DENSO

DENSO MANUFACTURING MICHIGAN, INC.
One Denso Road
Battle Creek, Michigan 49015-1083
Tel (269) 965-3322 Fax (269) 965-8399

December 21, 2015

Mr. Rex Lane
Air Quality Division
Michigan Dept. of Environmental Quality
7953 Adobe Road
Kalamazoo, MI 49009-5026

Dear Mr. Lane:

Please find the enclosed Machine Oil Mass Balance Report for DENSO Manufacturing Michigan, Inc. (DMMI). The report outlines testing performed to determine the evaporative loss rate of forming oil used by DMMI. A copy of this report is also being sent to the Technical Programs Unit by DMMI.

Also enclosed is the ROP Report Certification Form EQP 5736.

Please contact me if you have any questions regarding the enclosed report.

Sincerely,

Jody L. Smith, PE
Advanced Environmental Engineer

Enc.

cc: Technical Programs Unit- Karen Kajiya-Mills

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RECEIVED
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AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Denso Manufacturing MI, Inc. County: Calhoun

Source Address: One Denso Road City: Battle Creek

AQD Source ID (SRN): N1192 ROP No.: MI-ROP-N1192-2003B ROP Section No.:

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From N/A To N/A

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Machine Oil Mass Balance Testing Report for PTIs 192-04A, 19-04B, 277-04E, 296-03A, 7-06E and 174-05.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

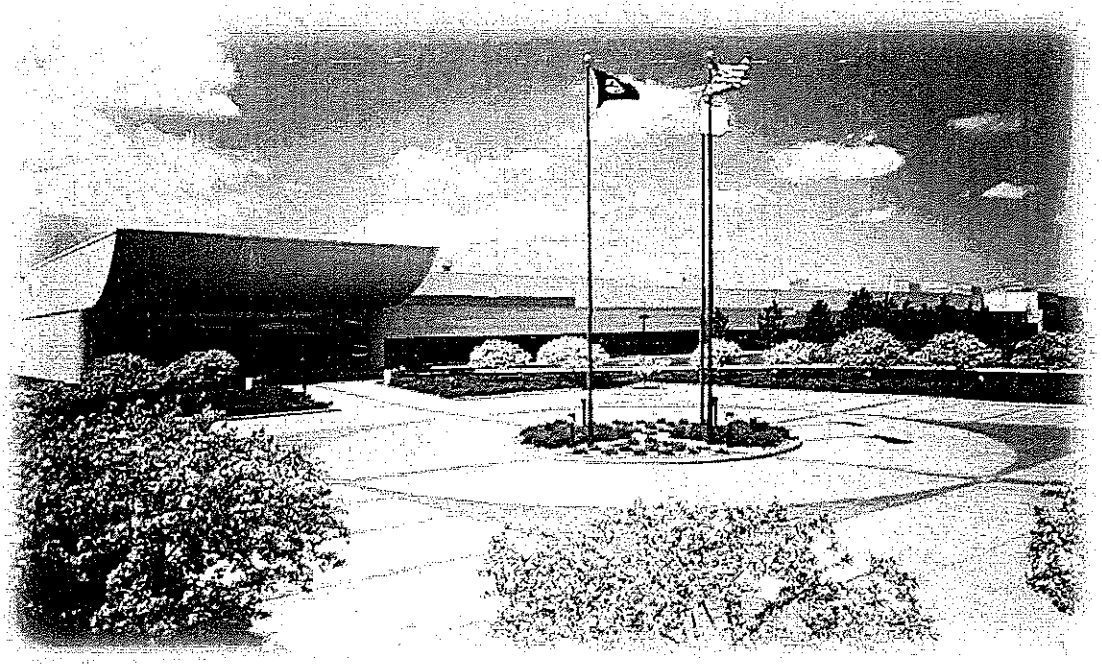
Kirk Hautau	Director of Engineering	269-965-3322
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official — Date: 12/17/15

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

DENSO



Report of Machine Oil Mass Balance Testing Performed at DENSO Manufacturing Michigan, Inc. Battle Creek, Michigan

Report Date:
December 21, 2015

TABLE OF CONTENTS

Appendices

I. Introduction

DENSO Manufacturing Michigan, Inc. (DMMI) produces automotive heat exchangers; including heaters, radiators, condensers and evaporators. These parts are produced from rolls of aluminum, which contain a cladding layer on the surface of the metal. The aluminum is lubricated with machining oil to facilitate the formation of aluminum tubes and fins. The tubes and fins are temporarily connected by metal wires to form the various heat exchanger parts. The machining oil must be removed from the tubes and fins in an oven degreaser, before they can be permanently attached in the brazing furnace. A portion of the oil evaporates as fugitive emissions from the cores before entry into the oven degreaser.

