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I. INTRODUCTION

Network Environmental, Inc. was retained by CMI Cast Parts, Inc. of Cadillac, Michigan to conduct a compliance emission study at their facility. The purpose of the study was to conduct emission sampling at the facility in order to meet the testing requirements of Michigan Department of Environmental Quality (MDEQ) Air Permits Nos. 171-95, 172-95, 173-95 and 174-95. The following testing was conducted:

Process	Source	Permit #	Compounds
Core/Mold Machines	North & South T-Scrubbers	171-95	Triethylamine
SPO Line	South Multiwash (shakeout & mold system) Iron Pouring & Mold Cooling (3 exhausts)	172-95	Total VOC's & CO
A-Line	Regenerative Thermal Oxidizer (RTO)	173-95	Particulate, Lead, Total VOC's & CO
Cupola	Scrubber Exhaust	174-95	Manganese

The sampling was conducted over the periods of November 19-20, 1996, December 10-12, 1996 and January 7, 1997 by Stephan K. Byrd, R. Scott Cargill, David D. Engelhardt, Vincent G. Schultes and Bertram J. Smith of Network Environmental, Inc.. Assisting in the study was Mr. Erik A. Olson of CMI Cast Parts, Inc.

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II.1 TABLE 1
CARBON MONOXIDE (CO) EMISSION RESULTS
CMI CAST PARTS, INC.
CADILLAC, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM	CO Emissions	
					PPM	Lbs/Hr
South Multiwash Exhaust	1	11/19/96	10:06-11:06	51,408	87.6	19.51
	2	11/19/96	11:18-12:18		77.4	17.24
	3	11/19/96	12:30-13:30		71.1	15.83
	Average				**78.7**	**17.53**
Mold Pouring #1 Exhaust	1	11/20/96	14:20-15:20	8,337	1,138	41.10
	2	11/20/96	15:56-16:56		1,119	40.41
	3	11/20/96	17:11-18:11		1,192	43.05
	Average				**1,150**	**41.52**
Mold Pouring #2 Exhaust	1	11/20/96	22:27-23:27	8,711	305	11.51
	2	11/20/96	23:43-00:43		270	10.19
	3	11/21/96	00:57-01:57		294	11.09
	Average				**290**	**10.93**
Mold Pouring #3 Exhaust	1	11/20/96	18:29-19:29	8,931	248	9.59
	2	11/20/96	19:47-20:47		289	11.18
	3	11/20/96	21:01-22:01		331	12.81
	Average				**289**	**11.19**
RTO Exhaust	1	12/12/96	10:31-11:31	77,330	24.0	8.04
	2	12/12/96	11:42-12:42		22.5	7.54
	3	12/12/96	12:51-13:51		22.0	7.37
	Average				**22.8**	**7.65**

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II.2 TABLE 2
TOTAL HYDROCARBON (VOC) EMISSION RESULTS
CMI CAST PARTS, INC.
CADILLAC, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate SCFM	VOC Emissions	
					PPM	Lbs/Hr
South Multiwash Exhaust	1	11/19/96	10:06-11:06	53,371	40.8	14.82
	2	11/19/96	11:18-12:18		46.1	16.75
	3	11/19/96	12:30-13:30		43.3	15.73
	Average				**43.4**	**15.77**
Mold Pouring #1 Exhaust	1	11/20/96	14:20-15:20	8,388	107.7	6.15
	2	11/20/96	15:56-16:56		108.5	6.20
	3	11/20/96	17:11-18:11		113.8	6.50
	Average				**110.0**	**6.28**
Mold Pouring #2 Exhaust	1	11/20/96	22:27-23:27	8,747	48.9	2.91
	2	11/20/96	23:43-00:43		45.8	2.73
	3	11/21/96	00:57-01:57		46.8	2.79
	Average				**47.2**	**2.81**
Mold Pouring #3 Exhaust	1	11/20/96	18:29-19:29	8,995	32.0	1.96
	2	11/20/96	19:47-20:47		37.3	2.28
	3	11/20/96	21:01-22:01		38.6	2.36
	Average				**36.0**	**2.20**
RTO Exhaust	1	12/12/96	06:36-07:38	78,121	5.1	2.71
	2	12/12/96	07:48-08:48		0.9	0.48
	3	12/12/96	09:05-10:05		0.9	0.48
	Average				**2.3**	**1.22**

