Supporting Documents for Proposed National Emission Standards for Automobile and Light Duty Truck Surface Coating:

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Baseline Organic Hazardous Air Pollutant (HAP) Emission Estimates for the Automobile and Light Duty Truck Surface Coating MACT Rule Development Project

July 19, 2002

MEMORANDUM

To: Dave Salman, EPA/OAQPS/ESD/CCPG

From: David Green, RTI

Subject: Baseline Organic Hazardous Air Pollutant (HAP) Emission Estimates for the Automobile and Light Duty Truck Surface Coating MACT Rule Development Project

This memo summarizes the baseline organic HAP emissions estimates for operations and facilities affected by the Automobile and Light Duty Truck Surface Coating MACT rule development project. During the first half of 1999, 62 auto assembly plant submitted responses to a U. S. EPA Information Collection Request (ICR) which provided data on the assembly and surface coating operations at the affected facilities. The ICR data are the source of these emission estimates. The emission estimates provided in this memo are based on the emissions that were either reported by the facilities or were calculated from the data supplied by the facilities in the ICR.

1. ICR Data Overview

The facilities provided data for a baseline reporting period which was defined either to be a calendar year or a model year cycle. All facilities except one reported data for a calendar year cycle, however, the calendar year reported varied between the years 1996, 1997 or 1998. Of the 62 plants, 24 plants reported data from 1996, 10 plants reported data from 1997, and 30 plants reported data from 1998. Table A.1 provides a listing of the baseline reporting year and the reported total production (number of vehicles) for the reporting period for each facility.

The ICR requested data be supplied for all operations with the potential to emit organic HAP, and specifically requested data for the following operations:

- Electrodeposition Primer (EDP)
- Primer-surfacer
- Topcoat

- Miscellaneous Assembly operations (included sealer, deadener, blackout, windshield primer/adhesive and final repair)
- Cleaning and Purge
- Wastewater Treatment
- Fueling of vehicles and fuel storage

Of the data provided, the EDP, primer-surfacer and topcoat operations have the most reliable data for determination of a baseline emissions estimate. These data were derived by using a standard VOC emission protocol developed by the industry and EPA in the late 1980's and adapting it to address organic HAP emissions. The method for adapting the protocol is discussed below.

The data provided in the ICR for the EDP, primer-surfacer and topcoat operations included: 1) the mass of organic HAP emitted, 2) the mass of organic HAP emitted per liter of solids deposited (emission rate), 3)specific VOC and organic HAP content data for each coating used, 4) the volume used for each coating, and 5) a description of any control systems including the capture, destruction, and overall efficiencies.

For the EDP operation, the mass of organic HAP used (before controls) was reported. In many cases the plants reported that there were controls present on the operation, however some of these plants were unable to provide estimates of overall control efficiency.

For the cleaning and purge operation, the ICR responses provided a description of the cleaning methods used, the organic HAP content data for the materials used, the volume of each material used, and the overall efficiencies of any control devices used to control emissions from the cleaning/purge operations. The facilities did not calculate an organic HAP emission estimate for cleaning operations. All materials used for cleaning were assumed to be emitted. Except where estimates of purge material control efficiency were provided, it was assumed that all purge materials that approximately 50 percent of the purge materials used were emitted.

The data provided by the plants for the miscellaneous operations, fueling and fuel storage and wastewater treatment included a description of the operation, the volume used and the percent organic HAP content of the materials used, any control device used and any known capture and destruction efficiencies. This estimate does not include emissions from these sources but they are likely to represent a small proportion of the total emissions.

2. Method Used to Derive Organic HAP Emission Estimates

For primer-surfacer and topcoat operations, the ICR instructions identified two alternatives for the determination of organic HAP emission estimates based on the data derived from the VOC protocol. The ICR instructions indicated that the preferred method to determine the emission rates and volumes would be by adapting the automobile VOC protocol calculations for each month in the reporting period by substituting the organic HAP content of each coating for the VOC content of that coating. Any appropriate adjustments in capture efficiencies or solvent loading would then be made to convert to organic HAP from VOC.

As an alternative, the facility could calculate the mass of organic HAP used for the month (using the percentage of organic HAP in the material and the volumes used that month), compare it to the mass of VOC used for the month, and express the results as a percentage. The percentage determined could be used to estimate the organic HAP emission rate from the VOC emission rate by multiplying the VOC emission rate by the calculated percentage to get the organic HAP emission rate. The rate would be multiplied by the volume of solids deposited to determine the mass of organic HAP emitted. Most plants did not indicate the method used to determine the emission estimates reported for primer-surfacer and topcoat, however, some plants did indicate that they used the VOC protocol adapted as instructed.

The ICR did not provide specific instructions on deriving the organic HAP emission estimate for the EDP operation. EDP emission estimates were made by adjusting organic HAP usage (i. e. the mass of organic HAP contained in the additions of coating components and other additives to the EDP system) to account for the overall control efficiency. Where control systems of unknown efficiency were in use, a calculated average overall efficiency achieved at other facilities operated by the same manufacturer was applied in order to determine the baseline emission for the EDP operation.

With regard to the miscellaneous operations, no emission estimates were provided by the facilities. Usage data were provided, however, the relatively low organic HAP usage in these operations would not materially affect the overall baseline emissions. The facilities did not calculate organic HAP emission estimates for the wastewater treatment system.

Based on the ICR data and information, the cleaning and purge operations were found to have a high potential for organic HAP emissions. Emission estimates for cleaning and purging were developed using the volume of materials used, the organic HAP content reported for the materials used and if appropriate, a percent reduction factor for control devices. The purge operations were consistent in that each plant operated a purge recovery system, however, the data were inconsistent in providing the percent recovery or emission reduction provided by the recovery system. Since the descriptions of the purge systems were very consistent, control efficiency estimates for those plants with unknown purge control efficiencies were assumed to be equal to the midrange of the efficiencies for plants that provided this information.

3. Baseline Organic HAP Estimates

Table 1 provides the baseline organic HAP emission estimates for operations with significant emissions as discussed above.

Table 1. Industry-wide Organic HAP Emission Estimates

Operation	Total Organic HAP Emitted (Tons/year)
Electrodeposition Primer (EDP)	706.65
Primer Surfacer	2,178.75
Topcoat	7,376.3
Cleaning and Purge	7,842
Total of all above operations	18,103.69
Primer Surfacer and Topcoat combined	9,555.04
Primer Surfacer, Topcoat and EDP combined	10,261.69

Emissions estimates from major coating operations and cleaning and purging operations at each facility are given in Table A. 2. Emission estimates for combined EDP, primer-surfacer and topcoat operations, and for primer-surfacer and topcoat operations are given in Table A. 3.

4. Identity of Speciated Organic HAP Emitted

Information on the identity of the organic HAP emitted was derived from the content data for each coating and material. The ICR requested that speciated HAP information be provided for organic, inorganic and exempt (non-VOC) organic solvents in the form of a volume or weight percent content in the coatings descriptions. Generally, the facilities did not quantify the individual HAP emissions. Any estimates provided were for "total" organic HAP as opposed to the individual compounds. Inorganic HAP compounds were found primarily in pigment portion (non-volatile particulate) of the coatings.

The emissions were quantified for three specific organic HAP compounds for which delisting petitions had been submitted to EPA. The specific HAPs that were quantified were methylethyl ketone (MEK) (CAS No. 78-93-3), ethylene glycol butylether (EGBE) (CAS No. 111-76-2) and methanol (CAS No. 67-56-1). Table 2 lists the individual HAPs reported by the facilities. Tables A.4, A.5 and A.6 give the amount of EGBE, MEK and methanol used by each facility. The data reported here and in Tables A.4. through A.6 for EGBE, MEK and methanol pertain to the 33 plants out of 62 (including several that conducted no painting operations) that did not claim any of their coating content data as confidential.

Table 2 - List of HAP Compounds reported as constituents in coatings used in the Automobile Surface Coating Industry.

CAS No.	**HAP Compound Name**
79-10-7	Acrylic acid
98-82-8	Cumene
107-21-1	Ethylene glycol
100-41-4	Ethylbenzene
50-00-0	Formaldehyde
110-54-3	Hexane
67-56-1	Methanol
78-93-3	Methyl ethyl ketone
108-10-1	Methyl isobutyl ketone
91-20-3	Naphthalene
100-42-5	Styrene
108-88-3	Toluene
1330-20-7	Xylenes
	Glycol ethers
111-76-2	2-Butoxy ethanol (EGBE)
112-07-2	2-Butoxyethyl acetate
112-25-4	Ethyl Glycol monohexyl ether
112-34-5	Diethylene glycol monobutyl ether
	Chromium compounds
	Cobalt compounds
	Lead compounds
	Manganese compounds
	Nickel compounds

Table A. 1. - Reporting Year and Total Production by Facility

FACID	Facility Name	Reporting Year	Total Production
001A	Mitsubishi Normal Assembly Plant	1996	195,978
002A	Honda East Liberty Auto Plant	1998	238,753
003A	Subaru-Isuzu Automotive Inc.	1997	187,096
004A	Nissan Motor Manufacturing Corp. USA - Line IV	1996	186,793
004B	Nissan Motor Manufacturing Corp., USA - Line HF	1996	264,420
005A	AutoAlliance International Inc.	1997	CBI[1]
006A	Mercedes-Benz U.S. International, Inc.	1998	100,612
007A	BMW Manufacturing Corp.	1996	50,613
008A	Toyota Motor Manufacturing Kentucky Inc. Paint #1	1998	244,077
008B	Toyota Motor Manufacturing Kentucky Inc.-Paint #2	1998	231,000
009A	New United Motor Mfg. Inc. NUMMI - Car Line	1998	203,189
009B	New United Motor Mfg. Inc. NUMMI - Truck Line	1998	158,966
010A	DC - Belvidere Assembly Plant	1996	247,275
010B	DC - Connor Assembly Plant	1996	1,687
010C	DC - Jefferson North Assembly Plant	1996	304,098
010D	DC - Newark Assembly Plant	1998	182,041
010E	DC - Sterling Heights Assembly Plant	1996	232,767
010F	DC - St. Louis North Assembly Plant	1996	127,322
010G	DC - St. Louis South Assembly Plant	1996	313,050
010H	DC - Toledo Assembly Plant I	1996	247,768
010I	DC - Toledo Assembly Plant II	1996	0[2]
010J	DC - Warren Truck Assembly Plant	1996	180,111
012A	Ford Atlanta Assembly Plant	1997	245,230
012B	Ford Edison Assembly Plant	1996	127,836
012C	Ford Kansas City Passenger Assembly Plant	1996	201,493
012D	Ford Kansas City Truck Plant	1996	217,503
012E	Ford Lorain Assembly Plant	1998	no data[3]
012F	Ford Louisville Assembly Plant	1996	400,858
012G	Ford Michigan Truck Plant	1997	278,588
012H	Ford Norfolk Assembly Plant	1997	233,566
012I	Ford Avon Lake Assembly Plant	1997	301,683
012J	Ford St. Louis Assembly Plant	1996	229,756
012K	Ford Wayne Assembly Plant	1997	277,435
012L	Ford Wixom Assembly Plant	1996	144,850
012M	Ford Dearborn Assembly Plant	1996	130,358
012N	Ford Chicago Assembly Plant	1996	276,284
012O	Ford Kentucky Truck Plant	1997	227,696
012P	Ford Twin Cities Assembly Plant	1996	157,180
013A	GM Bowling Green Assembly	1998	30,628
014A	GM Doraville Assembly Plant	1998	257,306
015A	GM Buick City Assembly Center	1998	178,176
016A	GM Hamtramck Assembly Plant	1998	228,316
017A	GM Fairfax Assembly Plant	1997	237,376
018A	GM Orion Assembly	1998	180,327
019A	GM Oklahoma City Assembly Plant	1997	174,603
020A	GM Arlington Assembly Plant	1998	118,151

021A	GM North American Truck Group	1998	138,815
022A	GM Flint Assembly Plant	1998	79,888
023A	GM Ft. Wayne Assembly	1998	155,918
024A	GM Janesville Assembly Plant	1998	213,582
025A	GM Linden Assembly	1998	172,752
026A	GM Moraine Assembly Plant	1998	257,048
027A	GM Pontiac East Assembly Plant	1998	188,736
028A	GM Shreveport Assembly Plant	1998	185,841
029A	GM Wentzville Assembly Center	1998	135,881
030A	GM Lansing Car Assembly - M Plant	1998	151,206
030B	GM Lansing Car Assembly - C Plant	1998	106,020
031A	GM Lordstown Assembly Plant	1998	321,610
032A	Saturn Corporation	1998	235,423
033A	GM Wilmington Assembly Plant	1998	100,233
034A	Honda Marysville Auto Plant- Line 1	1996	219,618
034B	Honda Marysville Auto Plant - Line 2	1996	206,965
035A	GM Lansing Craft Centre Plant #2	1998	13,608
036A	TABC, Inc.	1998	159,176
038A	AM General Assembly Plant	No Data	

[1] Production data considered Confidential Business Information (CBI)

[2] Plant conducts assembly only. Auto bodies assembled in Toledo II are painted in Toledo I.

[3] No paint activities.

Appendix A. 2. - Organic HAP Emission Estimates by Facility for Baseline Operations

FACID	Facility Name	Primer Surfacer TPY	Topcoat TPY	EDP TPY	Cleaning/Purge TPY	Total TPY
001A	Mitsubishi Normal Assembly Plant	92.08	46.50	22.70	54.00	215.27
002A	Honda East Liberty Auto Plant	26.40	113.40	9.04	42.00	190.84
003A	Subaru-Isuzu Automotive Inc.	11.51	17.61	14.18		43.30
004A	Nissan Motor Manufacturing Corp. USA - Line IV	15.92	18.14	5.04	16.00	55.10
004B	Nissan Motor Manufacturing Corp., USA - Line HF	138.86	107.04	21.05		266.95
005A	AutoAlliance International Inc.	6.06	23.45	5.44	106.00	140.95
006A	Mercedes-Benz U.S. International, Inc.	14.05	29.61	0.28	90.00	133.94
007A	BMW Manufacturing Corp.	6.10	9.49	0.28		15.87
008A	Toyota Motor Manufacturing Kentucky Inc. Paint #1	68.87	99.58	22.82	143.00	334.27
008B	Toyota Motor Manufacturing Kentucky Inc.-Paint #2	38.44	60.99	25.80	49.00	174.22
009A	New United Motor Mfg. Inc. NUMMI - Car Line	38.59	63.93	4.30	118.00	224.82
009B	New United Motor Mfg. Inc. NUMMI - Truck Line	10.35	15.95	1.13	16.00	43.43
010A	DC - Belvidere Assembly Plant	0.00	16.98	2.78	24.00	43.76
010C	DC - Jefferson North Assembly Plant	0.01	40.38	12.81	149.00	202.19
010D	DC - Newark Assembly Plant	0.00	17.66	6.06	184.00	207.73
010E	DC - Sterling Heights Assembly Plant	0.00	39.76	3.63	20.00	63.38
010F	DC - St. Louis North Assembly Plant	10.79	37.04	8.66	8.00	64.48
010G	DC - St. Louis South Assembly Plant	0.00	49.96	4.29	433.00	487.24
010H	DC - Toledo Assembly Plant I	6.40	94.79	42.59	495.00	638.79
010J	DC - Warren Truck Assembly Plant	1.53	22.33	3.18	8.00	35.04
012A	Ford Atlanta Assembly Plant	100.96	170.40	39.44	200.00	510.80
012B	Ford Edison Assembly Plant	35.95	120.17	0.21	243.00	399.33
012C	Ford Kansas City Passenger Assembly Plant	55.71	185.48	29.28	355.00	625.47
012D	Ford Kansas City Truck Plant	34.81	176.68	41.16	385.00	637.65
012F	Ford Louisville Assembly Plant	157.92	410.17	9.79	158.00	735.88
012G	Ford Michigan Truck Plant	54.79	120.49	3.76	162.00	341.04
012H	Ford Norfolk Assembly Plant	65.74	168.71	42.87	87.00	364.32
012I	Ford Avon Lake Assembly Plant	55.30	191.59	2.60	223.00	472.49
012J	Ford St. Louis Assembly Plant	106.69	337.70	6.54	977.00	1427.93
012K	Ford Wayne Assembly Plant	24.83	162.97	3.50	70.00	261.30
012L	Ford Wixom Assembly Plant	18.78	39.65	7.43	82.00	147.86