During brazing, the parts are heated to a point where the cladding layers melt and the material flows together. Upon exiting the furnace, the parts are cooled by fans, which re-harden the cladding material, resulting in permanently joined fins and tubes.

The machining oil used to facilitate forming of components for the various heat exchanger parts is currently recognized as containing volatile organic compounds (VOCs). On some manufacturing lines, the oil is subject to evaporative loss from the time the cores are formed until they enter the oven degreasers. On other lines, the cores are directly fed into the degreasers with no staging and no evaporative loss of oil.

Testing to determine the amount of evaporative loss of forming oil from cores in each product group produced at DMMI (condenser, evaporator, heater core, and radiator) was conducted to fulfill conditions specified by the following permits to install:

192-04A; RS Evaporator #2
19-04B; Heater Core #1 and #2
277-04E; Condenser MF3 #1 & Condenser MF4 #1 and #2
296-03A; Radiator #5
7-06E; RS Evaporator #5
174-05; Radiator #2

The testing was performed in accordance with the test protocol approved by MDEQ. All inquiries related to the testing conducted and contents of this report should be directed to:

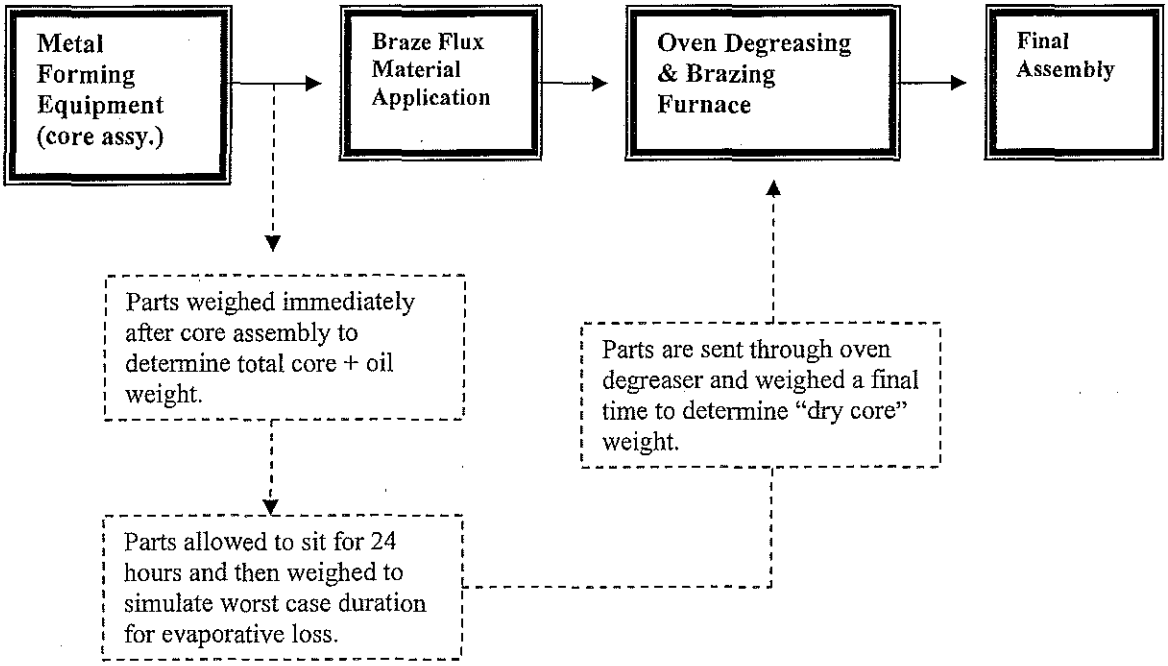
Jody L. Smith, PE
Advanced Environmental Engineer
DENSO Manufacturing Michigan, Inc.
One Denso Road
Battle Creek, Michigan 49037
(269) 565-8562
jody_smith@denso-diam.com

The following individuals took part in the evaporative loss testing.