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II.3 TABLE 3
TRIETHYLAMINE EMISSION RESULTS
CMI CAST PARTS, INC.
CADILLAC, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate SCFM	Triethylamine Emissions	
					Mg/M^3	Lbs/Hr
South T-Scrubber Exhaust	1	1/7/97	10:27-11:27	1,603	0.08	0.0005
	2	1/7/97	11:30-12:30		0.87	0.0052
	3	1/7/97	12:33-13:33		0.42	0.0025
	Average				**0.46**	**0.0027**
North T-Scrubber Exhaust	1	12/12/96	10:45-11:45	602	30.21	0.068
	2	12/12/96	11:50-12:50		32.74	0.074
	3	12/12/96	12:53-13:53		45.09	0.102
	Average				**36.01**	**0.081**

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II.4 TABLE 4
PARTICULATE EMISSION RESULTS
CMI CAST PARTS, INC.
CADILLAC, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate SCFM	Particulate Emissions	
					Lbs/1000 Lbs, Dry	Lbs/Hr
RTO Exhaust	1	12/12/96	06:18-08:25	75,716	0.0016	0.55
	2	12/12/96	09:09-11:12	75,110	0.0017	0.58
	3	12/12/96	11:47-13:50	83,536	0.0017	0.62
	Average			**78,121**	**0.0017**	**0.58**

II.5 TABLE 5
LEAD (Pb) EMISSION RESULTS
CMI CAST PARTS, INC.
CADILLAC, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate SCFM	Lead (Pb) Emissions	
					ug/M^3	Lbs/Hr
RTO Exhaust	1	12/12/96	06:18-08:25	75,716	N.D.	N.D.
	2	12/12/96	09:09-11:12	75,110	N.D.	N.D.
	3	12/12/96	11:47-13:50	83,536	N.D.	N.D.
	Average			**78,121**	**N.D.**	**N.D.**

N.D. = Not Detected at a detection limit of 3.43 ug/M^3 (0.0010 Lbs/Hr).

.122 lb/Ton

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II.6 TABLE 6
MANGANESE (Mn) EMISSION RESULTS
CMI CAST PARTS, INC.
CADILLAC, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate SCFM	Manganese (Mn) Emissions	
					Mg/M^3	Lbs/Hr
Cupola Exhaust	1	12/10/96	10:12-11:16	57,175	0.702	0.150
	2	12/10/96	12:33-13:39	55,918	0.626	0.131
	3	12/10/96	14:45-15:49	56,178	0.571	0.120
	Average			**56,424**	**0.633**	**0.134**

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III. DISCUSSION OF RESULTS

The results of the testing are summarized in Tables 1 through 6 (Sections II.1 through II.6) as follows:

Table 1 - Carbon Monoxide (CO) Emission Results

Table 2 - Total Hydrocarbon (VOC) Emission Results

Table 3 - Triethylamine Emission Results

Table 4 - Particulate Emission Results

Table 5 - Lead Emission Results

Table 6 - Manganese Emission Results

III.1 SPO Line

Testing for the SPO Line consisted of sampling the South Multiwash Exhaust (shakeout & mold system) and the three Mold Pouring Exhausts.

III.1.1 CO - The average CO emission rates for these sources in terms of pounds of CO per hour (Lbs/Hr) were 17.53 Lbs/Hr for the South Multiwash, 41.52 Lbs/Hr for the #1 Mold Pouring Exhaust, 10.93 Lbs/Hr for the #2 Mold Pouring Exhaust and 11.19 Lbs/Hr for the #3 Mold Pouring Exhaust.

The average CO mass rates in terms of pounds of CO per ton of iron poured (Lbs/Ton) were 0.58 Lbs/Ton for the South Multiwash, 1.78 Lbs/Ton for the #1 Mold Pouring Exhaust, 0.47 Lbs/Ton for the #2 Mold Pouring Exhaust and 0.48 Lbs/Ton for the #3 Mold Pouring Exhaust. **The total mass rate for the SPO Line was 3.31 Lbs/Ton.**

The established CO mass rate emission limit for the SPO Line (MDEQ Air Permit No. 172-95) is 4.23 Lbs/Ton of Iron Poured.