012M	Ford Dearborn Assembly Plant	52.70	77.57	21.27	83.00	234.54
012N	Ford Chicago Assembly Plant	45.57	177.22	58.10	291.00	571.89
012O	Ford Kentucky Truck Plant	85.00	148.09	0.67	76.00	309.76
012P	Ford Twin Cities Assembly Plant	8.60	94.60	0.75	224.00	327.95
013A	GM Bowling Green Assembly	18.05	183.61	0.00		201.66
014A	GM Doraville Assembly Plant	18.21	602.05	2.65	301.00	923.92
015A	GM Buick City Assembly Center	82.14	64.00	2.25	108.00	256.39
016A	GM Hamtramck Assembly Plant	52.99	106.40	24.07		183.46
017A	GM Fairfax Assembly Plant	11.51	253.72	24.42	140.00	429.65
018A	GM Orion Assembly	52.06	124.73	2.40	80.00	259.19
019A	GM Oklahoma City Assembly Plant	39.97	95.20	81.08	192.00	408.25
020A	GM Arlington Assembly Plant	15.68	183.61	1.75		201.04
021A	GM North American Truck Group	0.00	101.83	2.24		104.06
022A	GM Flint Assembly Plant	11.17	35.90	15.30	36.00	98.37
023A	GM Ft. Wayne Assembly	21.71	290.90	2.39	356.00	671.00
024A	GM Janesville Assembly Plant	18.23	175.80	0.62	248.00	442.65
025A	GM Linden Assembly	0.00	117.82	2.69	14.00	134.51
026A	GM Moraine Assembly Plant	0.00	112.26	26.53	67.00	205.79
027A	GM Pontiac East Assembly Plant	74.19	564.67	2.55		641.41
028A	GM Shreveport Assembly Plant	0.00	79.25	3.02	12.00	94.28
029A	GM Wentzville Assembly Center	48.18	155.75	0.22	161.00	365.15
030A	GM Lansing Car Assembly - M Plant	4.92	83.57	1.70	77.00	167.18
030B	GM Lansing Car Assembly - C Plant	3.41	65.87	1.18	57.00	127.45
031A	GM Lordstown Assembly Plant	120.35	128.42	0.99	131.00	380.76
032A	Saturn Corporation	45.81	102.66	4.79	121.00	274.26
033A	GM Wilmington Assembly Plant	0.93	43.16	1.71	122.00	167.81
034A	Honda Marysville Auto Plant- Line 1	72.12	89.41	9.25	47.00	217.78
034B	Honda Marysville Auto Plant - Line 2	55.92	82.15	8.98		147.05
036A	TABC, Inc.	21.89	27.49	0.44	1.00	50.82
						0.00
Total	Tons per Year (TPY)	2178.75	7376.30	706.65	7842.00	18103.69

Appendix A. 3. - Organic HAP Emission Estimates by Facility for Baseline Operation Combinations

FACID	Facility Name	PS/TC/EDP Combined Total Organic HAP Emissions TPY	PS/TC Combined Total Organic HAP Emissions TPY
001A	Mitsubishi Normal Assembly Plant	161.27	138.57
002A	Honda East Liberty Auto Plant	148.84	139.80
003A	Subaru-Isuzu Automotive Inc.	43.30	29.12
004A	Nissan Motor Manufacturing Corp. USA - Line IV	39.10	34.06
004B	Nissan Motor Manufacturing Corp., USA - Line HF	266.95	245.90
005A	AutoAlliance International Inc.	34.95	29.51
006A	Mercedes-Benz U.S. International, Inc.	43.94	43.66
007A	BMW Manufacturing Corp.	15.87	15.59
008A	Toyota Motor Manufacturing Kentucky Inc. Paint #1	191.27	168.46
008B	Toyota Motor Manufacturing Kentucky Inc.-Paint #2	125.22	99.43
009A	New United Motor Mfg. Inc. NUMMI - Car Line	106.82	102.52
009B	New United Motor Mfg. Inc. NUMMI - Truck Line	27.43	26.30
010A	DC - Belvidere Assembly Plant	19.76	16.98
010C	DC - Jefferson North Assembly Plant	53.19	40.38
010D	DC - Newark Assembly Plant	23.73	17.66
010E	DC - Sterling Heights Assembly Plant	43.38	39.76
010F	DC - St. Louis North Assembly Plant	56.48	47.82
010G	DC - St. Louis South Assembly Plant	54.24	49.96
010H	DC - Toledo Assembly Plant I	143.79	101.20
010J	DC - Warren Truck Assembly Plant	27.04	23.86
012A	Ford Atlanta Assembly Plant	310.80	271.36
012B	Ford Edison Assembly Plant	156.33	156.12
012C	Ford Kansas City Passenger Assembly Plant	270.47	241.19
012D	Ford Kansas City Truck Plant	252.65	211.49
012F	Ford Louisville Assembly Plant	577.88	568.09
012G	Ford Michigan Truck Plant	179.04	175.28
012H	Ford Norfolk Assembly Plant	277.32	234.45
012I	Ford Avon Lake Assembly Plant	249.49	246.89
012J	Ford St. Louis Assembly Plant	450.93	444.39
012K	Ford Wayne Assembly Plant	191.30	187.80
012L	Ford Wixom Assembly Plant	65.86	58.43
012M	Ford Dearborn Assembly Plant	151.54	130.27

012N	Ford Chicago Assembly Plant	280.89	222.79
012O	Ford Kentucky Truck Plant	233.76	233.09
012P	Ford Twin Cities Assembly Plant	103.95	103.20
013A	GM Bowling Green Assembly	201.66	201.66
014A	GM Doraville Assembly Plant	622.92	620.27
015A	GM Buick City Assembly Center	148.39	146.14
016A	GM Hamtramck Assembly Plant	183.46	159.39
017A	GM Fairfax Assembly Plant	289.65	265.24
018A	GM Orion Assembly	179.19	176.80
019A	GM Oklahoma City Assembly Plant	216.25	135.17
020A	GM Arlington Assembly Plant	201.04	199.29
021A	GM North American Truck Group	104.06	101.83
022A	GM Flint Assembly Plant	62.37	47.07
023A	GM Ft. Wayne Assembly	315.00	312.61
024A	GM Janesville Assembly Plant	194.65	194.03
025A	GM Linden Assembly	120.51	117.82
026A	GM Moraine Assembly Plant	138.79	112.26
027A	GM Pontiac East Assembly Plant	641.41	638.86
028A	GM Shreveport Assembly Plant	82.28	79.25
029A	GM Wentzville Assembly Center	204.15	203.93
030A	GM Lansing Car Assembly - M Plant	90.18	88.48
030B	GM Lansing Car Assembly - C Plant	70.45	69.27
031A	GM Lordstown Assembly Plant	249.76	248.77
032A	Saturn Corporation	153.26	148.47
033A	GM Wilmington Assembly Plant	45.81	44.09
034A	Honda Marysville Auto Plant- Line 1	170.78	161.53
034B	Honda Marysville Auto Plant - Line 2	147.05	138.07
036A	TABC, Inc.	49.82	49.39
	Totals	10261.69	9555.04

Appendix A. 4. - EGBE Emission Estimates by Facility and Operation

FACID	Facility Name	EDP EGBE	Primer Surfacer EGBE	Top Coat EGBE	Total EGBE	Tons per year EGBE
001A	Mitsubishi Normal Assembly Plant	52,401	0	0	52,401	26.20
002A	Honda East Liberty Auto Plant	49,579	0	0	49,579	24.79
003A	Subaru-Isuzu Automotive Inc.	62,234	5,586	18,367	86,187	43.09
004A	Nissan Motor Manufacturing Corp. USA - Line IV	na	na	na	0	0.00
004B	Nissan Motor Manufacturing Corp., USA - Line HF	na	na	na	0	0.00
005A[1]	AutoAlliance International Inc.	24,374	3,439	2,190	30,003	15.00
006A[1]	Mercedes-Benz U.S. International, Inc.	17,151	33,129	69,766	120,046	60.02
007A	BMW Manufacturing Corp.	0	12,394	27,799	40,193	20.10
008A	Toyota Motor Manufacturing Kentucky Inc. Paint #1	38,327	42,101	69,819	150,247	75.12
009A	Toyota Motor Manufacturing Kentucky Inc.-Paint #2	44,420	31,434	121,608	197,462	98.73
009A	New United Motor Mfg. Inc. NUMMI - Car Line	25,566	24,175	194	49,935	24.97
009B	New United Motor Mfg. Inc. NUMMI - Truck Line	14,144	13,081	8,264	35,489	17.74
010A	DC - Belvidere Assembly Plant	8,103	0	890	8,993	4.50
010C	DC - Jefferson North Assembly Plant	94,661	0	0	94,661	47.33
010D	DC - Newark Assembly Plant	28,688	0	23,930	52,618	26.31
010E[1]	DC - Sterling Heights Assembly Plant	10,913	0	5,050	15,963	7.98
010F	DC - St. Louis North Assembly Plant	40,848	0	27,955	68,803	34.40
010G	DC - St. Louis South Assembly Plant	15,087	0	23,228	38,315	19.16
010H	DC - Toledo Assembly Plant I	51,531	0	0	51,531	25.77
010J	DC - Warren Truck Assembly Plant	7,615	0	0	7,615	3.81
015A	GM Buick City Assembly Center	38,452	0	1,714	40,166	20.08
018A	GM Orion Assembly	36,119	5	1,751	37,875	18.94
019A	GM Oklahoma City Assembly Plant	111,866	0	0	111,866	55.93
021A	GM North American Truck Group	34,323	na	0	34,323	17.16
022A	GM Flint Assembly Plant	21,171	0	0	21,171	10.59
024A	GM Janesville Assembly Plant	25,740	0	0	25,740	12.87
025A	GM Linden Assembly	35,824	0	0	35,824	17.91
028A	GM Shreveport Assembly Plant	31,146	0	0	31,146	15.57
029A	GM Wentzville Assembly Center	37,927	0	47,766	85,693	42.85
031A	GM Lordstown Assembly Plant	76,971	0	0	76,971	38.49
032A	Saturn Corporation	52,578	0	92,439	145,017	72.51

034A	Honda Marysville Auto Plant- Line 1	21,348	1,302	672	23,322	11.66
034B	Honda Marysville Auto Plant - Line 2	20,755	0	831	21,586	10.79
036A[2]	TABC, Inc.	10,014	4,093	0	14,107	7.05
	Totals	1,139,876	170,739	544,233	1,854,848	927.42

[1] Data are for all glycol ether HAPs.

[2] Primer-surfacer data are for all glycol ether HAPs.

Appendix A. 5. - MEK Emission Estimates by Facility and Operation

FACID	Facility Name	EDP MEK	Primer Surfacer MEK	Top Coat MEK	Total MEK	Tons per Year MEK
001A	Mitsubishi Normal Assembly Plant	0	50,128	0	50,128	25.06
002A	Honda East Liberty Auto Plant	0	0	189	189	0.09
003A	Subaru-Isuzu Automotive Inc.	0	0	12,491	12,491	6.25
004A	Nissan Motor Manufacturing Corp. USA - Line IV	na	na	na	0	0.00
004B	Nissan Motor Manufacturing Corp., USA - Line HF	na	na	na	0	0.00
005A	AutoAlliance International Inc.	24,374	0	0	24,374	12.19
006A	Mercedes-Benz U.S. International, Inc.	0	0	0	0	0.00
007A	BMW Manufacturing Corp.	0	0	0	0	0.00
008A	Toyota Motor Manufacturing Kentucky Inc. Paint #1	0	359	19,265	19,624	9.81
008B	Toyota Motor Manufacturing Kentucky Inc.-Paint #2	0	0	0	0	0.00
009A	New United Motor Mfg. Inc. NUMMI - Car Line	25,566	5,715	81	31,362	15.68
009B	New United Motor Mfg. Inc. NUMMI - Truck Line	14,144	5,000	3,255	22,399	11.20
010A	DC - Belvidere Assembly Plant	0	0	0	0	0.00
010C	DC - Jefferson North Assembly Plant	0	0	0	0	0.00
010D	DC - Newark Assembly Plant	0	0	0	0	0.00
10E	DC - Sterling Heights Assembly Plant	0	0	0	0	0.00
010F	DC - St. Louis North Assembly Plant	0	0	0	0	0.00
010G	DC - St. Louis South Assembly Plant	0	0	0	0	0.00
010H	DC - Toledo Assembly Plant I	0	0	0	0	0.00
010J	DC - Warren Truck Assembly Plant	0	0	0	0	0.00
015A	GM Buick City Assembly Center	0	0	0	0	0.00
018A	GM Orion Assembly	0	0	0	0	0.00
019A	GM Oklahoma City Assembly Plant	0	0	0	0	0.00
021A	GM North American Truck Group	0	na	0	0	0.00
022A	GM Flint Assembly Plant	0	0	0	0	0.00
024A	GM Janesville Assembly Plant	0	0	0	0	0.00
025A	GM Linden Assembly	0	0	0	0	0.00
028A	GM Shreveport Assembly Plant	0	0	0	0	0.00
029A	GM Wentzville Assembly Center	0	0	0	0	0.00
031A	GM Lordstown Assembly Plant	0	0	0	0	0.00
032A	Saturn Corporation	0	0	0	0	0.00

034A	Honda Marysville Auto Plant- Line 1	0	0	2,212	2,212	1.11
034B	Honda Marysville Auto Plant - Line 2	0	6,875	4,118	10,993	5.50
036A	TABC, Inc.	0	498	3,520	4,018	2.01
	Totals	64,084	68,575	45,131	177,790	88.90

Appendix A. 6. - Methanol Emission Estimates by Facility and Operation

FACID	Facility Name	EDP Methanol	Primer Surfacer Methanol	Top Coat Methanol	Total Methanol OHAP	Tons per Year Methanol
001A	Mitsubishi Normal Assembly Plant	0	1,556	25,796	27,352	13.68
002A	Honda East Liberty Auto Plant	0	452	122	574	0.29
003A	Subaru-Isuzu Automotive Inc.	0	18,424	69,188	87,612	43.81
004A	Nissan Motor Manufacturing Corp. USA - Line IV	na	na	na	0	0.00
004B	Nissan Motor Manufacturing Corp., USA - Line HF	na	na	na	0	0.00
005A	AutoAlliance International Inc.	0	893	8,932	9,825	4.91
006A	Mercedes-Benz U.S. International, Inc.	0	0	0	0	0.00
007A	BMW Manufacturing Corp.	0	0	67	67	0.03
008A	Toyota Motor Manufacturing Kentucky Inc. Paint #1	0	35,181	30,543	65,724	32.86
008B	Toyota Motor Manufacturing Kentucky Inc.-Paint #2	0	2,976	3,035	6,011	3.01
009A	New United Motor Mfg. Inc. NUMMI - Car Line	25,566	14,736	244	40,546	20.27
009B	New United Motor Mfg. Inc. NUMMI - Truck Line	14,144	8,347	11,809	34,300	17.15
010A	DC - Belvidere Assembly Plant	0	0	0	0	0.00
010C	DC - Jefferson North Assembly Plant	0	0	0	0	0.00
010D	DC - Newark Assembly Plant	0	0	0	0	0.00
10E	DC - Sterling Heights Assembly Plant	0	0	0	0	0.00
010F	DC - St. Louis North Assembly Plant	0	0	0	0	0.00
010G	DC - St. Louis South Assembly Plant	0	0	0	0	0.00
010H	DC - Toledo Assembly Plant I	0	193	0	193	0.10
010J	DC - Warren Truck Assembly Plant	0	0	78	78	0.04
015A	GM Buick City Assembly Center	0	1,394	0	1,394	0.70
018A	GM Orion Assembly	0	3,643	0	3,643	1.82
019A	GM Oklahoma City Assembly Plant	0	0	25,336	25,336	12.67
021A	GM North American Truck Group	0	na	25,155	25,155	12.58
022A	GM Flint Assembly Plant	0	0	5,182	5,182	2.59
024A	GM Janesville Assembly Plant	0	0	40,723	40,723	20.36
025A	GM Linden Assembly	0	0	30,799	30,799	15.40
028A	GM Shreveport Assembly Plant	0	0	20,262	20,262	10.13
029A	GM Wentzville Assembly Center	0	15,335	0	15,335	7.67
031A	GM Lordstown Assembly Plant	0	35,645	0	35,645	17.82
032A	Saturn Corporation	0	33,302	0	33,302	16.65

034A	Honda Marysville Auto Plant- Line 1	0	0	1,100	1,100	0.55
034B	Honda Marysville Auto Plant - Line 2	0	873	19,183	20,056	10.03
036A	TABC, Inc.	0	0	9,668	9,668	4.83
	Totals	39,710	172,950	327,222	539,882	270

HAP Control Technologies in the Automobile and Light-duty Truck Surface Coating Industry

September 30, 1998

MEMORANDUM

To: Dave Salman, EPA/OAQPS/ESD/CCPG

From: Veronica Hanzel, Kevric
David Green, RTI

Subject: HAP Control Technologies in the Automobile and Light-duty Truck Surface Coating Industry

1.0 Introduction

This memo presents a discussion on the technologies currently in use in the automobile and light-duty truck surface coating industry for control of emissions of hazardous air pollutants (HAP) and volatile organic compounds (VOC) from surface coating operations. The HAP emissions from the surface coating operations are generated primarily from the preparation and painting of the car bodies, the application of adhesives, and the cleaning of the spray booths and application equipment. The largest portion of the emissions comes from the painting operation, as a result of the use and application of solvent and solvent borne coatings. The HAP emissions identified are primarily organic HAP, released from the volatile portion of the coatings or the cleaning solvents. To a small extent, particulate (inorganic) HAP may be contained in some coating pigments or additives and may be present in the coating overspray.