Jonathan Rhodes – Evaporator
David VanDoren – Radiator
Justus Ongeri – Heater Core
Kyle Howard - Condenser

III. Source Description

The portions of the manufacturing processes involved for each product type tested are similar. As stated above, metal forming equipment is used to form fins and tubes from rolls of aluminum. The aluminum is lubricated with machining oil to facilitate the formation of fins and tubes. End plates and other components of the cores are stamped. All of these components are then bound together by wire wrapping machines in preparation for oven degreasing. The diagram below illustrates the process flow and general steps of the testing process.



Pollution control for VOC emissions occurs at the oven degreaser exhaust. Exhaust from the oven degreaser is routed through a thermal oxidizer, except for C924 and E124 degreasers. The presence of the thermal oxidizer has no bearing on the outcome of the evaporative loss determination test because this test only measures the total oil on cores and the oil which evaporates prior to degreasing. Monitoring of process related instrumentation is not applicable to this test.

1.1 PURPOSE

To provide a standard procedure for determining the evaporative loss rate of forming oil from the time parts exit the core assembly process until they enter the oven degreaser, as required by our air permits. This procedure will also provide a method for determining the average amount of forming oil used per part produced.

1.2 SCOPE

This testing procedure will apply to all core manufacturing processes at DMMI.

1.3 RESPONSIBILITY

The Production Engineering departments will conduct the testing at the request of the Environmental Department.

1.4 ACTIONS AND METHODS

1.4.1 Determination of representative sample

1.4.1.1 Environmental Section will evaluate permit conditions and communicate testing requirements and other necessary information to appropriate personnel in the Production Engineering departments. This information will include:

- Purpose of the test
- Specific production line and/or machines involved
- Any specific testing procedure requirements noted in a permit condition
- Due date for completion of testing

1.4.1.2 Production Engineering will provide the following information

- Part numbers produced in affected area and surface area of each part number
- Available production forecast for each part number

1.4.1.3 The Environmental Section will provide the test plan to the AQD District Supervisor for approval if required by the air permits and notify the District Supervisor or Compliance Support Unit at least 7 days prior to anticipated testing dates.

1.4.2 Testing Procedure

1.4.2.1 Sample lot will consist of five assembled cores of each part number.

1.4.2.2 Cores should be stacked by part number to simulate actual process conditions. Weigh each core with a scale capable of reading to the tenth of a gram and record the results. (= **a**) Also record the date and time.

1.4.2.3 Place stacked cores in a container capable of collecting and containing any forming oil that drips. The purpose of the container is to ensure that oil does not create a slip hazard by dripping onto a walking surface. However, the container must allow exposure of parts to the general plant air to simulate typical conditions for evaporative loss.

V. Test Results and Discussion

The results of the evaporative loss rate determinations for each of the affected process areas are presented in Table 1 of Section II of this report. The evaporative loss rates were determined using the procedures and calculations described in the test procedure presented in Section IV.

Actual test data and associated calculations are presented in Appendix A of this report.

Appendix A

Test Data and Calculations

Evaporative Loss for Evaporator Area

2015 Test
By: Jonathan Rhodes
Degreaser #: C924 Degreaser Temp Set-Point: 230°C Degreaser Residence Time: 3 min 49 secs
CA/FF m/c # for Part 'CUSW': C-965 Fin oil set points: 1.325, 1.375, 1.350, 1.475, 2.350, 1.850, 2.600
CA/FF m/c # for Part '150L': C-965 Fin oil set points: 1.325, 1.375, 1.350, 1.475, 2.350, 1.850, 2.600
CA/FF m/c # for Part '044L': C-867 Fin oil set points: 1.500, 1.500, 1.900, 1.450, 1.525, 1.325, 2.200