III.1.2 Total VOC - The average VOC emission rates for these sources in terms of pounds of VOC per hour (Lbs/Hr) were 15.77 Lbs/Hr for the South Multiwash, 6.28 Lbs/Hr for the #1 Mold Pouring Exhaust, 2.81 Lbs/Hr for the #2 Mold Pouring Exhaust and 2.20 Lbs/Hr for the #3 Mold Pouring Exhaust. **The total VOC mass emission rate for the SPO Line was 27.06 Lbs/Hr.**

The established VOC mass emission limit for the SPO Line (MDEQ Air Permit No. 172-95) is 61.0 Lbs/Hr.

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III.2 A Line Iron Pouring & Mold Cooling

Testing the A Line Iron Pouring & Mold Cooling consisted of sampling the Regenerative Thermal Oxidizer Exhaust (RTO).

III.2.1 CO - The CO mass emission rates for the RTO exhaust were 8.04 Lbs/Hr for sample one, 7.54 Lbs/Hr for sample two and 7.37 Lbs/Hr for sample three. **The average CO mass emission rate for the RTO Exhaust was 7.65 Lbs/Hr.**

The established CO mass emission limit for the A Line Iron Pouring & Mold Cooling (MDEQ Air Permit No. 173-95) is 14.0 Lbs/Hr.

III.2.2 VOC - The VOC mass emission rates for the RTO exhaust were 2.71 Lbs/Hr for sample one, 0.48 Lbs/Hr for sample two and 0.48 Lbs/Hr for sample three. **The average VOC mass emission rate for the RTO Exhaust was 1.22 Lbs/Hr.**

The established VOC mass emission limit for the A Line Iron Pouring & Mold Cooling (MDEQ Air Permit No. 173-95) is 13.0 Lbs/Hr.

III.2.3 Particulate - The particulate mass emission rates for the RTO exhaust were 0.55 Lbs/Hr for sample one, 0.58 Lbs/Hr for sample two and 0.62 Lbs/Hr for sample three. **The average particulate mass emission rate for the RTO Exhaust was 0.58 Lbs/Hr.**

The established particulate mass emission limit for the A Line Iron Pouring & Mold Cooling (MDEQ Air Permit No. 173-95) is 2.6 Lbs/Hr.

III.2.4 Lead (Pb) - Lead (Pb) was not detected for all three samples at a detection limit of 0.0010 Lbs/Hr.

The established lead mass emission limit for the A Line Iron Pouring & Mold Cooling (MDEQ Air Permit No. 173-95) is 0.11 Lbs/Hr.

III.3 Core/Mold Machines

Testing for the Core/Mold Machines consisted of sampling the North and South T-Scrubbers.

III.3.1 Triethlyamine - The North Scrubber triethylamine mass emission rates averaged 0.081 Lbs/Hr. The South Scrubber triethylamine mass emission rates averaged 0.0027 Lbs/Hr. **The total triethylamine mass rate for the Core/Mold Machines was 0.084 Lbs/Hr.**

The established triethylamine mass emission limit for the Core/Mold Machines (MDEQ Air Permit No. 171-95) is 0.25 Lbs/Hr.

III.4 Cupola Scrubber Exhaust

III.4.1 Manganese (Mn) - The Mn mass emission rates for the Cupola Scrubber Exhaust were 0.150 Lbs/Hr for sample one, 0.131 Lbs/Hr for sample two and 0.120 Lbs/Hr for sample three. **The average Mn mass emission rate for the Cupola Scrubber Exhaust was 0.134 Lbs/Hr.**

The established Mn mass emission limit for the Cupola Scrubber Exhaust (MDEQ Air Permit No. 174-95) is 0.62 Lbs/Hr.

IV. SAMPLING AND ANALYTICAL PROTOCOL

The sampling on the sources was conducted at the following locations:

T-Scrubbers	10 and 24 inch I.D. exhausts. Both locations meet the 8 duct diameters downstream and 2 duct diameters upstream requirement of U.S. EPA Reference Method 1.
South Multiwash	52 inch I.D. exhaust. Location meets the 8 duct diameters downstream and 2 duct diameters upstream requirement of U.S. EPA Reference Method 1.
Iron Pouring & Mold Cooling	Three (3) - 24 inch I.D. exhausts. All the locations meet the 8 duct diameters downstream and 2 duct diameters upstream requirement of U.S. EPA Reference Method 1.
RTO	6 foot I.D. exhaust. Sampling location approximately 2 duct diamters downstream and 2 duct diameters upstream from the nearest disturbances.
Cupola Scrubber	48 inch I.D. exhaust. Location meets the 8 duct diameters downstream and 2 duct diameters upstream requirement of U.S. EPA Reference Method 1.