Spray booth HAP emissions are released in a large volume of air. Typically, air movement in the spray booths is controlled for quality and worker health concerns. This control requires that all overspray and vapor be moved away from the application area and worker respiratory zone. This is accomplished by large air handling systems that move large volumes of air through the booth. The result is a very high flow, low concentration waste gas stream with respect to the concentration of HAP/VOC constituents. Following coating application, vehicle bodies move to a higher temperature bake oven in which volatile components of the coating (including water, where present) are evaporated, and the film is cured. The exhaust from these bake ovens is a lower volume, higher concentration, higher temperature gas stream which is more amenable to control with devices such as thermal oxidizers.

With respect to emissions resulting from clean-up activities, the industry has focused on management practice and changes in the cleaning material formulations. The section "Process Description" details practices which minimize or eliminate use of HAP containing materials. The emissions that are generated from clean-up activities are not controlled (with the exception of those that are controlled by the capture/control systems otherwise present in the spray booth). Control of these emissions will be discussed as part of the waste gas stream generated by the coating application operations.

The discussion below identifies the types of technology and controls currently in use in the automobile and light-duty truck surface coating industry for control of HAP in the surface coating operations. These technologies are used widely in the industry, although there are many variations within the facilities as to the configuration, extent, type of equipment and type of coatings used. The following presentation below discusses the "generic" technology and its application to these operations.

The application of control technology for treatment of HAP emissions has been derived from the existing technology used to control VOC emissions. Since most HAPs from the operation are also VOC by definition, this is effective. The control efficiencies for these technologies are not specific to control of HAP, but are based on control of total VOC emissions.

2.0 TECHNOLOGY DISCUSSION

A discussion of the technologies that are most commonly used in this industry follows. The automobile and light-duty truck surface coating industry is constantly researching and implementing new control strategies both from the pollution prevention standpoint as well as end-of-process treatment.

There are primarily three types of HAP/VOC emission control technologies used in the automobile and light-duty truck surface coating industry;

1) Use of coating and cleaning materials with low HAP content (i.e. waterborne, powder, or low-HAP solvent based materials);

2) Use of application techniques which achieve a high transfer efficiency, and/or clean-up techniques with minimal use of HAP/VOC containing materials; and

3) Add-on waste gas treatment equipment.

The first two types of technology focus on the reduction or elimination of HAP in the materials being applied or on minimizing the amount of material used in order to reduce potential for emissions. For discussion purposes, these are grouped together and referred to as "low emission paint systems". The third technology focuses on removal of the HAP from the effluent air stream, either by destruction or by recovery for recycling and reuse.

2.1 Low Emission Paint Systems

Use of low emission paint systems, can reduce or eliminate the emissions from manufacture, processing, handling, transportation and storage.[4] For instance, emissions can be successfully reduced by raising the solids content in the paint or by replacing the HAP solvent with another solvent (i.e. water or non-HAP organic solvent). The use of coating or cleaning materials with low or no HAP content is accomplished by reformulating the materials that are applied.

In electrodeposition primer, as used for primer coating of car bodies, the major solvent is demineralized water. Waterborne paints are also in use for primer-surfacer and metallic and solid color base coats. HAP emissions can also be decreased by substituting non-HAP organic solvents for some or all of the HAP.

An increase in the solids content of the coating also reduces the amount of solvent carrier needed and thus reduces emissions. Using powder paints completely eliminates solvent content and therefore, emissions. [4]

For cleaning applications, the cleaning material used is directly related to the coating material being removed. The industry has moved, where feasible, to the use of aqueous based detergents and/or low HAP content cleaners.

Development of materials with low or no HAP solvent content is currently being pursued as a joint effort between the automobile manufacturers and their coatings suppliers. In order to implement a change to a coating formulation, adjustments must also be made to the method and equipment used to apply the materials to the car body, so as to achieve the required quality characteristics. Therefore, the development of new coating materials must be simultaneously coordinated with new or revised application methods, equipment, clean-up practices and overall feasibility for large scale application.

The second aspect of the low emission paint systems is the use of systems with high coating efficiencies. Coating efficiency, or "Transfer Efficiency" refers to the ratio of the amount of coating solids used to the amount deposited on the surface. The higher the transfer efficiency, the less paint used and the less lost as overspray. Painting systems of high transfer efficiency used in the automobile industry include electrodeposition (dip) primer and electrostatic spraying.

Electrostatic spraying methods achieve comparatively high transfer efficiency by creating an electrostatic field between the spray gun and the metal surface. Electrostatic spraying uses either pneumatic or rotation atomization of the paint.[4]

Clean-up activities that minimize emissions include the use of masking/covering of equipment and surfaces and manual removal of coating materials such as scraping, and wire brushing. Some plants are using a patented, fluidized bed system based on a pyrolysis removal technique for cleaning of spray booth floor grates. Other HAP minimizing cleaning techniques include high pressure water sprays, high pressure hot water sprays and the use of strippable coatings.

The adoption/implementation of new coating materials and/or changes to the application methods and equipment can require investment in new spray booths and application equipment. In addition, new materials must be throughly tested and evaluated in order to maintain quality and durability standards.

2.2 Waste Gas Treatment

The treatment of an exhaust gas stream requires additional equipment at the end of the process to remove the emissions generated by the process. Control equipment is in use at all plants. However, not all operations or exhaust streams are controlled. Exhaust gas treatment systems consist of several stages which include capture of contaminated air, removal of paint solids, concentration of vapors (organics), and removal of organics by either a recovery or destruction mechanism.

The types and configuration, including the extent of capture and treatment of emissions varies between facilities, and even between coating lines within a facility. This variability appears to be the result of attempts to implement new technologies as changes in operations and facilities allow. The strategy has been based on controlling those streams that offer the greatest potential emissions reduction for a given investment. The direction, therefore, is not toward plant wide systems, but rather toward individual systems added to operating units within the total process.

The waste gas stream created during the coating application operation is a high flow, low concentration waste stream. This affects the choice of control technologies used. Recent research indicates that commercially available technologies for control of gas streams containing less than 100 ppm organic vapor can achieve destruction and removal efficiencies greater than 99 percent.[2] Control of low concentration streams is more expensive per mass of HAP because equipment cost is affected by volumetric flow rate, fan horsepower for capturing and moving the streams is proportional to volumetric flow rate and auxiliary fuel (or a concentrator system) may be needed for oxidation of these streams. Exhausts generated in the bake ovens are lower flow, higher concentration streams because a much lower volume of air per vehicle is passed through the oven than through the spray booth. These streams can generally be controlled more cost-effectively (that is, with smaller equipment, and less auxiliary fuel).

The automobile industry has typically implemented add-on controls that first remove overspray solids and then destroy the organic vapor content by incineration. Overspray removal takes place in the spray booth. Organics can be removed from the spray booth exhausts as well as from the exhausts of drying equipment. The potential processes include concentrating organic vapor, condensing, and cost effective incineration and heat recovery technologies. The discussion below addresses the various types of technologies currently used to control these waste gas streams. These systems were primarily designed to control total VOC emissions. Published data and specifications regarding efficiencies of equipment or processes are based on total VOC emissions and are not specific to individual HAP emissions.

2.2.1 Waste Gas Capture

Control of the HAP/VOC emissions is first dependent on capturing the waste gas or vapor laden air stream containing the HAP/VOC contaminants. The spray booths are equipped with air handling systems capable of replacing the booth air on a continuous basis during the operation. The circulation of the air from the spray booth is necessary for two reasons; 1) protection of the worker from vapors and paint overspray, and 2) as a quality control measure to remove of paint solids (overspray) from the immediate area of the application. These systems are primarily down-draft systems where air enters from vents at the top of the spray booth cell and is drawn downward through floor grates at the base of the cell. Where workers are present in the spray booths, this air flow removes the vapors and/or paint particles from the respiration level of the worker. Some spray booths are unoccupied, with the paint application done by automated and robotic equipment. In these booths, it is not necessary to protect worker health on a continual basis and the concentration of vapor and solids may be higher, limited by quality and fire prevention concerns.

In most cases, these air handling systems provide the capture method by which the paint overspray and vapor laden air are removed from the booth and channeled into the control devices. In all cases, these air handling systems create a high flow, low concentration waste gas stream.

Following the spray booth were coatings are applied, vehicle bodies go to a bake oven, passing in some plants, through a "heated flash" zone. Partial drying of the coatings occurs in the heated flash zone. Lower volumes of air are vented from this area than from the spray booth, because overspray control is not necessary. Additional drying and curing of the coatings takes place in the bake oven. Because this zone is closely enclosed, higher concentration, lower volume exhaust streams can be captured. These streams can be controlled more cost effectively.

2.2.2 Paint Solids Removal

The first treatment of the air leaving the spray booth is removal of the paint solids or overspray. The air is drawn to an area underneath the spray booth that is wetted with water. The water droplets together with waste air are accelerated in a Venturi nozzle so that intensive mixing of the waste gas and the droplets takes place. This results in removal of over 99 percent of particles which ensures a residual particle content of less than 3 mg per cubic meter in the air discharged.[4]

The permissible residual content of particles depends on whether the cleaned waste air is fed directly back to the spray booth or whether it is fed to a VOC/HAP control device . For secondary removal of paint particles after Venturi washing (especially if the air is recirculated), or to protect subsequent equipment (such as concentrator rotors and heat exchangers), it may be necessary to provide additional paint particle separators.[4] Further removal may be accomplished using dry filters and/or wet electrofilters. In an electrofilter system, an electrostatic field charges the paint droplets which causes them to migrate to the deposition electrodes which are wetted with water.

2.2.3 Solvent Vapor Concentrating and Solvent Recovery

Due to the low solvent vapor concentration in the waste air stream from the spray booths, many facilities utilize a concentrating technology to raise the concentration of the organic constituents in the air stream in order to make removal or destruction of the organic less expensive. Concentrating the organics lowers the cost of destruction.

Concentrating of the organic vapor in the exhaust air stream is accomplished by either internal or external means, or a combination of both. Internal concentrating refers to feeding the spray booth air, after adequate particle removal and drying, back into the spray booth. The vapor laden air is recirculated continuously with only a small proportion of the air being discharged to the control device. This small amount of exhaust air with high solvent concentration can be economically treated by the methods described below. These spray booths are always unmanned (i.e. operated using robotics or other automated equipment).

External concentrating (rotor technique) is achieved by continuously circulating the spray cabin air through a rotor, adsorbing the solvent, and then desorbing it to an external hot air stream. The adsorption materials used include carbon fiber paper, zeolite, and activated charcoal. This system can concentrate the solvent by a ratio between 1:6 to 1:20, depending on the raw gas concentration. This comparatively small quantity of gas can then be economically treated using the methods described below.[4] An example of a rotary type adsorption system manufactured by Eisenmann is illustrated in Attachment 3.1. Sorbent (activated carbon or zeolite) bed absorbers, as shown in Attachment 3.2 can also be used. Technologies being used specifically for low concentration gases, in industries other than the automobile and light-duty truck surface coating industry include absorption/stripping processes and UV/ozone catalytic oxidation.[2]

2.2.4 Removal of Organic Vapor

The most common methods of removal of organics are thermal and catalytic oxidation which are destruction techniques. In some facilities, on some operations, the vapor is concentrated by a method described above and then fed to an oxidizer.

2.2.4.1 Removal of Organics by Oxidation

Oxidation processes convert organic compounds, whether hydrocarbon or oxygenated, to CO_2 and H_2O. If the organic is halogenated, the corresponding halogen acids will be formed as products of combustion. Oxidation is used for the destruction of a wide variety of organic vapors. It is best suited to applications where the gas stream has a consistent flow rate and concentration of organic vapor.

Conceptually, oxidizers can be divided into three sections: an auxiliary fuel combustion section, a fume and combustion product mixing section, and an oxidation (or reaction) section. Physically, the oxidizer sections may be merged and all the processes may occur in one chamber.[3]

In the combustion section, an auxiliary fuel is fired to supply the heat to raise the temperature of the waste gas to promote oxidation of the organic vapors. Usually, a portion of the waste gas stream supplies the oxygen.[3]

The mixing section is designed to provide intimate mixing between the combustion products (from combustion of the auxiliary fuel) and the remaining fume gases. To ensure good mixing it is necessary to provide high velocity gas flow to produce turbulence. Gas velocities in oxidizers range from 25 to 50 feet per second. Ideally, the temperature profile at the outlet of the mixing section would be flat. Oxidation sections have length to diameter ratios determined by the type of pollutant; residence times are dictated primarily by chemical kinetic considerations.[3] These issues are discussed in more detail below.

Oxidizers can be divided into three categories: direct combustion or flaring, thermal oxidation, and catalytic oxidation. Flares are a simple form of thermal oxidation which do not use a confined combustion chamber. As with other forms of thermal oxidation, flares often require supplemental fuel. Flaring is seldom used for control of HAP due to the potential inefficiencies (i.e. there is no residence time and combustion must occur instantaneously at the burner). Therefore, flares are most often used when the emission stream is intermittent or uncertain, such as the result of a process upset or emergency.

The two types of oxidation technologies that are typically used in the automobile and light-duty truck surface coating operations are thermal and catalytic oxidation.

2.2.4.1.1 Thermal Oxidation

Thermal oxidizers or afterburners can be used over a fairly wide range of organic vapor concentrations. The concentration of the organics in air must be substantially below the lower flammable level (lower explosive limit). Reactions are conducted at elevated temperatures in order to ensure high chemical reaction rates for the destruction of organics.

An effective thermal afterburner design must provide for an adequate combination of (1) a sufficiently high temperature, (2) a high enough residence time (usually above 0.5 seconds) and (3) adequate mixing or turbulence in the combustion chamber. A small deficiency in any one component may be compensated for by an increase in another. Direct flame contact is not required, although exposure to the extremely high temperature in the flame, even for a short period, is beneficial.[1]

A critical design and operational consideration for thermal oxidizers is the mixing of the fuel combustion gases and the waste gas stream, in order to achieve complete system mixing to yield a uniform temperature profile through the cross section of the combustion chamber.[1] To achieve this temperature profile, it is necessary to preheat the feed stream with auxiliary energy. Along with the contaminant-laden gas stream, air and fuel are continuously delivered to the reactor, where the fuel is combusted with air in the firing unit (burner). The burner may use the air in the process waste stream as the combustion air for auxiliary fuel, or a separate source of outside air may be used for this purpose.

The products of combustion and the unreacted waste gas stream are mixed and enter the reaction zone of the oxidizer. The pollutants in the waste gas stream are then reacted at elevated temperature. Thermal oxidizers requires operating temperatures in the 1200 to 2000 degrees F range for combustion of most pollutants. A residence time of 0.2 to 2.0 seconds is required; this factor is dictated by kinetic considerations. A length-to-diameter ratio of 2.0 to 3.0 is usually employed. [2]

The end products are continuously discharged at the outlet of the oxidizer. The average gas velocity can range from as low as 10 fps to as high as 50 fps. The velocity increases from the inlet to outlet due to the increase in the gas volume and the increased temperature due to reaction. These high velocities are required to prevent settling of particulates and to minimize the dangers of flashback and fire.

Proper mixing is important in combustion processes for two reasons. First, for complete combustion to occur, every particle of waste and fuel must come in contact with air (oxygen). If this does not happen, unreacted solvent and fuel will be exhausted from the stack. Second, not all of the fuel or waste stream is in direct contact with the burner flame. In most incinerators, a portion of the waste stream may bypass the flame and be mixed at some point downstream of the burner with the hot products of combustion. If the two streams are not completely mixed, a portion of the waste stream will not react at the required temperature and incomplete combustion will occur.[1]

A number of methods are available to improve mixing, including the use of refractory baffles, swirl-fired burners and baffle plates. Unless properly designed, some of these mixing devices may create "dead spots" and reduce operating temperatures.[1]

Oxygen is necessary for combustion to occur. To achieve compete combustion of a compound, a sufficient supply of oxygen must be present to convert all of the carbon to carbon dioxide. This quantity of oxygen is referred to as the stoichiometric or theoretical amount. If less oxygen or air is available than the theoretical amount, a mixture will be produced which will result in incomplete combustion of the waste stream. In most cases, more than the theoretical amount of air is provided to ensure complete combustion.[1] This excess air must be balanced to minimize heat loss.

Natural gas is the fuel typically used to preheat the gas stream. The energy (heat) liberated by the thermal oxidation reaction can be directly recovered by a suitable external heat exchange system. Heat recovery is important, owing to the high temperatures involved. There are two types of heat recovery systems, recuperative and regenerative. The use of heat exchangers reduces fuel consumption, which results in fewer NOx compounds. These types of heat recovery systems are discussed below. An example of a regenerative thermal incineration system manufactured by DURR is illustrated in Attachment 3.4.