	Date: 11/24/15 Time: 3:00PM	Date: 11/25/15 Time: 3:00 PM	Date: 11/25/15 Time: 3:00 PM			
CUSW	A : Pre-Degreaser, at Core Assy (g)	B : Pre-Degreaser, after 24-hrs (g)	C : Post-Degreasing, (before furnace.) (g)	D: Oil Use Per Part (A-C)	E: Evaporative Loss (A - B)	Evaporative Loss Percent (E/D)
1	753.9	746.8	744.5	9.4	7.1	75.5%
2	752.1	750.2	747.5	4.6	1.9	41.3%
3	749.6	748.8	746.8	2.8	0.8	28.6%
4	750.9	751.0	747.3	3.6	-0.1	-2.8%
5	748.1	752.3	747.6	0.5	-4.2	-840.0%
			Totals	**20.9**	**5.5**	**26.3%**

	Date: 11/24/15 Time: 12:30PM	Date: 11/25/15 Time: 12:30 PM	Date: 11/25/15 Time: 3:00 PM			
150L						
1	1024.8	1023.5	1018.4	6.4	1.3	20.3%
2	1025.0	1024.6	1018.7	6.3	0.4	6.3%
3	1025.0	1024.7	1018.5	6.5	0.3	4.6%
4	1025.2	1024.7	1018.5	6.7	0.5	7.5%
5	1029.3	1028.0	1022.3	7.0	1.3	18.6%
			Totals	**32.9**	**3.8**	**11.6%**

	Date: 11/24/15 Time: 1:30PM	Date: 11/25/15 Time: 3:00PM	Date: 11/25/15 Time: 3:00 PM			
044L						
1	1262.4	1259.8	1251.2	11.2	2.6	23.2%
2	1262.5	1261.3	1252.8	9.7	1.2	12.4%
3	1260.7	1259.9	1250.8	9.9	0.8	8.1%
4	1261.2	1260.4	1251.6	9.6	0.8	8.3%
5	1260.1	1258.5	1250.7	9.4	1.6	17.0%
			Totals	**49.8**	**7.0**	**14.1%**
			Totals Avg.	**34.5**	**5.4**	**15.7%**

To be filled in by Environmental Section		LBS VOC Emitted per Ton Oil Used
Category Size 1 (Part CUSW) = **approx. 25.9%** of production	2000 * .259 * 25.1 =	136.3
Category Size 2 (Part 150L) = **approx. 38.8%** of production	2000 * .388 * 11.6 =	89.6
Category Size 3 (Part 044L) = **approx. 35.3%** of production	2000 * .353 * 14.1 =	99.2
	TotalLbs VOC Emitted Per Ton Oil Us	**325.2**
	Average Evaporative Loss Rate =	**16.3%**

Evaporative Loss for 'Radiator' Area

2015 Test

By: Dave Van Doren Date: 11/24- 11/25/15

Degreaser #: R-740 (Line 4) Deg. Temp Set-Point: 210 - 215°C Degreaser Residence Time: 30min

CA/FF machine #s for Part 'X': R-514 (GSR) Oil application set point (if appl.): N/A

CA/FF machine #s for Part 'Y': R-911 (EFD) Oil application set point (if appl.): 1.7, 1.6, 1.0

CA/FF machine #s for Part 'Z': R-112 (EFD) Oil application set point (if appl.): 1.7, 1.5, 1.2

		Date:11/24/15 Time: 10:00	Date: 11/25/15 Time: 10:00	Date: 11/25/15 Time: 11:30			
	A : Pre-Degreaser, at Core Assy (gm)	B : Pre-Degreaser, after 24-hrs (gm)	C : Post-Degreasing, (after furnace if nec.) (gm)	D: Oil Use Per Part (A-C)	E: Evaporative Loss (A - B)	Evaporative Loss Percent (E/D)
Part 'X'	GSR 16D 8950					
1	2084.9	2080.6	2075.0	9.9	4.3	43.4%
2	2084.7	2080.0	2074.6	10.1	4.7	46.5%
3	2078.8	2073.9	2068.9	9.9	4.9	49.5%
4	2079.7	2075.3	2069.8	9.9	4.4	44.4%
5	2078.2	2074.3	2068.3	9.9	3.9	39.4%
			Totals	**49.7**	**22.2**	**44.7%**