IV.1 Carbon Monoxide - The CO sampling was conducted in accordance with U.S. EPA Reference Method 10. Three samples, each sixty minutes in duration, were collected from each of the exhausts tested. A Thermo Environmental Model 48H gas analyzer was used to monitor the exhausts. A heated teflon sample line was used to transport the exhaust gases to a gas conditioner to remove moisture and reduce the temperature. From the gas conditioner stack gases were passed to the analyzer. The analyzer produces instantaneous readouts of the CO concentrations (PPM).

The analyzer was calibrated by direct injection prior to the testing. A span gas of either 843.0 PPM or 409.7 PPM was used to establish the initial instrument calibration. Calibration gases of 147.0 PPM, 254.0 PPM and 409.7 PPM were used to determine the calibration error of the analyzer. The sampling system (from the back of the stack probe to the analyzer) was injected using the either the 147.0 PPM or the 843.0 PPM gas to determine the system bias. After each sample, a system zero and system injection of either 147.0 PPM or 843.0 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the exhausts. A strip chart recorder was also used to record the data as a backup to the DAS. A diagram of the sampling train is shown in Figure 1.

IV.2 Total Hydrocarbons - The VOC sampling was conducted in accordance with U.S. EPA Reference Method 25A. A Thermo Environmental Model 51 portable flame ionization detector (FID) was used to monitor the exhausts. A heated teflon sample line was used to transport the exhaust gases to the analyzer. The analyzer produces instantaneous readouts of the hydrocarbon concentrations (PPM as propane).

The analyzer was calibrated by system injection (from the back of the stack probe to the analyzer) prior to the testing. A span gas of either 455.5 PPM or 448.8 PPM propane was used to establish the initial instrument calibration. Calibration gases of 148.0 PPM, 150.4 PPM and 245.7 PPM propane were used to determine the calibration error of the analyzer. After each sample, a system zero and system injection of either 148.0 PPM or 150.4 PPM propane were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified propane.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the

data from the exhausts. A strip chart recorder was also used to record the data as a backup to the DAS. A diagram of the sampling train is shown in Figure 2.

IV.3 Total Particulate - The total particulate emission sampling was conducted in accordance with U.S EPA Reference Method 5. Method 5 is an out of stack filtration method. Three (3) samples were collected from the RTO exhaust. Each sample was 120 minutes in duration, and had minimum sample volumes of sixty (60) dry standard cubic feet. The particulate sampling train was combined with the lead (Pb) sampling train (EPA Method 12). The samples were collected isokinetically. The filters and probe/nozzle rinses were analyzed for total particulate by gravimetric analysis before being analyzed for lead. All the quality assurance and quality control procedures listed in the method were incorporated in the sampling and analysis. A diagram of the sampling train is shown in Figure 3.

IV.4 Lead & Manganese - The Pb and Mn emission sampling was conducted by employing U.S EPA Methods 12 & 29. Three (3) samples were collected from the cupola and the RTO exhausts. Each sample was 60 minutes in duration for the cupola and 120 minutes in duration for the RTO. The samples had minimum sample volumes of thirty (30) dry standard cubic feet on the cupola and sixty (60) dry standard cubic feet on the RTO. The samples were collected on quartz filters, and in a nitric acid/hydrogen peroxide solution. The filters and nozzle/probe rinses were analyzed for particulate by gravimetric analysis prior to the RTO lead analysis. The filters, nozzle/probe rinses and impinger soultions were combined and analyzed for lead or manganese by inductively coupled argon plasma (ICAP) analysis. All the quality assurance and quality control procedures listed in the method were incorporated in the sampling and analysis. A diagram of the sampling train is shown in Figure 3.

IV.5 Triethylamine - The triethylamine emission sampling was conducted in accordance with U.S. EPA Reference Method 18. Three (3) samples, each sixty (60) minutes in duration, were collected from each of the two scrubbers. The samples were collected on silica gel sorbent tubes using a pump equipped with a calibrated critical orifice. The silica gel tubes were desorbed and analyzed for triethylamine by gas chromatography (NPD) in accordance with NIOSH Method 221.

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IV.6 Exhaust Gas Parameters - In conjunction with the other sampling, the exhaust gas parameters (air flow rate, temperature, moisture and density) were determined by employing U.S. EPA Reference Methods 1 through 4. All the quality control and quality assurance requirements listed in the methods were incorporated in the sampling and analysis.

This report was prepared by:

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