2.2.4.1.2 Catalytic Oxidation

Catalytic oxidizers modify the flame-based oxidizer concept by adding a catalyst to promote the oxidation reaction, allowing faster reaction and/or reduced reaction temperature. This may allow more cost-effective operation at low organic vapor concentrations than even regenerative thermal incineration. A faster reaction requires a smaller oxidizer, thus reducing capital costs: and low operating temperatures generally reduce auxiliary fuel requirements, thus reducing operating costs.[1]

A catalyst is a substance that changes the rate of a chemical reaction and does not appear to change chemically in doing so. In the case of afterburners the catalyst functions to promote the oxidation reactions at a somewhat lower temperature than occurs in thermal afterburners.[2] The catalyst promotes the oxidation reaction on its surface (i.e., solid-gas interface) at lower temperatures by providing alternative reaction pathways that have faster rates than the corresponding gas-phase reactions.

A catalytic afterburner consists of a preheating section, a temperature indicator-controller, a chamber containing the catalyst, safety equipment and usually, heat-recovery equipment. The organic vapor containing gas is first indirectly preheated by the exhaust gas. For the low concentrations of interest here, supplemental fuel is used to further preheat the gas, usually in an open flame burner, to the reaction temperature. The gas then passes over the catalyst, where the organic vapor is oxidized. The operating temperature to achieve a particular destruction efficiency depends on the concentrations and composition of the organic vapor in the emission stream and the type of catalyst used.[2] A typical catalytic oxidizer is illustrated in Attachment 3.5.

Commercial catalysts usually consist of noble metals or metal oxides. The type of catalyst used depends on the type of organic vapor. For example, some noble metal catalysts may be poisoned by chlorinated organic vapor, even at very low concentrations. In such cases metal oxides that are more resistant to halogenated compounds must be used.[2]

The catalyst is often platinum combined with other metals and deposited in porous form on an inert substrate. Metallic oxide catalysts are usually homogeneous granules. Catalysts may be supported on granular particles or on rigid structures. The catalyst may be either fixed or mobile (fluid bed).

Catalytic oxidizers typically control air temperature into the catalyst at 650 to 800 degrees F. Typical hydrocarbon destruction efficiencies range from 90 to 98 percent, depending on the ratio of the volume of catalyst used to the air-flow volume.[2] Destruction efficiencies are typically near 96 percent, but can be increased by using additional catalyst or higher temperatures (and thus more supplemental fuel).

Catalysts are susceptible to loss of performance as a result of coating (masking) and reaction with contaminants (poisoning). Dryer exhaust gases containing silicones, tars, resins and dusts will cause masking, and those containing high levels of phosphorus compounds, heavy metals, halogens, or sulfur will cause poisoning. Also, excessive temperatures can cause crystal growth of the catalyst support and loss of activity. The upper temperature limit appears to be 1400 degrees F for platinum catalysts and lower for metallic oxide catalysts.[3]

Granular catalysts are susceptible to abrasion, which may extend the useful life of the catalyst by removing masking and surface poisons. However, it may ultimately cause failure by converting the catalyst into fines, which may eventually pass through the retaining screens. Therefore, periodic replacement of the catalyst is necessary, even with proper usage.[3]

The preheating section may have either electric or natural gas fired heaters. Liquid fuels are avoided as inefficient burning will contribute to masking of the catalyst.

Catalytic oxidation is not as broadly applicable as thermal incineration for treatment of HAP due to its greater sensitivity to pollutant characteristics and process conditions (i.e. high temperatures, high concentrations of organics, fouling from particulate matter or polymers, and deactivation by halogens or certain metals).[2] However, in some cases, design and operational conditions can be controlled such that catalytic oxidation becomes the treatment method of choice, due to the potential offset in operating costs.

2.2.4.1.3 Heat Recovery

Depending on the type of heat recovery unit, oxidizers are further classified as (1) regenerative or (2) recuperative. Thermal and catalytic oxidizers are available with or without recuperative or regenerative heat recovery. Typically, the industry has used regenerative heat recovery systems due to cost efficiencies.

Regenerative thermal oxidizers consist of a flame-based combustion chamber that connects two (or three) fixed beds containing inert (e.g. ceramic) packing. Incoming gas enters one of the beds where it is preheated. The heated gas flows into the combustion chamber, the organic materials burn, and the hot flue gases flow through the packed beds which capture, store, and permit recovery of the heat generated during oxidation. Regenerative units operate in the range of 1400 degrees to 1800 degrees F. [2]

The packed beds store the heat energy during one cycle and then release it as the beds reheat the incoming solvent laden gas during the second cycle. Up to 95 percent of the energy in the flue gas can be recovered in this manner. Hydrocarbon destruction efficiencies range from 95 to 99 percent for the regenerative units. The packed beds, in effect, are direct contact heat exchangers.[2]

The cycling between chambers or beds typically results in somewhat lower destruction efficiencies than are achieved in a conventional recuperative thermal oxidizer, generally below 99 percent. The lower destruction efficiency for regenerative thermal oxidizers has been attributed in part to valve leaks within the system.[2]

Recuperative units continually transfer heat from a hot stream to a colder stream in a countercurrent flow arrangement using a shell and tube heat exchanger to transfer the heat generated by incineration to preheat the feed stream. Operating temperatures of recuperative units range between 1250 degrees F and 1450 degrees F. Hydrocarbon destruction efficiencies range from 97 to 99 percent for the recuperative units. Thermal recovery efficiencies typically ranges from 45 to 76 percent for recuperative units.

Recuperative thermal incineration has a much lower thermal efficiency and as a result is far less economical for low solvent concentrations. The lack of recuperative thermal incinerators in high flow, low concentration VOC streams is probably driven by the high operating costs for these systems.[2]

Regenerative heat recovery is more commonly used in the automobile surface coating industry. Regenerative heat recovery is often less expensive than recuperative heat recovery for systems with flows above 50,000 scfm. Hybrid systems, which combine different devices from different vendors to make up a control system are also in use.[2]

2.2.4.2 Recovery for Reuse

Adsorption systems rely on a packed bed containing an adsorbent material to capture the VOC or organic HAP compounds. Activated carbon is the most common adsorbent material for these systems, but alumina, silica gel, and polymers are also used. Adsorbers can achieve removal efficiencies of up to 99 percent, and in many cases, allow for the recovery of the emitted compound. Benzene, methyl ethyl ketone, and toluene are examples of compounds that are effectively captured by carbon bed adsorption systems.

Adsorption beds must be regenerated or replaced periodically to maintain the bed's effectiveness. If adsorbers are exposed to high temperature gases (over 130 degrees C, high humidity, or excessive organic concentrations, the organic compound will not be captured and "breakthrough" of the bed will occur. Monitoring of process conditions is therefore important to maintain the effectiveness of the adsorber performance.[3] An example of an adsorption/recovery system is illustrated in Attachment 3.3.

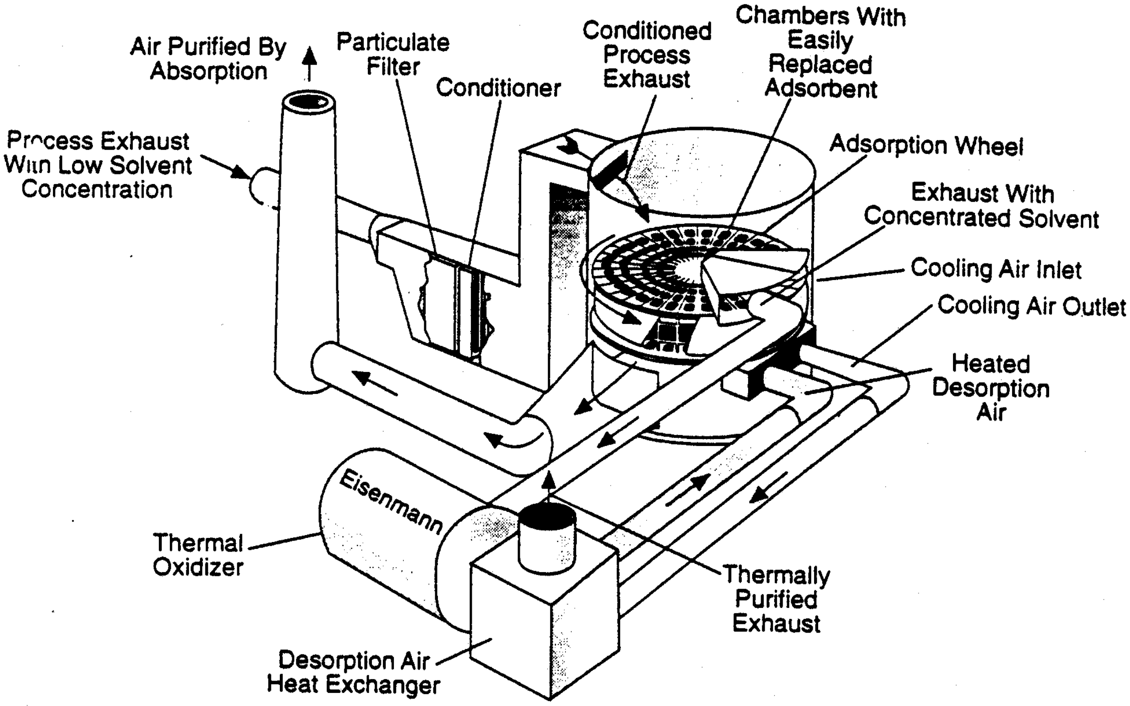
Absorbers are similar to wet scrubbers in that they expose the emission stream to a solvent which removes the VOC or organic HAP. The solvent is selected to remove one or more particular compounds. Replacement of the solvent results in the need for disposal of the used solvent, often increasing potential for contamination of ground and surface water. Absorbers are therefore often used in conjunction with thermal oxidation systems in which the waste solvent can be destroyed.[3]

With regard to the surface coating of automobile and light-duty trucks, in most cases it has not been economically feasible to recover the solvent for reuse. This is primarily because the treatment systems must be capable of handling the waste air stream from multiple booths. The materials being applied in the various booths, are mixtures of solvents and other materials. Once recovered, these mixtures are not worth enough to offset the cost of recovery.

3.0 ATTACHMENTS

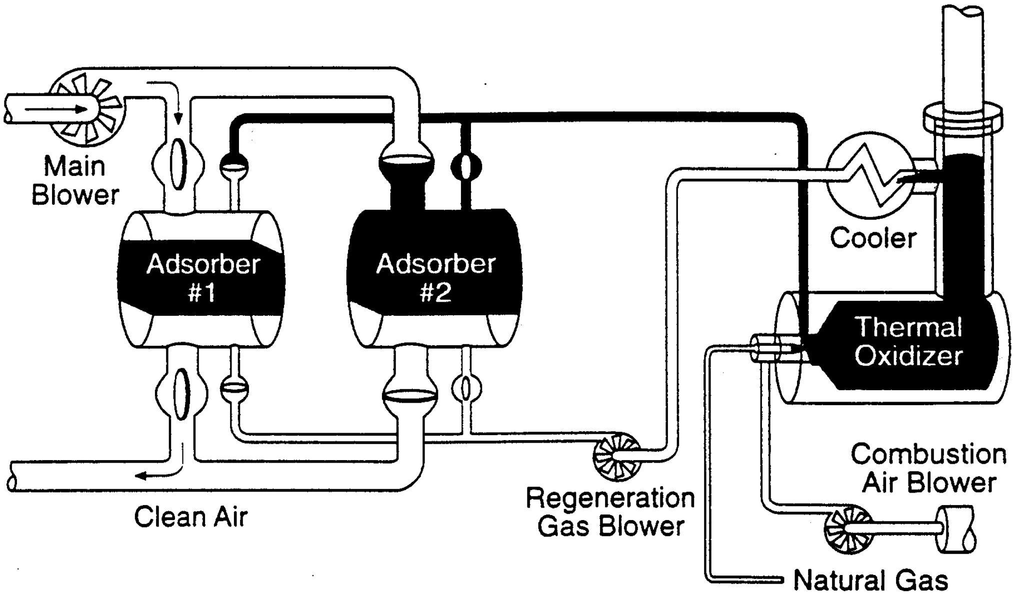
ATTACHMENT 3.1

Source: EPA Report No. 456/R-95-03, "Survey of Control Technologies for Low Concentration Organic Vapor Gas Streams", R. A. Zerbonia EtaL., Research Triangle Institute, Research Triangle Park, NC, 1995, page 83.



The Eisenmann Rotary Adsorber

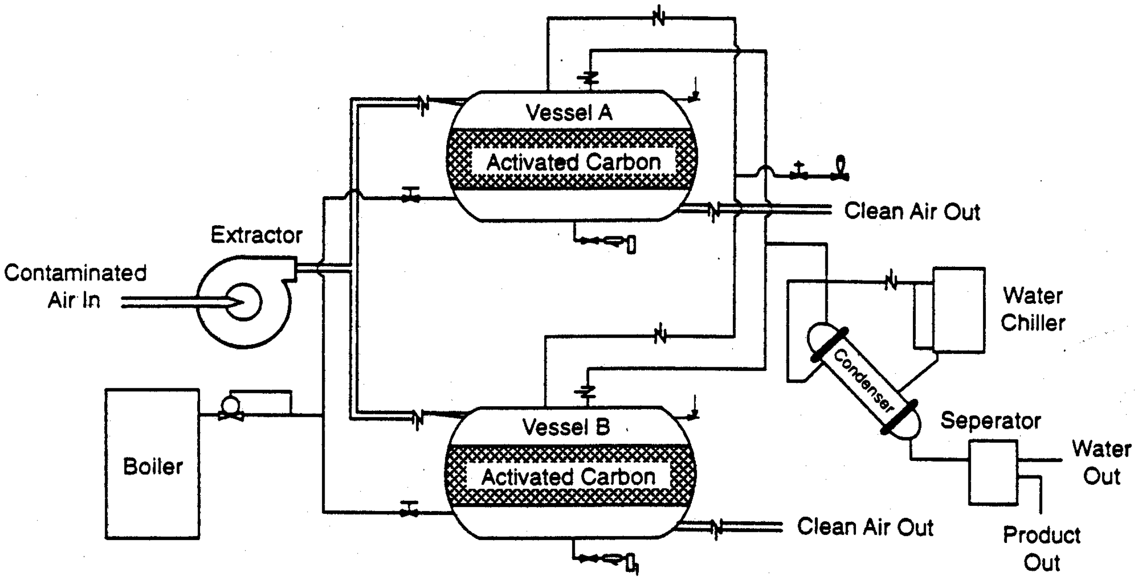
ATTACHMENT 3.2



CADRE Adsorption-Regeneration Process

***Source:** EPA Report No. 456/R-95-03, "Survey of Control Technologies for Low Concentration Organic Vapor Gas Streams", R. A. Zerbonia EtaL, Research Triangle Institute, Research Triangle Park, NC, 1995, page 59.*

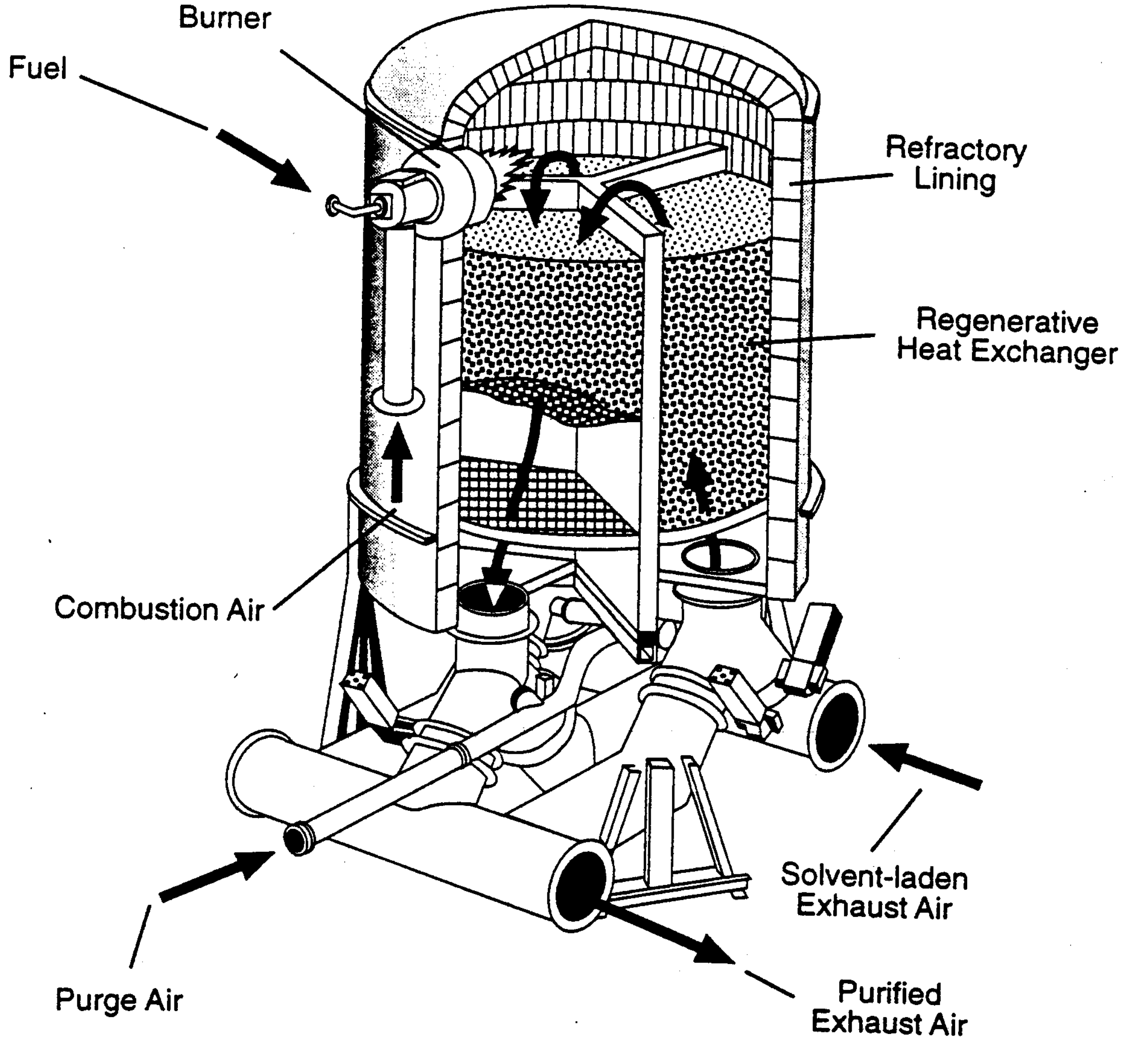
ATTACHMENT 3.3



Kelco VAPOREX™ System

Source: EPA Report No. 456/R-95-03, "Survey of Control Technologies for Low Concentration Organic Vapor Gas Streams", R. A. Zerbonia Etal., Research Triangle Institute, Research Triangle Park, NC, 1995, page 87.

