54	
Exhaust Gas Conditions				
Outlet Oxygen (%, dry)	9.32	9.44	9.40	
Inlet Oxygen (%, dry)	9.37	9.47	9.42	
Outlet Carbon Monoxide				
Outlet Carbon Monoxide (ppmv dry)	1.45	1.31	1.31	1.36
Concentration (ppmvd @15% Oxygen)	0.74	0.68	0.67	0.70
Inlet Carbon Monoxide				
Inlet Carbon Monoxide (ppmv dry)	66.99	63.05	63.44	64.49
Concentration (ppmvd @15% Oxygen)	34.27	32.53	32.61	33.14
Carbon Monoxide DRE (%)	97.8%	97.9%	97.9%	97.9%

6.9 Summary Data

SUMMARY DATA - COMPLIANCE TESTING
03-Aug-22

	Time	Inlet Oxygen (%, dry)	Inlet Carbon Monoxide (ppmv dry)	Outlet Oxygen (%, dry)	Outlet Carbon Monoxide (ppmv dry)
Engine B Run 1	11:26-12:26	9.34	69.23	9.27	1.55
Engine B Run 2	12:40-13:40	9.44	65.06	9.36	1.41
Engine B Run 3	13:54-14:54	9.40	65.35	9.32	1.39

CALIBRATION SUMMARY
03-Aug-22

	Time	Inlet Oxygen (%, dry)	Inlet Carbon Monoxide (ppmv dry)	Outlet Oxygen (%, dry)	Outlet Carbon Monoxide (ppmv dry)
Cal Error Zero 1 - UHP N2 Out	9:22	0.01	0.15	-0.01	0.02
Cal Error Zero 1 - UHP N2 In	9:23	0.01	-0.61	-0.01	0.02
Cal Error Hi 1 - CC447132	9:29	20.09	121.99	19.89	29.91
Cal Error Hi 1 - CC469776	9:31	20.09	123.34	12.28	27.87
Cal Error Mid 1 - CC159788	9:33	10.18	60.20	9.94	14.93
Cal Error Mid 1 - CC46550	9:34	10.17	60.08	9.94	14.93
System Bias Mid 1 - CC159788	9:48	10.09	60.09	20.67	0.03
System Bias Zero 1 - UHP N2 In	9:51	0.04	-0.36	20.67	0.01
System Bias Zero 1 - UHP N2 Out	10:41	10.09	60.32	0.10	0.12
System Bias Mid 1 - CC46550	10:44	20.81	0.07	9.89	14.83
Strat Check 1 -	11:17	9.42	66.27	9.37	1.68
Strat Check 2 -	11:21	9.50	64.73	9.43	1.66
Strat Check 3 -	11:25	9.41	68.59	9.27	1.64
System Bias Zero 2 - UHP N2 Out	12:31	0.03	-0.38	0.02	0.10
System Bias Zero 2 - UHP N2 In	12:31	0.03	-0.38	0.01	0.09
System Bias Mid 2 - CC159788	12:33	10.09	60.11	9.85	14.90
System Bias Mid 2 - CC46550	12:34	10.09	59.97	9.85	14.88
System Bias Zero 3 - UHP N2 In	13:43	0.04	-0.38	0.02	0.07
System Bias Zero 3 - UHP N2 Out	13:44	0.03	-0.46	0.02	0.10
System Bias Mid 3 - CC46550	13:47	10.09	60.03	9.85	14.86
System Bias Mid 3 - CC159788	13:48	10.09	59.93	9.85	14.88
System Bias Zero 4 - UHP N2 In	14:57	0.04	-0.37	0.02	0.08
System Bias Zero 4 - UHP N2 Out	14:57	0.04	-0.38	0.02	0.07
System Bias Mid 4 - CC46550	14:59	10.08	59.70	9.84	14.88
System Bias Mid 4 - CC159788	15:00	10.09	59.91	9.85	14.83