		Date:11/24/15 Time: 10:15	Date: 11/25/15 Time: 10:15	Date: 11/25/15 Time: 11:35			
Part 'Y'	27D 2221					
1	3623.4	3615.1	3595.4	28.0	8.3	29.6%
2	3625.0	3617.8	3595.7	29.3	7.2	24.6%
3	3620.8	3614.7	3595.0	25.8	6.1	23.6%
4	3623.3	3616.8	3593.7	29.6	6.5	22.0%
5	3621.7	3614.9	3597.0	24.7	6.8	27.5%
			Totals	**137.4**	**34.9**	**25.4%**

		Date:11/24/15 Time: 10:05	Date: 11/25/15 Time: 10:05	Date: 11/25/15 Time: 11:40			
Part 'Z'	16D 6901					
1	1823.5	1819.3	1814.3	9.2	4.2	45.7%
2	1827.6	1822.4	1817.6	10.0	5.2	52.0%
3	1822.2	1819.1	1813.2	9.0	3.1	34.4%
4	1822.4	1819.1	1813.3	9.1	3.3	36.3%
5	1826.1	1822.0	1816.7	9.4	4.1	43.6%
			Totals	**46.7**	**19.9**	**42.6%**
			Totals Avg.	**77.9**	**25.7**	**32.9%**

To be filled in by Environmental Section		LBS VOC Emitted per Ton Oil Used
Category Size 1 (Part 6901) = approx. 39.7% of production	2000 * .397 * 42.6 =	338.3
Category Size 2 (Part 8950) = approx. 32.4% of production	2000 * .324 * 44.7 =	289.4
Category Size 3 (Part 2221) = approx. 28.0% of production	2000 * .280 * 25.4 =	142.2
	TotalLbs VOC Emitted Per Ton Oil Use	**770.0**
	Average Evaporative Loss Rate =	**38.5%**

Evaporative Loss for Heater Core Area

		Set point	Actual Temp
2015 Test	Degreaser Temp	Zone 1 : 185 C	Zone 1 : 190 C
		Zone 2 : 185 C	Zone 1 : 189 C
By: Justus Ongeri		Zone 3: 185 C	Zone 1 : 193 C

Degreaser #: H-751 — Degreaser Residence Time: 7.27minutes

CA/FF m/c # for Part '7110': H-716 — Oil app. set point:EFD: 1.6, 1.6, 1.4 Tank:24.0, Nozzle: 15.0

CA/FF m/c # for Part '6970': H-718 — Oil app. set point:EFD: 1.6, 1.6, 1.5, 0 Tank:20.0, Nozzle: 11.5

CA/FF m/c # for Part '1580': H-716 — Oil app. set point:EFD: 1.6, 1.6, 1.4 Tank:24.0, Nozzle: 15.0

	A : Pre-Degreaser, at Core Assy (gm)	B : Pre-Degreaser, after 24-hrs (gm)	C : Post-Degreasing, (after furnace if nec.) (gm)	D: Oil Use Per Part (A-C)	E: Evaporative Loss (A - B)	Evaporative Loss Percent (E/D)
Part '7110'	Date: 11/23/15 Time: 2:00 pm	Date: 11/24/15 Time: 2:00 pm	Date: 11/24/15 Time: 2:20 pm			
1	535.3	534.5	533.6	1.7	0.8	47.1%
2	536.5	535.7	534.8	1.7	0.8	47.1%
3	535.7	534.7	533.9	1.8	1.0	55.6%
4	536.2	535.4	534.8	1.4	0.8	57.1%
5	536.2	535.4	534.5	1.7	0.8	47.1%
			Totals	**8.3**	**4.2**	**50.6%**
Part '6970'	Date: 11/23/15 Time: 2:20 pm	Date: 11/24/15 Time: 2:10 pm	Date: 11/24/15 Time: 2:25 pm			
1	390.2	389.6	388.1	2.1	0.6	28.6%
2	390.7	390.0	388.6	2.1	0.7	33.3%
3	391.4	390.7	389.3	2.1	0.7	33.3%
4	391.7	390.9	389.5	2.2	0.8	36.4%
5	391.3	390.6	389.2	2.1	0.7	33.3%
			Totals	**10.6**	**3.5**	**33.0%**
Part '1580'	Date: 11/24/15 Time: 3:00 pm	Date: 11/25/15 Time: 2:20 pm	Date: 11/25/15 Time: 2:42 pm			
1	416.7	416.3	413.7	3.0	0.4	13.3%
2	418.2	418.0	415.2	3.0	0.2	6.7%
3	418.1	417.8	415.0	3.1	0.3	9.7%
4	417.7	417.3	414.2	3.5	0.4	11.4%
5	418.2	417.8	415.2	3.0	0.4	13.3%
			Totals	**15.6**	**1.7**	**10.9%**
			Totals Avg.	**11.50**	**3.13**	**27.2%**