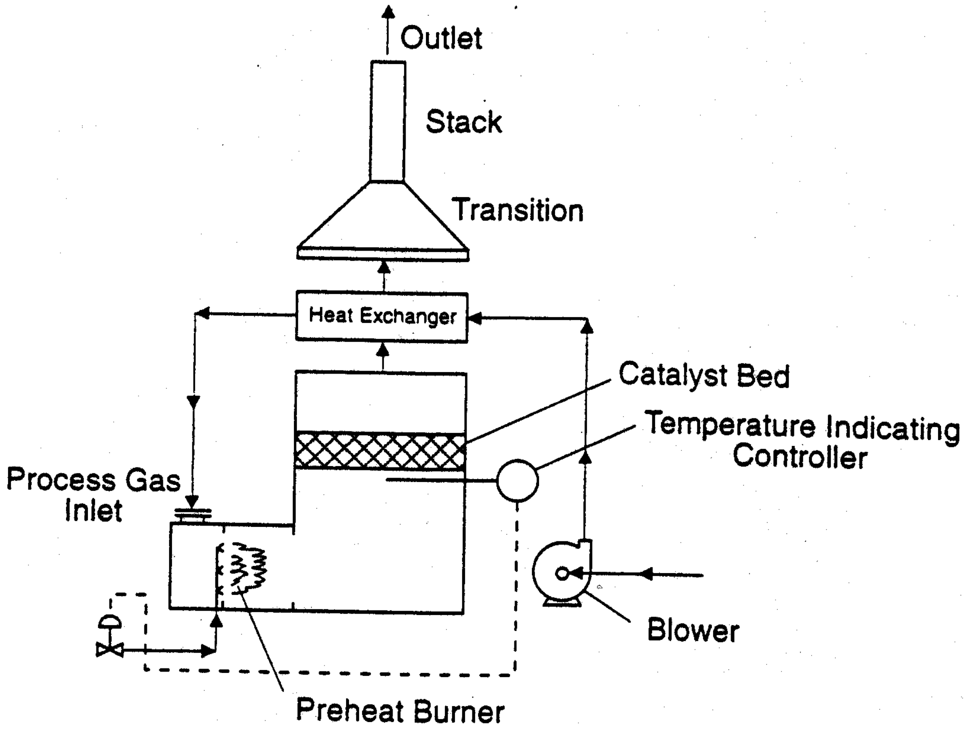
ATTACHMENT 3.4



Dürr Regenerative Thermal Incinerator – Horizontal Flow Design

Source:* *EPA Report No. 456/R-95-03, "Survey of Control Technologies for Low Concentration Organic Vapor Gas Streams", R. A. Zerbonia Etal., Research Triangle Institute, Research Triangle Park, NC, 1995, page 41.

ATTACHMENT 3.5



ARI Fluid-Bed Catalytic Incinerator

Source:* *EPA Report No. 456/R-95-03, "Survey of Control Technologies for Low Concentration Organic Vapor Gas Streams", R. A. Zerbonia EtaL., Research Triangle Institute, Research Triangle Park, NC, 1995, page 17.

4.0 References

[1] Air Pollution Engineering Manual., Bunicore, A. and W. T. Davis, eds. Air & Waste Management Association, 1992

[2] Survey of Control Technologies for Low Concentration Organic Vapor Gas Streams, EPA Report No. 456/R-95-03, R. A. Zerbonia Et al., Research Triangle Park, NC, 1995.

[3] Air Pollution Control Technologies, Chapter 65, EPA Report No. 600/A-98/059, C. A. Miller, Research Triangle Park, NC, 1998.

[4] Emission Reduction Volume-Production Car Body Painting Plants, Kommission Reinhaultund der Luft im VDI und DIN, Germany, April 1996.

[5] Chemical Aspects of Afterburner Systems, Barnes, RH. Et al., EPA, Industrial Environmental Research Lab, Research Triangle Park, NC, 1979.

[6] Destruction of Air Emissions Using Catalytic Oxidation, M. Kosusko, EPA, Research Triangle Park, NC, 1988.

[7] Destruction of Chlorinated Hydrocarbons by Catalytic Oxidation, M. A. Palazzolo Et al., Radian Corporation, Research Triangle Park, NC, 1986.

[8] Destruction of Organic Contaminants by Catalytic Oxidation, Ashworth, R.A., Et al., Radian Corporation, Research Triangle Park, NC, 1987.

[9] Destruction of Volatile Organic Compounds Using Catalytic Oxidation, Kosusko, M., EPA, Research Triangle Park, NC, 1990.

[10] Hazardous/toxic air pollutant control technology; a literature review, G. S. Shareef, Radian Corporation, Research Triangle Park, NC, 1984.

[11] Handbook on Control Technologies for Hazardous Air Pollutants: HAP Manual, EPA, M. K. Sink, Research Triangle Park, NC, 1990.

Economic Inputs: Automobile and Light Duty Truck Surface Coating NESHAP

April 25, 2002

MEMORANDUM

To: Dave Salman, EPA/OAQPS/ESD/CCPG

From: David Green, RTI

Subject: Economic Inputs: Automobile and Light Duty Truck
Surface Coating NESHAP
EPA Contract 68-D1-073, Work Assignment 001
RTI Contract 08220.000.001

The purpose of this memorandum is to present estimates of the nationwide costs of compliance with the proposed automobile and light duty truck surface coating NESHAP. The compliance costs consist of the capital and operating costs associated with retrofit of add-on controls, the incremental costs associated with use of lower HAP solvent based coatings, and monitoring, reporting and record keeping (MMR) costs. The estimates are based on the plants in operation during the reporting year for the Information Collection Request (ICR) which EPA developed to obtain HAP emission data for the project, and include 58 facilities for which ICR data are available. Two additional facilities submitted ICRs, however the emissions data from these facilities could not be interpreted. Every facility in this source category is a major source. No facilities in this source category are operated by small businesses.

Table 1 summarizes the costs, by facility, for existing automobile and light duty truck surface coating facilities. It was assumed that facilities that were not presently in compliance with the proposed standards would adopt one or more of 4 different emission control strategies. All plants that had uncontrolled electrodeposition (EDP) operations where assumed to use strategy 1. Costs for this strategy were to install a control system based on a regenerative thermal oxidizer with 95 percent thermal recovery. An overall efficiency of 85 percent was assumed. Control costs for this strategy were based on a the capacity of a recently installed system at the Daimler Chrysler Newark plant. Costs for a system of this capacity were estimated with EPA's "Total Annual Cost Spreadsheet Program--Regenerative Thermal Oxidizers"[1]. Capital costs were escalated to the fourth quarter of 1998 using the Vatuvuk cost index, and a capital recovery factor of 11 percent was assumed.

All plants that were not in compliance after controlling EDP emissions with primer/surfacer HAP to VOC ratios of greater than 0.3 were assumed to employ strategy 2. This involved substitution of non-HAP solvents for HAP solvents to bring the HAP/VOC ratio to 0.3. The cost for this option was assumed to be $0.23/lb HAP eliminated. This figure is based on the difference between the cost for aromatic solvents[2] (e. g. toluene, xylene) of $1.18 to 1.20/gallon, or $0.17/lb, and that of non-HAP solvents (e.g. ethyl acetate, butyl acetate) of $0.40/lb.[3]

All plants that were not in compliance after applying strategies 1 and 2, as appropriate, that had topcoat HAP to VOC ratios of greater than 0.3 were assumed to employ strategy 3. This involved substitution of non-HAP solvents for HAP solvents to bring the HAP/VOC ratio to 0.3. The same costs and solvent price assumptions were used for strategy 3 as for strategy 2.

Residual HAP emissions after application of strategies 1, 2 and 3 were assumed to be controlled by installation of additional capture and control systems on the exhaust from automated sections of primer-surfacer and topcoat spray booths where solvent-borne coatings are used and on the exhaust from the heated flash zone where waterborne basecoats are used. These exhaust streams were assumed to be controllable at $10,000/ton of VOC based on permit application estimates for automated spray booth zone exhaust control costs for similar controls at new paint shops adjusted to account for retrofitting these controls at existing paint shops. Because of the low HAP to VOC ratio in the emission streams, a cost of $40,000/ton of HAP was assigned. This cost was divided evenly between capital recovery and operating costs. Capital costs were estimated by assuming a capital recovery factor of 11 percent.

Nationwide energy impacts to operate capture systems and regenerative thermal oxidizers, were estimated at 4.9 billion standard cubic feet (SCF) of natural gas per year and 180 million kilowatt hours (kwhr) per year. Natural gas and electricity were assumed to cost $3.20/SCF and $0.06/kwhr respectively. For an average vehicle, the energy used to refine and process the raw materials, make the parts and components, assemble the vehicle and deliver the product to the showroom was estimated at 156 million Btu.[4]

Total cost for installation and operation of retrofit technologies for the 58 plants was estimated at $148 million/year. The two plants with uninterpretable emissions data may be accounted for by multiplying this estimate by 60/58.

New plants are assumed to have no additional control costs related to this NESHAP, as newly constructed compliant paintshops are not expected to cost more to build and operate than newly constructed non-compliant paintshops. New plants are expected to be built with control systems on EDP systems for VOC and/or odor control purposes, powder or low HAP primer-surfacer operations, and waterborne basecoat/solvent-borne clearcoat topcoat systems with control of the exhaust from automated sections of primer-surfacer and topcoat spray booths where solvent-borne coatings are used and control of the exhaust of the heated flash zone where waterborne basecoats are used.

Table 2 summarizes estimated MMR costs for compliance with the proposed NESHAP. Labor rates (professional: $40/hr, technical: $30/hr, and clerical: $18/hr) are based on total compensation for workers in manufacturing industries[5]. Hourly costs included a one time effort to modify the plant record keeping system, which was amortized over 15 years; record keeping labor; testing labor for add-on control device systems required (strategies 1 and 4) to comply with the proposed NESHAP, amortized over 15 years; monitoring labor; and reporting labor. Total MMR costs for existing plants is estimated at $2.01 million per year. New plants would incur costs of record keeping and reporting only, as testing and monitoring would be required for compliance with existing VOC rules. These costs are estimated at $18,000 per plant per year.

References

1. Vatuvuk, W. M.., Co$t-Air Control Cost Spreadsheets, Second Edition. U. S. Environmental Protection Agency, Research Triangle Park, NC. July 1999.

2. Chemical Week, March 13, 2000.

3. Chemical Week Product Focus 2000, http://www.chemweek.com/marketplace/product focus/2000.

4. United States Automotive Materials Partnership, Life-cycle Assessment Special Topics Group, as cited in National Academy of Engineering, "Industrial Environmental Performance Metrics: Challenges and Opportunities". 1999

5. U. S. Department of Labor, Bureau of Labor Statistics. Employer Costs for Employee Compensation--March 1999. USDL 99-173. June 24, 1999.

Table 1 . Strategies and Costs of Compliance with Automobile Surface Coating Rule

	Strategy 1				Strategy 2				Strategy 3				Strategy 4				Total
Plant	Strategy 1	Total Capital $	Annual Operating	Total Annualized Cost	Strategy 2	Total Capital $	Annual Operating	Annualizec Cost	Strategy 3	Total Capital $	Annual Operating	Annualizec Cost	Strategy 4	Total Capital $	Annual Operating	Annualizec Capital Cost	Annualized cost of applicable strategies
DC - Belvidere Assembly Plant																	0
GM Shreveport Assembly Plant																	0
DC - Newark Assembly Plant																	0
DC - St. Louis South Assembly Plant																	0
DC - Warren Truck Assembly Plant																	0
Nissan Motor Manufacturing Corp. USA - Line IV																	0
DC - Sterling Heights Assembly Plant																	0
DC - Jefferson North Assembly Plant																	0
AutoAlliance International Inc.														0	0	0	0
BMW Manufacturing Corp.					yes		1797	1797						0	0	0	1797
DC - St. Louis North Assembly Plant														0	0	0	0
Ford Wixom Assembly Plant													yes	695921	76551	76551	153103
GM Moraine Assembly Plant	yes	1.08E+06	127,000	244967										0	0	0	244967
New United Motor Mfg. Inc.NUMMI - Truck Line													yes	1036891	114058	114058	228116
GM Linden Assembly													yes	6842537	752679	752679	1505358
Toyota Motor Manufacturing Kentucky Inc.-Paint #2													yes	7163483	787983	787983	1575966
Ford Michigan Truck Plant					yes		15685	15685	yes		26881	26881		0	0	0	42566
GM North American Truck Group													yes	6363033	699934	699934	1399867
Ford Avon Lake Assembly Plant													yes	16650004	1831500	1831500	3663001
Mercedes-Benz U.S. Interational, Inc.					yes		4705	4705					yes	1523427	167577	167577	339859
GM Wilmington Assembly Plant					yes		256	256					yes	3314541	364600	364600	729455
Nissan Motor Manfacturing Corp., USA - Line HF	yes	1.08E+06	127,000	244967									yes	17290600	1901966	1901966	4048899
GM Flint Assembly Plant	yes	1.08E+06	127,000	244967									yes	2586539	284519	284519	814006
Ford Twin Cities Assembly Plant									yes		16513	16513	yes	2856589	314225	314225	644963
GM Lansing Car Assembly - M Plant					yes		1173	1173	yes		13144	13144	yes	2489094	273800	273800	561918
DC - Toledo Assembly Plant I	yes	1.08E+06	127,000	244967									yes	5872455	645970	645970	1536907
Ford Kansas City Truck Plant	yes	1.08E+06	127,000	244967									yes	17276458	1900410	1900410	4045788
GM Janesville Assembly Plant					yes		4718	4718					yes	16803441	1848379	1848379	3701475
GM Lansing Car Assembly - C Plant					yes		813	813	yes		9906	9906	yes	3092157	340137	340137	690993
Honda Marysville Auto Plant - Line 2													yes	14026726	1542940	1542940	3085880
Honda East Liberty Auto Plant									yes		25306	25306	yes	5697050	626676	626676	1278657
Toyota Motor Manufacturing Kentucky Inc. Paint #1													yes	18894644	2078411	2078411	4156822
GM Hamtramck Assembly Plant	yes	1.08E+06	127,000	244967									yes	15201577	1672173	1672173	3589314
Ford Wayne Assembly Plant					yes		6344	6344	yes		28502	28502	yes	8277721	910549	910549	1855944
Honda Marysville Auto Plant- Line 1													yes	17889704	1967867	1967867	3935735
TABC, Inc.					yes		6083	6083					yes	3187448	350619	350619	707322
Ford Kentucky Truck Plant					yes		23879	23879					yes	16659168	1832508	1832508	3688896
New United Motor Mfg. Inc. NUMMI - Car Line													yes	11761620	1293778	1293778	2587556
GM Buick City Assembly Center					yes		25008	25008					yes	8360469	919652	919652	1864311
Ford Norfolk Assembly Plant	yes	1.08E+06	127,000	244967	yes		17726	17726	yes		39291	39291	yes	5559042	611495	611495	1524973
GM Orion Assembly					yes		18404	18404					yes	14162391	1557863	1557863	3134130
GM Lordstown Assembly Plant					yes		40700	40700					yes	14895676	1638524	1638524	3317748
Mitsubishi Normal Assembly Plant	yes	1.08E+06	127,000	244967	yes		31513	31513					yes	5134289	564772	564772	1406023
Saturn Corporation													yes	18445203	2028972	2028972	4057945
Ford Chicago Assembly Plant	yes	1.08E+06	127,000	244967									yes	25741123	2831524	2831524	5908014
Ford Edison Assembly Plant									yes		23125	23125	yes	12065754	1327233	1327233	2677591
Ford Kansas City Passenger Assembly Plant	yes	1.08E+06	127,000	244967					yes		33163	33163	yes	19342184	2127640	2127640	4533411
GM Arlington Assembly Plant													yes	26099084	2870899	2870899	5741798
Ford Louisville Assembly Plant					yes		45502	45502					yes	59808610	6578947	6578947	13203396
GM Wentzville Assembly Center					yes		13186	13186					yes	22232764	2445604	2445604	4904394
Ford Atlanta Assembly Plant	yes	1.08E+06	127,000	244967	yes		29920	29920	yes		24007	24007	yes	16486916	1813561	1813561	3926016

Table 1 . Strategies and Costs of Compliance with Automobile Surface Coating Rule

	Strategy 1				Strategy 2				Strategy 3				Strategy 4				Total
Plant	Strategy 1	Total Capital $	Annual Operating $	Total Annualized Cost	Strategy 2	Total Capital $	Annual Operating $	Annualized Cost	Strategy 3	Total Capital $	Annual Operating $	Annualized Cost	Strategy 4	Total Capital $	Annual Operating $	Annualized Capital Cost	Annualized cost of applicable strategies
GM Ft. Wayne Assembly					yes		7803	7803	yes		54191	54191	yes	20892666	2298193	2298193	4658381
GM Fairfax Assembly Plant	yes	1.08E+06	127,000	244967					yes		51450	51450	yes	18021705	1982388	1982388	4261192
GM Oklahoma City Assembly Plant	yes	1.08E+06	127,000	244967									yes	16710688	1838176	1838176	3921318
Ford Dearborn Assembly Plant	yes	1.08E+06	127,000	244967									yes	17687090	1945580	1945580	4136127
Ford St. Louis Assembly Plant					yes		28603	28603	yes		70390	70390	yes	31168476	3428532	3428532	6956058
GM Doraville Assembly Plant									yes		153879	153879	yes	43077532	4738529	4738529	9630936
GM Pontiac East Assembly Plant					yes		23852	23852	yes		171806	171806	yes	34128933	3754183	3754183	7704024
																sum	1.48E+08

Strategy 1 is to add a control system for EDP
Strategy 2 is to reformulate p/s to a HAP/VOC ratio of 0.3
Strategy 3 is to reformulate topcoat to a HAP/VOC ratio of 0.3
Strategy 4 is to improve control on p/s and topcoat at a cost of $40,000/ton of HAP

Table 2. Estimated Monitoring, Reporting and Recordkeeping Costs of Automobile Surface Coating Rule

Plant	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Set up Rcrdkpng System Note 1	Yearly cost	Recordkpg Note 2	Testing Note 3	Yearly cost	Monitoring Note 4	Reporting Note 5	Total Annual MMR costs
DC - Belvidere Assembly Plant					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
GM Shreveport Assembly Plant					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
DC - Newark Assembly Plant					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
DC - St. Louis South Assembly Plant					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
DC - Warren Truck Assembly Plant					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
Nissan Motor Manufacturing Corp. USA - Line IV					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
DC - Sterling Heights Assembly Plant					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
DC - Jefferson North Assembly Plant					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
AutoAlliance International Inc.					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
BMW Manufacturing Corp.		yes			$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
DC - St. Louis North Assembly Plant					$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
Ford Wixom Assembly Plant				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Moraine Assembly Plant	yes				$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
New United Motor Mfg. Inc.NUMMI - Truck Line				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Linden Assembly				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Toyota Motor Manufacturing Kentucky Inc.-Paint #2				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Ford Michigan Truck Plant		yes	yes		$20,000	$2,200	$15,600	0	$0	0	2320	$20,120
GM North American Truck Group				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Ford Avon Lake Assembly Plant				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Mercedes-Benz U.S. Interational, Inc.		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Wilmington Assembly Plant		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Nissan Motor Manfacturing Corp., USA - Line HF	yes			yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
GM Flint Assembly Plant	yes			yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
Ford Twin Cities Assembly Plant			yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Lansing Car Assembly - M Plant		yes	yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
DC - Toledo Assembly Plant I	yes			yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
Ford Kansas City Truck Plant	yes			yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
GM Janesville Assembly Plant		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Lansing Car Assembly - C Plant		yes	yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Honda Marysville Auto Plant - Line 2				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Honda East Liberty Auto Plant			yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Toyota Motor Manufacturing Kentucky Inc. Paint #1				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Hamtramck Assembly Plant	yes			yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
Ford Wayne Assembly Plant		yes	yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Honda Marysville Auto Plant- Line 1				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
TABC, Inc.		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Ford Kentucky Truck Plant		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
New United Motor Mfg. Inc. NUMMI - Car Line				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Buick City Assembly Center		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736

Table 2. Estimated Monitoring, Reporting and Recordkeeping Costs of Automobile Surface Coating Rule

Plant	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Set up Rcrdkpng System Note 1	Yearly cost	Recordkpg Note 2	Testing Note 3	Yearly cost	Monitoring Note 4	Reporting Note 5	Total Annual MMR costs
Ford Norfolk Assembly Plant	yes	yes	yes	yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
GM Orion Assembly		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Lordstown Assembly Plant		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Mitsubishi Normal Assembly Plant	yes	yes		yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
Saturn Corporation				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Ford Chicago Assembly Plant	yes			yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
Ford Edison Assembly Plant			yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Ford Kansas City Passenger Assembly Plant	yes		yes	yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
GM Arlington Assembly Plant				yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Ford Louisville Assembly Plant		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Wentzville Assembly Center		yes		yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
Ford Atlanta Assembly Plant	yes	yes	yes	yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
GM Ft. Wayne Assembly		yes	yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Fairfax Assembly Plant	yes		yes	yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
GM Oklahoma City Assembly Plant	yes			yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
Ford Dearborn Assembly Plant	yes			yes	$20,000	$2,200	$15,600	18480	$2,033	15600	2320	$37,753
Ford St. Louis Assembly Plant		yes	yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Doraville Assembly Plant			yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736
GM Pontiac East Assembly Plant		yes	yes	yes	$20,000	$2,200	$15,600	9240	$1,016	15600	2320	$36,736

Sum	$1,944,528
Allowance for two plants with confusing data	67,053
	2,011,580

Professional Hours @$40, Technical hours@$30, Clerical hours @$18.
Note 1. Modify recordkeeping system, 500 professional hours; one time cost, ammortize over 15 years
Note 2. 1 technical hour/shift; 10 shifts/week.
Note 3. 280 technical hours/system; once every 15 years; plus 10% for repeat tests
Note 4. 1 technical hour/shift; 10 shifts/week
Note 5. 40 technical hours/yr + 40 clerical hours/yr

Determination of MACT Floor for Main Coating Operations at Automobile and Light Duty Truck Surface Coating Facilities

July 22, 2002

MEMORANDUM

To: Dave Salman, EPA/OAQPS/ESD/CCPG

From: David Green, RTI

Subject: Determination of MACT Floor for Main Coating Operations at Automobile and Light Duty Truck Surface Coating Facilities
EPA Contract 68-D1-073, Work Assignment 001
RTI Contract 08220.000.001

The purpose of this memorandum is describe the procedure by which the MACT floor emission limit for the major coating operations (electrodeposition primer, primer-surfacer and topcoat) was determined. These operations are considered by the industry to make up a coating system and thus it is appropriate to combine them for purposes of the NESHAP. In December, 1999 EPA submitted an information collection request to operators of all automobile assembly plants in the United States. Operators responded with data which permitted calculation of monthly organic HAP emission rates for each of the major coating operations in use at their plants. Data were provided for the most recent year available, which was generally calendar year 1998. Some assembly plants did not operate paintshops during the reporting year. Four assembly plants operated two separate coating lines, and kept separate records for each line. Data were received for a total of 60 coating lines. Since most plants were required to comply with VOC emissions limits based on VOC emissions per gallon of applied coating solids, the data for primer surfacer and topcoat operations were generally derived from plant records used for VOC compliance, with adjustments made for the organic HAP content of the coating materials, using a consistent protocol. Emissions rates from electrodeposition primer operations were primarily calculated from records of monthly material usage and composition, and control system performance.

Data from the three operations were summed on an annual basis and ranked to determine the best (based on lowest annual emission rate) plants (or individual lines, where separate records were maintained for two lines). These data are shown in Table 1. It should be noted that data for two plants were not understandable, however, it was confirmed that the performance of these plants would not put them in the MACT floor group, so that their actual numeric emission rates did not influence the determination of the MACT floor.

Because there are 60 sources, the group comprising the MACT floor includes 8 plants. It was determined that several of the plants with the lowest emission rates operated during the year 1998 without applying a full body primer-surfacer. These plants (Belvedere, Warren, Jefferson North, and St. Louis North) do not represent current technology (they have all since converted to full body primer surfacer application, in an attempt to improve coating quality) and were excluded from the MACT floor group. It was also determined that 4 of the plants with the lowest emission rates (Newark, St. Louis South, Sterling Heights and Shreveport) applied an essentially HAP emission-free powder primer-surfacer. Because of the state of present technology, these plants applied a film approximately 3.5 times thicker than that applied by liquid primer-surfacer operations. This excess solids application decreased the organic HAP emission rate, and thus it was not comparable with the other data. The organic HAP emission rates for these plants were adjusted by decreasing the reported mass of solids applied in the primer-surfacer operation by a factor of 3.5. With this adjustment, these plants remained in the MACT floor group but were represented by data consistent with the liquid primer technology used in most of the plants.

The annual emission data of Table 1 were used to select the 8 best plants which represent the MACT floor. Because these data represent annual rates, and compliance is to be demonstrated on a monthly basis, determining the MACT floor based on the data in this table would leave even the best plants out of compliance about half of the time. Monthly emission rates for the major coating operations (electrodeposition primer, primer-surfacer and topcoat) are shown in Table 2. The peak monthly rate for each plant is also shown. The peak monthly rates for the best plants (the plants with the lowest annual emission rates) were used to determine the MACT floor.

Some plants have either extremely well controlled electrodeposition systems, or use extremely low organic HAP materials in their electrodeposition systems. The best technology available at present for emission limitation from electrodeposition can be defined by use of materials at the analytical detection limit for organic HAP (that is, each material used in the system must contain no more than 1.0 percent by weight of any organic HAP, and no more than 0.1 percent by weight of any OSHA defined carcinogen). Alternately, the best technology available at present for emission limitation from electrodeposition operation can be represented by capture of bake oven emissions with 95 percent control of captured emissions. Plants meeting either of these criteria, could achieve MACT by meeting an emission limit based on that achieved by emission rates from primer-surfacer and topcoat operations at the best performing 8 plants (the plants with the lowest combined primer-surfacer and topcoat emission rates) based on these operations. Plants with the best electrodeposition primer emission limitations could choose to comply on a 2-operation basis (eliminating some of the recordkeeping requirements, or alternately some of the testing and monitoring requirements) or a 3-operation basis.

The annual emission data of Table 3 represent the emission rates from the combined primer-surfacer and topcoat application. As for the 3-operation rates shown in Table 1, this table includes some plants which did not apply a full body primer in the reporting year. Also, the same adjustment for powder primer-surfacer application is included in Table 3 as in Table 1. These data were used to select the 8 best plants which represent the MACT floor. As with Table 1, these data represent annual rates, and compliance is to be demonstrated on a monthly basis. Monthly emission rates for the major coating operations for combined primer-surfacer and topcoat application are shown in Table 4. The peak monthly rate for each plant is also shown. The peak monthly rate for the best 8 plants (the plants with the lowest annual emission rates) was used to determine the MACT floor.

The calculation of the MACT floor for existing plants for electrodeposition primer, primer-surfacer and topcoat is shown in Table 5. The average emission rate for the best performing 8 existing plants, disregarding those plants with unrepresentative operations in the reporting year is 0.59 lb organic HAP per gallon of applied coating solids.

The calculation of the MACT floor for existing plants for primer-surfacer and topcoat is shown in Table 6. The average emission rate for the best performing 8 existing plants, disregarding those plants with unrepresentative operations in the reporting year is 1.10 lb organic HAP per gallon of applied coating solids. Compliance with this limit would only represent MACT for those plants with electrodeposition systems that meet the criteria above.

The MACT floor for new and reconstructed plants, based on the best performing representative existing plant is 0.30 pounds of organic HAP per gallon of applied coating solids for the major coating operations (electrodeposition primer, primer-surfacer and topcoat). For new plants meeting the electrodeposition system criteria described above, MACT for primer-surfacer and topcoat operations would also be represented by 0.50 pounds of organic HAP per gallon of applied coating solids.

Table 1. Annual Organic HAP Emission Rates from Combined Operations (Electrodeposition Primer, Primer-surfacer andTopcoat) Adjusted for Powder Primer-Surfacer Solids Usage, Sorted by Annual Rate

Facility Name	Total OHAP Emissions	Total solids applied	Annual Rate[1]
	pounds	gallons	lb/gacs
DC - Belvidere Assembly Plant[3]	39,519	227,634	0.1736
DC - Newark Assembly Plant[3]	47,457	216,256	0.2194
DC - Warren Truck Assembly Plant	54,083	245,733	0.2201
DC - St. Louis South Assembly Plant[3]	108,490	445,631	0.2435
DC - Jefferson North Assembly Plant[3]	106,380	367,618	0.2894
DC - Sterling Heights Assembly Plant[3]	86,762	288,223	0.3010
AutoAlliance International Inc.	69,901	144,728	0.4830
DC - St. Louis North Assembly Plant	112,961	213,156	0.5299
Nissan Motor Manufacturing Corp. USA - Line IV	171,241	317,890	0.5387
Ford Wixom Assembly Plant	131,728	206,788	0.6370
BMW Manufacturing Corp.	29,995	46,300	0.6478
New United Motor Mfg. Inc.NUMMI - Truck Line	54,862	72,427	0.7575
GM Shreveport Assembly Plant[3]	164,551	208,021	0.7910
GM Moraine Assembly Plant[3,4]	277,580	340,120	0.8161
Toyota Motor Manufacturing Kentucky Inc.-Paint #2	250,441	286072	0.8754
Ford Michigan Truck Plant	358,073	399,571	0.8961
Ford Avon Lake Assembly Plant	498,984	526,390	0.9479
Mercedes-Benz U.S. Interational, Inc.	87,876	89,487	0.9820
GM Wilmington Assembly Plant	91,614	90,343	1.0141
Nissan Motor Manfacturing Corp., USA - Line HF	533,901	513,199	1.0403
GM Flint Assembly Plant	124,735	117,122	1.0650
Ford Twin Cities Assembly Plant	207,903	192,200	1.0817
GM Lansing Car Assembly - M Plant	180,359	166,587	1.0827
GM North American Truck Group[3]	208,126	189,510	1.0982
DC - Toledo Assembly Plant I	287,578	250,956	1.1459
GM Linden Assembly[3]	241,019	208,452	1.1562
Ford Kansas City Truck Plant	505,300	408,812	1.2360
GM Janesville Assembly Plant	389,300	311,645	1.2492
GM Lansing Car Assembly - C Plant	140,903	111,984	1.2582
Honda Marysville Auto Plant - Line 2	294,092	232,997	1.2622
Honda East Liberty Auto Plant	297,678	235,471	1.2642
Toyota Motor Manufacturing Kentucky Inc. Paint #1	382,543	291169	1.3138
GM Hamtramck Assembly Plant	366,922	264,647	1.3865
Ford Wayne Assembly Plant	382,608	270,827	1.4127
Honda Marysville Auto Plant- Line 1	341,560	241,288	1.4156
TABC, Inc.	99,643	70,083	1.4218
Ford Kentucky Truck Plant	467,521	326,384	1.4324
New United Motor Mfg. Inc. NUMMI - Car Line	213,640	140,437	1.5213
GM Buick City Assembly Center	296,781	186,992	1.5871
Ford Norfolk Assembly Plant	554,640	349,062	1.5889

Table 1. Annual Organic HAP Emission Rates from Combined Operations (Electrodeposition Primer, Primer-surfacer andTopcoat) Adjusted for Powder Primer-Surfacer Solids Usage, Sorted by Annual Rate

Facility Name	Total OHAP Emissions	Total solids applied	Annual Rate[1]
	pounds	**gallons**	**lb/gacs**
GM Orion Assembly	358,385	224,062	1.5995
GM Lordstown Assembly Plant	499,517	308,208	1.6207
Mitsubishi Normal Assembly Plant	322,547	184,608	1.7472
Saturn Corporation	306,530	172,720	1.7747
Ford Chicago Assembly Plant	561,780	299,763	1.8741
Ford Edison Assembly Plant	312,655	157,140	1.9897
Ford Kansas City Passenger Assembly Plant	540,940	259,290	2.0862
GM Arlington Assembly Plant	402,070	191,634	2.0981
Ford Louisville Assembly Plant	1,155,765	548,905	2.1056
GM Wentzville Assembly Center	408,307	191,518	2.1319
Ford Atlanta Assembly Plant	621,600	289,110	2.1500
GM Ft. Wayne Assembly	630,007	284,298	2.2160
GM Fairfax Assembly Plant	579,306	248,334	2.3328
GM Oklahoma City Assembly Plant	432,504	184,744	2.3411
Ford Dearborn Assembly Plant	303,080	120,605	2.5130
Ford St. Louis Assembly Plant	901,850	320,590	2.8131
GM Doraville Assembly Plant	1,245,831	336,761	3.6995
GM Pontiac East Assembly Plant	1,282,826	304,575	4.2119
Subaru-Isuzu Automotive Inc.[2]	86,608	na	na
GM Bowling Green Assembly[2]	134,553	na	na

Notes:

[1] GACS is gallons of applied coatings solids.