To be filled in by Environmental Section		LBS VOC Emitted per Ton Oil Used
Category Size 1 (Part 6970) = approx. 5.3% of production	2000 * .053 * 33.0 =	35.0
Category Size 2 (Part 1580) = approx. 74.7% of production	2000 * .747 * 10.9 =	162.8
Category Size 3 (Part 7110) = approx. 20.0% of production	2000 * .200 * 50.6 =	202.4
	TotalLbs VOC Emitted Per Ton Oil Used	**400.2**
	Average Evaporative Loss Rate =	**20.0%**

Evaporative Loss for Condenser Area

2015 Test
By: Kyle Howard

Degreaser #:	Degreaser Temp Set-Point: 280, 280	Degreaser Residence Time:
CA/FF machine #s TK8X:	C-505	Oil application set point (if appl.): 2.45, 2.1, 2.5
CA/FF machine #s 051A:	C-515	Oil application set point (if appl.): 2.2, 2.2, 2.4
CA/FF machine #s BF4:	C-1102 (CA #2)	Oil application set point (if appl.): 11, 11, 11

	Date: 11/11 Time: 9:02 AM	Date: 11/12 Time: 9:15 AM	Date: 11/12 Time: 1:15 PM			
	A : Pre-Degreaser, at Core Assy (gm)	B : Pre-Degreaser, after 24-hrs (gm)	C : Post-Degreasing, (after furnace if nec.)	D: Oil Use Per Part (A-C)	E: Evaporative Loss (A - B)	Evaporative Loss Percent (E/D)
TK8X						
1	2383.8	2382.6	2382.1	1.7	1.2	70.6%
2	2383.7	2382.6	2381.4	2.3	1.1	47.8%
3	2386.7	2385.4	2383.3	3.4	1.3	38.2%
4	2387.1	2386.4	2384.9	2.2	0.7	31.8%
5	2382.8	2381.7	2380.4	2.4	1.1	45.8%
			Totals	**12.0**	**5.4**	**45.0%**

	Date: 11/11 Time: 9:02 AM	Date: 11/12 Time: 9:15 AM	Date: 11/12 Time: 1:15 PM			
051A						
1	1953.6	1952.5	1951.1	2.5	1.1	44.0%
2	1954.8	1954.6	1949.9	4.9	0.2	4.1%
3	1956.1	1955.7	1952.9	3.2	0.4	12.5%
4	1958.0	1957.6	1955.6	2.4	0.4	16.7%
5	1955.2	1953.0	1952.7	2.5	2.2	88.0%
			Totals	**15.5**	**4.3**	**27.7%**

	Date: 11/11 Time: 9:02 AM	Date: 11/12 Time: 9:15 AM	Date: 11/12 Time: 1:15 PM			
BF4						
1	1062.7	1061.1	1056.9	5.8	1.6	27.6%
2	1062.5	1062.1	1056.2	6.3	0.4	6.3%
3	1066.6	1066.2	1060.0	6.6	0.4	6.1%
4	1065.8	1065.2	1059.0	6.8	0.6	8.8%
5	1063.2	1060.0	1057.0	6.2	3.2	51.6%
			Totals	**31.7**	**6.2**	**19.6%**
			Totals Avg.	**19.7**	**5.3**	**26.9%**

To be filled in by Environmental Section		LBS VOC Emitted per Ton Oil Used
Category Size 1 (Part BF4) = approx. 17.3% of production	2000 * .173 * 19.6 =	67.7
Category Size 2 (Part 051A) = approx. 61.9% of production	2000 * .619 * 27.7 =	343.4
Category Size 3 (Part TK8X) = approx. 20.8% of production	2000 * .208 * 45.0 =	187.2
	Total Lbs VOC Emitted Per Ton Oil Us	**598.3**
	Average Evaporative Loss Rate =	**29.9%**