[2] OHAP emission rate and/or mass data was not available.

[3] The GACS for primer/surfacer for this plant was adjusted by a factor of 3.5.

[4] GM Moraine had missing topcoat data for the 10th month. Annuals were calculated using 11 months provided.

Table 2. Monthly Organic HAP Emission Rates for Combined Opertations (Electrodeposition Primer, Primer-Surfacer and Topcoat) Adjusted for Powder Primer-Surfacer Solids Usage, Sorted by Highest Monthly Rate

	Organic HAP Emission Rate (lbs organic HAP/gallon of Applied Coating Solids												
Facility Name	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**July**	**August**	**Sept**	**Oct**	**Nov**	**Dec**	**MAX**
						pounds/gallon of applied coating solids							
DC - Belvidere Assembly Plant	0.1676	0.1846	0.1745	0.1724	0.1674	0.1741	0.1767	0.1704	0.1704	0.1706	0.1789	0.1866	**0.1866**
DC - Warren Truck Assembly Plant	0.2081	0.2224	0.2279	0.2344	0.1687	0.2166	0.1743	0.2113	0.2138	0.2193	0.2323	0.2259	**0.2344**
DC - St. Louis South Assembly Plant	0.2414	0.2523	0.2353	0.2258	0.2470	0.2407	0.0000	0.2503	0.2405	0.2749	0.2412	0.2309	**0.2749**
DC - Newark Assembly Plant	0.2073	0.2035	0.2022	0.1992	0.1926	0.1995	0.2054	0.2011	0.2142	0.2426	0.2990	0.2573	**0.2990**
DC - Sterling Heights Assembly Plant	0.2966	0.3139	0.3099	0.3001	0.2763	0.3076	0.3046	0.3026	0.2985	0.2759	0.3361	0.3267	**0.3361**
AutoAlliance International Inc.	0.6090	0.6612	0.5979	0.4256	0.4723	0.4543	0.0000	0.3110	0.4486	0.4323	0.4261	0.3934	**0.6612**
Nissan Motor Manufacturing Corp. USA - Line IV	0.5460	0.5500	0.5380	0.5710	0.5700	0.5200	0.4120	0.5880	0.5450	0.6660	0.5020	0.4310	**0.6660**
DC - Jefferson North Assembly Plant	0.3119	0.2593	0.2664	0.6752	0.3077	0.3008	0.2859	0.3119	0.2826	0.2957	0.3007	0.3000	**0.6752**
DC - St. Louis North Assembly Plant	0.3599	0.3994	0.3848	0.4098	0.5712	0.5846	0.6665	0.6329	0.5985	0.6311	0.5015	0.7023	**0.7023**
BMW Manufacturing Corp.	0.60	0.63	0.66	0.67	0.76	0.74	0.67	0.65	0.57	0.65	0.55	0.62	**0.76**
Ford Wixom Assembly Plant	0.7183	0.7796	0.7443	0.7178	0.6943	0.6796	0.2300	0.6792	0.6500	0.6184	0.6492	0.6382	**0.7796**
New United Motor Mfg. Inc.NUMMI - Truck Line	0.6995	0.7326	0.6742	0.7192	0.7191	0.7964	0.7575	0.7988	0.7581	0.8222	0.8073	0.8671	**0.8671**
GM Shreveport Assembly Plant	0.798	0.800	0.841	0.787	0.907	0.911	na	0.756	0.797	0.805	0.631	0.762	**0.911**
Ford Michigan Truck Plant	0.8874	0.9011	0.9606	0.8934	0.8854	0.8666	0.8963	0.8510	0.9317	0.8807	0.9044	0.9042	**0.9606**
Toyota Motor Manufacturing Kentucky Inc.-Paint #2	0.8806	0.8858	0.9108	0.9035	0.9191	0.8969	0.9134	0.7653	0.8229	0.8351	0.8670	0.9675	**0.9675**
GM Moraine Assembly Plant	0.4008	0.3662	0.3840	0.3890	0.3803	0.3448	1.0067	0.3963	0.3508	0.4039	0.4682	0.2878	**1.0067**
Ford Avon Lake Assembly Plant	0.9615	0.9532	0.9500	0.9142	0.8998	0.9035	0.8514	0.9924	0.9825	0.9812	1.0681	0.9751	**1.0681**
Ford Twin Cities Assembly Plant	1.0849	1.1224	1.0890	1.0978	1.0621	1.1261	1.0267	1.1277	1.1236	0.9832	1.0661	1.0528	**1.1277**
GM North American Truck Group	1.1249	1.1324	1.1241	1.1339	1.1088	1.0599	0.0000	1.0486	1.0587	1.0951	1.0719	1.0865	**1.1339**
Nissan Motor Manfacturing Corp., USA - Line HF	0.9192	1.0067	1.1338	1.1744	1.0229	0.9844	0.9181	1.0278	0.9619	1.1960	0.9887	1.1418	**1.1960**
DC - Toledo Assembly Plant I	1.2095	1.1965	1.2092	1.2008	1.1189	1.1368	1.1300	1.1467	1.1218	1.0930	1.0466	1.0849	**1.2095**
Mercedes-Benz U.S. Interational, Inc.	1.0430	0.6647	1.0583	1.2264	0.7836	0.9369	1.1298	1.0643	0.8819	1.1291	0.9579	1.0447	**1.2264**
GM Flint Assembly Plant	1.2299	0.9428	1.0337	0.9891	1.2253	0.9451	0.0000	1.1727	1.1565	0.9815	1.1070	1.0118	**1.2299**
GM Linden Assembly	1.1425	0.9704	1.1948	1.1942	1.2219	1.3069	0.0000	1.1746	1.2531	1.2330	0.9799	1.1542	**1.3069**
Toyota Motor Manufacturing Kentucky Inc. Paint #1	1.2597	1.3088	1.3504	1.3295	1.3147	1.3174	1.2918	1.3089	1.3182	1.3132	1.3586	1.2943	**1.3586**
Ford Kansas City Truck Plant	1.3680	1.1808	1.2259	1.2072	1.2633	1.2807	1.2097	1.1966	1.1431	1.2376	1.2375	1.3280	**1.3680**
GM Janesville Assembly Plant	1.0334	0.9056	1.2348	1.1932	1.3702	1.3364	0.0000	1.2169	1.2730	1.3921	1.4778	1.2445	**1.4778**
TABC, Inc.	1.3171	1.4351	1.4545	1.4605	1.4639	1.4861	1.5213	1.3534	1.3608	1.4382	1.4015	1.3407	**1.5213**
GM Hamtramck Assembly Plant	1.4273	1.4015	1.0293	1.5002	1.3756	1.4046	0.2871	1.3349	1.3718	1.5297	1.4679	1.3833	**1.5297**
GM Wilmington Assembly Plant	1.3680	1.1247	1.5528	1.1552	0.9034	0.9324	0.0000	0.9103	0.9090	0.8904	0.8650	0.8742	**1.5528**
Honda Marysville Auto Plant- Line 1	1.5002	1.5075	1.4518	1.5098	1.5183	1.6043	1.3824	1.3081	1.3036	1.3259	1.2412	1.2871	**1.6043**
Ford Kentucky Truck Plant	1.4975	1.4266	1.2851	1.5513	1.4474	1.6198	1.4123	1.3971	1.4100	1.3874	1.3564	1.4164	**1.6198**
Ford Norfolk Assembly Plant	1.5475	1.5534	1.5934	1.6312	1.6173	1.6170	1.6252	1.4837	1.6068	1.5491	1.6354	1.6258	**1.6354**
Ford Wayne Assembly Plant	1.2837	1.4325	1.3931	1.4349	1.4447	1.6907	1.5629	1.2899	1.2571	1.4395	1.4126	1.2656	**1.6907**
Honda Marysville Auto Plant - Line 2	1.7089	1.4562	1.3881	1.4434	1.4214	1.1732	1.0947	1.1111	1.1160	1.1013	1.0396	1.1217	**1.7089**
New United Motor Mfg. Inc. NUMMI - Car Line	1.4368	1.5501	1.7735	1.8102	1.5101	1.4982	1.4364	1.5128	1.4467	1.4168	1.4194	1.4922	**1.8102**
GM Lordstown Assembly Plant	1.6189	1.8501	1.7421	1.6682	1.6385	1.5399	0.0099	1.4312	1.4809	1.6877	1.6103	1.6867	**1.8501**
Mitsubishi Normal Assembly Plant	1.7740	1.7433	1.7820	1.9016	1.6076	1.7934	1.8741	1.7940	1.6563	1.7100	1.6554	1.7907	**1.9016**
GM Buick City Assembly Center	1.6024	1.6397	1.6629	1.6031	1.7587	1.7606	2.0000	1.5026	1.4618	1.5740	1.6136	1.4704	**2.0000**
Ford Chicago Assembly Plant	1.8659	1.1535	1.9706	1.9157	1.9632	1.8855	1.9692	2.0081	1.9536	1.8878	1.8795	1.7806	**2.0081**
Ford Edison Assembly Plant	2.0130	2.0327	1.9581	1.9338	1.9669	1.8750	2.0274	2.0312	2.0590	2.0092	2.0875	1.8877	**2.0875**
Ford Louisville Assembly Plant	2.1139	1.9697	2.0599	2.1032	2.1805	2.1456	2.1308	2.0950	2.1359	2.0926	2.0948	2.1850	**2.1850**
Honda East Liberty Auto Plant	1.3994	2.2121	1.2261	1.1975	1.2004	1.5874	1.3967	1.1169	1.2249	0.9402	0.9503	1.0207	**2.2121**
Ford Kansas City Passenger Assembly Plant	1.9893	2.1062	2.1665	2.0421	2.1205	2.0433	1.8883	2.2235	2.1747	2.0731	2.0292	2.0815	**2.2235**
Ford Atlanta Assembly Plant	2.2305	2.1418	2.1637	2.1761	2.1803	2.1289	2.2446	2.1426	2.1270	2.1192	2.0892	2.0504	**2.2446**
GM Arlington Assembly Plant	2.3091	2.4053	2.1730	1.8685	2.2941	2.1379	0.0000	2.0984	2.2172	2.0879	1.9678	1.6933	**2.4053**
Saturn Corporation	1.9025	1.8268	1.7877	1.8620	1.7712	1.6531	1.6790	2.4095	1.7862	1.8730	1.3528	1.6047	**2.4095**
GM Wentzville Assembly Center	2.0930	2.1705	2.1664	2.1861	2.1357	2.0357	0.0000	1.7674	2.0983	2.1948	2.2270	2.4289	**2.4289**

Table 2. Monthly Organic HAP Emission Rates for Combined Opertations (Electrodeposition Primer, Primer-Surfacer and Topcoat) Adjusted for Powder Primer-Surfacer Solids Usage, Sorted by Highest Monthly Rate

	Organic HAP Emission Rate (lbs organic HAP/gallon of Applied Coating Solids												
Facility Name	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**July**	**August**	**Sept**	**Oct**	**Nov**	**Dec**	**MAX**
						pounds/gallon of applied coating solids							
GM Fairfax Assembly Plant	2.2966	2.1676	2.1870	2.2075	2.2669	2.4083	2.3460	2.4153	2.2822	2.5433	2.3846	2.4145	**2.5433**
GM Oklahoma City Assembly Plant	2.3225	2.3101	2.3190	2.3232	2.3218	2.3226	2.7062	2.3226	2.3226	2.3252	2.3226	2.3226	**2.7062**
GM Ft. Wayne Assembly	2.4882	2.3309	2.2817	2.6087	2.5792	0.8489	0.0000	2.7349	1.9344	2.7006	2.2446	2.1032	**2.7349**
GM Lansing Car Assembly - M Plant	1.3686	1.5161	1.6071	1.2589	1.1700	1.0011	2.8810	1.1760	1.1736	0.6662	0.9063	1.0527	**2.8810**
Ford Dearborn Assembly Plant	1.8946	1.9532	2.6012	2.5890	2.7024	1.7831	2.6000	2.7529	3.0145	2.6617	2.4688	2.6964	**3.0145**
Ford St. Louis Assembly Plant	2.6695	2.7662	2.8815	2.7712	2.7201	2.6782	3.0962	2.9301	2.9084	2.8349	2.8819	2.7096	**3.0962**
GM Lansing Car Assembly - C Plant	0.0000	0.0000	1.6956	1.4060	1.3576	1.1521	3.4248	1.4403	1.3395	1.2306	1.0942	1.1800	**3.4248**
GM Doraville Assembly Plant	4.7401	4.1223	3.9858	3.2906	3.6047	2.8554	0.0000	3.6238	3.7235	3.9599	3.4075	3.2761	**4.7401**
GM Orion Assembly	2.0190	1.9475	1.6404	1.8665	1.9076	1.6430	6.1185	1.5782	1.3519	1.3463	1.3941	1.2853	**6.1185**
GM Pontiac East Assembly Plant	4.8676	4.2679	3.9104	4.0212	4.3373	2.8231	6.5128	4.7575	4.4357	3.8915	4.1780	4.6569	**6.5128**
Subaru-Isuzu Automotive Inc.	na	na	na	na	na	na	na	na	na	na	na	na	**na**
GM Bowling Green Assembly	na	na	na	na	na	na	na	na	na	na	na	na	**na**

Table 3. Annual Organic HAP Emission Rates for Primer-surfacer and Topcoat Operations Combined-Sorted by Annual Rate (Adjusted Powder GACS Version)

Facility Name	Total OHAP Emissions	Total GACS[1]	Annual Rate
	pounds	gallons	lb/gal
DC - Newark Assembly Plant[3]	35,329	107,964	0.3272
DC - Belvidere Assembly Plant[3]	33,951	88,500	0.3836
DC - Warren Truck Assembly Plant	47,727	99,765	0.4784
DC - St. Louis South Assembly Plant[3]	99,913	196,763	0.5078
DC - Jefferson North Assembly Plant[3]	80,766	126,584	0.6380
DC - Sterling Heights Assembly Plant[3]	79,511	102,266	0.7775
AutoAlliance International Inc.	59,020	70,116	0.8418
DC - St. Louis North Assembly Plant	95,646	98,860	0.9675
Ford Wixom Assembly Plant	116,860	120,170	0.9725
GM Moraine Assembly Plant[3,4]	224,520	198,597	1.1305
GM Shreveport Assembly Plant[3]	158,506	130,033	1.2190
BMW Manufacturing Corp.	29,429	22,103	1.3314
New United Motor Mfg. Inc.NUMMI - Truck Line	52,593	38,474	1.3670
DC - Toledo Assembly Plant I	202,393	142,143	1.4239
GM Flint Assembly Plant	94,135	60,530	1.5552
Ford Avon Lake Assembly Plant	493,780	288,290	1.7128
Ford Kansas City Truck Plant	422,980	243,528	1.7369
Ford Michigan Truck Plant	350,560	195,965	1.7889
Ford Twin Cities Assembly Plant	206,400	114,429	1.8037
GM Linden Assembly[3]	235,643	123,611	1.9063
GM Wilmington Assembly Plant	88,186	43,920	2.0079
GM North American Truck Group[3]	203,652	96,847	2.1028
TABC, Inc.	98,771	46,931	2.1046
Toyota Motor Manufacturing Kentucky Inc.-Paint #2	198,851	90622	2.1943
Mercedes-Benz U.S. Interational, Inc.	87,311	37,629	2.3203
GM Oklahoma City Assembly Plant	270,339	116,247	2.3256
GM Lansing Car Assembly - M Plant	176,967	75,297	2.3503
Honda East Liberty Auto Plant	279,600	118,148	2.3665
Ford Norfolk Assembly Plant	468,900	194,935	2.4054
Ford Kentucky Truck Plant	466,180	187,362	2.4881
Nissan Motor Manufacturing Corp. USA - Line IV	161,698	63,896	2.5306
Toyota Motor Manufacturing Kentucky Inc. Paint #1	336,910	129836	2.5949
GM Janesville Assembly Plant	388,052	146,883	2.6419
GM Hamtramck Assembly Plant	318,785	118,601	2.6879

Table 3. Annual Organic HAP Emission Rates for Primer-surfacer and Topcoat Operations Combined-Sorted by Annual Rate (Adjusted Powder GACS Version)

Facility Name	Total OHAP Emissions	Total GACS[1]	Annual Rate
	pounds	gallons	lb/gal
Ford Wayne Assembly Plant	375,600	138,588	2.7102
Honda Marysville Auto Plant - Line 2	276,140	101,483	2.7211
New United Motor Mfg. Inc. NUMMI - Car Line	205,041	69,588	2.9465
GM Buick City Assembly Center	292,277	97,697	2.9917
Honda Marysville Auto Plant- Line 1	323,060	105,716	3.0559
GM Lansing Car Assembly - C Plant	138,549	43,677	3.1721
Ford Edison Assembly Plant	312,240	95,565	3.2673
Nissan Motor Manfacturing Corp., USA - Line HF	491,801	147,103	3.3432
Mitsubishi Normal Assembly Plant	277,146	82,522	3.3584
GM Ft. Wayne Assembly	625,220	185,985	3.3617
Ford Chicago Assembly Plant	445,580	129,866	3.4311
GM Arlington Assembly Plant	398,578	112,292	3.5495
GM Orion Assembly	353,593	98,945	3.5736
Ford Louisville Assembly Plant	1,136,180	310,619	3.6578
GM Wentzville Assembly Center	407,865	107,603	3.7904
Ford Atlanta Assembly Plant	542,720	141,179	3.8442
Ford Kansas City Passenger Assembly Plant	482,380	116,539	4.1392
GM Lordstown Assembly Plant	497,539	115,793	4.2968
Ford Dearborn Assembly Plant	260,540	58,083	4.4856
GM Fairfax Assembly Plant	530,470	111,510	4.7571
Ford St. Louis Assembly Plant	888,780	179,431	4.9533
Saturn Corporation	296,943	59,162	5.0191
GM Pontiac East Assembly Plant	1,277,721	198,394	6.4403
GM Doraville Assembly Plant	1,240,530	175,936	7.0510
Subaru-Isuzu Automotive Inc.[2]	58,243	na	na
GM Bowling Green Assembly[2]	134,553	na	na

Notes:

[1] GACS is gallons of applied coatings solids.

[2] OHAP emission rate and/or mass data was not available.

[3] The GACS for this plant reflects adjustment of primer/surfacer soilds by a factor of 3.5.

[4] GM Moraine had missing topcoat data for the 10th month. Annuals were calculated using 11 months provided.

Table 4. Monthly Organic HAP Emission Rates for Primer-surfacer and Topcoat Operations Combined, Adjusted for Powder Primer-Surfacer Solids Usage, Sorted by Peak Monthly Rate

	Organic HAP Emission Rate (lbs organic HAP/gallon of applied coating solids)												
Facility Name	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**August**	**Sept**	**Oct**	**Nov**	**Dec**	**Peak**
DC - Belvidere Assembly Plant	0.3923	0.4140	0.3914	0.3717	0.3658	0.3812	0.3963	0.3678	0.3808	0.3805	0.3955	0.3971	**0.4140**
DC - Newark Assembly Plant	0.2839	0.2804	0.2866	0.2776	0.2758	0.2861	0.2803	0.2906	0.3168	0.4056	0.4957	0.4286	**0.4957**
DC - Warren Truck Assembly Plant	0.4978	0.5013	0.4959	0.4916	0.5004	0.4903	0.4868	0.4641	0.4623	0.4587	0.4660	0.4436	**0.5013**
DC - St. Louis South Assembly Plant	0.5234	0.5040	0.5023	0.5236	0.5067	0.5109	0.0000	0.5150	0.4935	0.5073	0.5030	0.4970	**0.5236**
DC - Jefferson North Assembly Plant	0.6342	0.5744	0.6133	0.6236	0.6830	0.6923	0.6542	0.6634	0.6334	0.6439	0.6140	0.6336	**0.6923**
DC - Sterling Heights Assembly Plant	0.8254	0.8774	0.8190	0.8396	0.7418	0.7379	0.0000	0.7762	0.7791	0.7878	0.8191	0.7843	**0.8784**
AutoAlliance International Inc.	1.0135	1.0164	1.0117	0.7304	0.8220	0.8010	0.0000	0.7721	0.7195	0.7723	0.7658	0.7627	**1.0164**
DC - St. Louis North Assembly Plant	0.6922	0.6690	0.6602	0.6981	0.9752	1.0342	0.9775	1.2119	1.1415	1.1292	1.1260	1.2408	**1.2408**
Ford Wixom Assembly Plant	1.3133	1.2594	1.3178	1.1008	1.0488	1.0448	0.2377	1.0916	1.0576	1.0562	0.9548	1.0000	**1.3178**
GM Shreveport Assembly Plant	1.2057	1.2249	1.2646	1.1643	1.3045	1.3094	na	1.1506	1.3285	1.2122	1.0513	1.2062	1.3285
New United Motor Mfg. Inc.NUMMI - Truck Line	1.4169	1.4222	1.3559	1.4485	1.4225	1.4694	1.3087	1.3266	1.3223	1.3172	1.2751	1.3084	**1.4694**
DC - Toledo Assembly Plant I	1.5177	1.4869	1.5480	1.5341	1.4194	1.3985	1.4318	1.4072	1.3701	1.3336	1.2271	1.2918	**1.5480**
BMW Manufacturing Corp.	0.7403	0.7965	0.7544	0.8024	0.8420	0.9024	0.7725	0.7528	0.7397	0.7957	0.6470	0.7398	**1.6000**
GM Moraine Assembly Plant	1.1662	1.0819	1.1192	1.1026	1.0473	1.2125	1.6199	1.1279	1.1704	1.1697	1.1797	1.0910	**1.6199**
GM Flint Assembly Plant	1.5559	1.4790	1.3876	1.5500	1.5426	1.4971	0.0000	1.6741	1.5464	1.5097	1.7717	1.5778	**1.7717**
Ford Avon Lake Assembly Plant	1.7153	1.7065	1.7177	1.6161	1.6294	1.6284	1.5744	1.7718	1.8323	1.8386	1.8446	1.7891	**1.8446**
Ford Twin Cities Assembly Plant	1.8615	1.7845	1.7331	1.7624	1.8140	1.8289	1.8079	1.8789	1.8529	1.7769	1.7853	1.7851	**1.8789**
Ford Kansas City Truck Plant	1.9182	1.6689	1.7493	1.7883	1.7321	1.7342	1.6890	1.7259	1.6387	1.6978	1.7296	1.8169	**1.9182**
Ford Michigan Truck Plant	1.7850	1.7818	1.8540	1.7949	1.8051	1.7309	2.0000	1.7087	1.8132	1.7361	1.7370	1.8165	**2.0000**
GM Linden Assembly	1.9231	1.3948	2.0388	2.1109	2.1034	2.0785	0.0000	1.9202	2.0840	1.9827	1.7098	1.8977	**2.1109**
GM North American Truck Group	2.1265	2.1487	2.1432	2.1448	2.1239	2.0861	0.0000	1.9934	2.0469	2.0710	2.0693	2.1001	**2.1487**
Toyota Motor Manufacturing Kentucky Inc.-Paint #2	2.3118	2.1831	2.2631	2.1929	2.2000	2.0799	2.2312	2.1210	2.1094	2.1298	2.2560	2.2927	**2.3118**
TABC, Inc.	1.9745	2.1196	2.1904	2.2881	2.2841	2.0720	2.3265	2.0409	2.0379	2.0346	1.9575	1.9213	**2.3265**
Mercedes-Benz U.S. Interational, Inc.	2.3630	2.2871	2.1098	2.4477	2.2760	2.3490	2.3534	2.3294	2.3493	2.3304	2.3000	2.3572	**2.4477**
Ford Norfolk Assembly Plant	2.3087	2.3706	2.3991	2.4728	2.4694	2.4172	2.5171	2.2472	2.4360	2.3655	2.4664	2.4372	**2.5171**
Nissan Motor Manufacturing Corp. USA - Line IV	2.50	2.52	2.51	2.52	2.51	2.48	2.57	2.55	2.54	2.54	2.55	2.60	**2.60**
Ford Kentucky Truck Plant	2.5843	2.4925	2.5187	2.6236	2.5042	2.4122	2.4249	2.5011	2.4221	2.4543	2.4160	2.4267	**2.6236**
Honda East Liberty Auto Plant	2.4965	2.3421	2.4237	2.2929	2.4724	2.6472	2.4430	2.2215	2.2688	2.1471	2.2394	2.1794	**2.6472**
Toyota Motor Manufacturing Kentucky Inc. Paint #1	2.4373	2.5890	2.6005	2.6419	2.5825	2.5623	2.5196	2.6458	2.6681	2.6336	2.6228	2.6618	**2.6681**
Ford Wayne Assembly Plant	2.4767	2.8343	2.7720	2.7262	2.8032	2.8788	2.9207	2.5992	2.4579	2.7613	2.7592	2.4242	**2.9207**
GM Oklahoma City Assembly Plant	2.2964	2.2766	2.2964	2.2965	2.2962	2.2964	2.9557	2.2964	2.2964	2.2964	2.2964	2.2964	**2.9557**
GM Wilmington Assembly Plant	2.7558	2.2417	2.9723	2.3915	1.9663	1.6690	0.0000	2.0547	1.7462	1.6654	1.6827	1.6940	**2.9723**
GM Janesville Assembly Plant	2.5307	2.3666	2.5479	2.6468	2.7677	3.0044	0.0000	2.5270	2.5471	2.6161	2.7213	2.6668	**3.0044**
New United Motor Mfg. Inc. NUMMI - Car Line	2.8365	2.9953	2.9729	3.0153	2.9681	2.8986	2.9336	3.0453	2.9723	2.9244	2.8853	2.8813	**3.0453**
GM Lansing Car Assembly - M Plant	2.9311	2.9200	3.0603	2.9022	2.8612	2.8812	2.8810	2.7222	2.6834	1.0380	2.6679	2.7179	**3.0603**
GM Buick City Assembly Center	3.1083	3.0155	2.9272	2.9875	3.0862	2.9437	2.0000	2.9267	2.9317	2.9785	2.9976	3.0171	**3.1083**
GM Hamtramck Assembly Plant	2.6616	2.5416	1.8314	2.8773	2.9285	3.1432	0.0000	2.8003	2.8487	2.8489	2.7105	2.5457	**3.1432**
GM Lansing Car Assembly - C Plant	0.0000	0.0000	2.7279	3.2032	3.1941	3.3431	3.4248	3.1713	3.1553	3.1483	3.2290	3.1145	**3.4248**
Honda Marysville Auto Plant - Line 2	3.4298	3.1205	3.0030	3.1570	3.2102	2.5344	2.3341	2.4340	2.4330	2.3367	2.2000	2.4205	**3.4298**
Ford Edison Assembly Plant	3.4334	3.3577	3.2402	3.2524	3.2411	3.1000	3.1731	3.2618	3.2846	3.3131	3.3375	3.2561	**3.4334**
Honda Marysville Auto Plant- Line 1	3.5065	3.1008	3.0467	3.1241	3.0754	3.3201	3.0084	2.8768	2.8870	3.0048	2.8182	2.8203	**3.5065**
Ford Chicago Assembly Plant	3.3938	2.8223	3.4986	3.4227	3.5003	3.5777	3.3185	3.4833	3.4720	3.4159	3.4161	3.3727	**3.5777**
Mitsubishi Normal Assembly Plant	3.4657	3.4156	3.2921	3.3427	3.2791	3.3900	3.7104	3.4728	3.2444	3.2384	3.1707	3.4137	**3.7104**
Ford Louisville Assembly Plant	3.7178	3.5000	3.5585	3.6141	3.7127	3.6718	3.7150	3.6401	3.7141	3.6414	3.6713	3.8142	**3.8142**
GM Arlington Assembly Plant	3.6045	3.3702	3.4457	3.4457	3.4548	3.5076	0.0000	3.7690	3.8607	3.4635	3.5646	3.5053	**3.8607**
GM Wentzville Assembly Center	3.9618	3.9762	3.9693	3.8983	3.6210	3.6143	0.0000	3.6055	3.6597	3.7885	3.8024	3.7534	**3.9762**
Ford Atlanta Assembly Plant	3.9103	3.9302	3.8641	4.0049	3.8792	3.8594	3.8734	3.5072	3.8329	3.8507	3.8491	3.8530	**4.0049**
GM Ft. Wayne Assembly	3.9545	3.8373	3.8463	4.0774	3.9688	1.0439	0.0000	3.8357	2.5868	3.7515	3.6172	3.5522	**4.0774**

Table 4. Monthly Organic HAP Emission Rates for Primer-surfacer and Topcoat Operations Combined, Adjusted for Powder Primer-Surfacer Solids Usage, Sorted by Peak Monthly Rate

	Organic HAP Emission Rate (lbs organic HAP/gallon of applied coating solids)												
Facility Name	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**August**	**Sept**	**Oct**	**Nov**	**Dec**	**Peak**
Nissan Motor Manfacturing Corp., USA - Line HF	3.1161	3.4665	3.3564	4.2655	3.3401	3.2058	3.2262	3.2558	3.1522	3.3455	3.1987	3.2432	**4.2655**
Ford Kansas City Passenger Assembly Plant	4.2540	4.1268	4.0772	4.1008	4.0974	4.0345	4.3846	4.2871	4.1701	4.0918	4.0904	4.1393	**4.3846**
GM Fairfax Assembly Plant	4.8748	4.9385	4.9676	4.8168	4.6544	4.9943	4.7448	4.6035	4.3457	4.9644	4.5967	4.6884	**4.9943**
GM Lordstown Assembly Plant	4.3614	5.3138	4.2036	4.2195	4.2154	4.1646	0.0000	4.1375	4.0424	4.2647	4.1908	4.2996	**5.3138**
Ford Dearborn Assembly Plant	5.1546	5.3298	4.4065	4.4472	4.4324	4.9843	4.3704	4.4744	4.4863	4.3312	4.2665	4.3956	**5.3298**
Ford St. Louis Assembly Plant	4.9428	4.8656	4.7800	4.9000	4.8519	4.9253	5.3373	5.0625	5.0677	4.8836	5.0682	4.9250	**5.3373**
GM Orion Assembly	4.0402	4.0259	3.8746	3.8600	3.8438	3.9427	6.1185	3.4725	3.3272	3.2579	3.1265	3.0109	**6.1185**
GM Pontiac East Assembly Plant	6.5842	6.5716	6.2792	6.3894	6.3192	5.9984	6.5128	6.5109	6.6513	7.0297	6.1565	6.4297	**7.0297**
GM Doraville Assembly Plant	7.3852	6.9748	6.9172	7.0489	6.8501	6.8510	0.0000	7.0378	6.9656	7.1965	6.9118	7.1880	**7.3852**
Saturn Corporation	5.2443	5.0976	4.8557	4.6716	4.6585	4.2926	4.3188	13.9318	4.6147	4.9702	4.5731	4.7392	**13.9318**
Subaru-Isuzu Automotive Inc.	na	na	na	na	na	na	na	na	na	na	na	na	**na**
GM Bowling Green Assembly	na	na	na	na	na	na	na	na	na	na	na	na	**na**

Table 5. Calculation of MACT Floor Emission Rate for Electrodeposition Primer, Primer-Surfacer and Topcoat Operations.

	FACILITY	SURFACER	ANNUAL	PEAK MONTH	PEAK MONTH (rounded up)
	Belvedere	not full body			
1	Newark	powder	0.22	0.2990	0.30
	Warren	not full body			
2	St Louis South	powder	0.24	0.2749	0.28
	Jefferson North	not full body			
3	Sterling Heights	powder	0.30	0.3361	0.34
4	Auto Alliance		0.48	0.6612	0.67
	St Louis North	not full body			
5	Nissan IV		0.54	0.6660	0.67
6	Wixom		0.64	0.7796	0.78
7	BMW		0.65	0.7600	0.76
8	NUMMI truck		0.76	0.8671	0.87
		TOTAL	3.83	4.6439	4.67
		DIVIDE BY 8	0.48	0.58	0.59

Table 6. Calculation of MACT Floor Emission Rate for Primer-Surfacer and Topcoat Operations.

	FACILITY	SURFACER	ANNUAL	PEAK MONTH	PEAK MONTH (rounded up)
1	Newark	powder	0.33	0.4957	0.50
	Belvedere	not full body			
	Warren	not full body			
2	St Louis South	powder	0.51	0.5236	0.53
	Jefferson North	not full body			
3	Sterling Heights	powder	0.78	0.8130	0.82
4	Auto Alliance		0.84	1.0164	1.02
	St Louis North	not full body			
5	Wixom		0.97	1.3178	1.32
6	Moraine		1.13	1.6199	1.62
7	Shreveport	powder	1.22	1.3300	1.33
8	BMW		1.33	1.600	1.60
		TOTAL	7.11	8.7164	8.74
		DIVIDE BY 8	0.89	1.09	1.10