

APPENDIX E

Supporting Emission Calculations

TABLE 10
Summary Of Potential Criteria and Greenhouse Gas Emissions
 AVX Corporation, Myrtle Beach, SC

Emission Unit ID No.	Department	Uncontrolled Emissions															
		PM (tpy)	PM (lb/hr)	SO ₂ (tpy)	SO ₂ (lb/hr)	NOx (tpy)	NOx (lb/hr)	CO (tpy)	CO (lb/hr)	VOC (tpy)	VOC (lb/hr)	CO ₂ (tpy)	CO ₂ (lb/hr)	N ₂ O (tpy)	N ₂ O (lb/hr)	Methane (tpy)	Methane (lb/hr)
14	RMM	0.50	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Slip Mfg	-	-	-	-	-	-	-	-	24.46	5.58	-	-	-	-	-	-
16	Metals	1.17	0.27	-	-	-	-	-	-	6.16	1.41	-	-	-	-	-	-
17	CMAQ Buildup (perm & temp)	0.03	0.01	0.003	0.001	0.44	0.10	0.37	0.08	128.83	29.41	0.53	0.12	-	-	-	-
18	CMAQ Support	15.26	3.48	-	-	-	-	-	-	1.19	0.27	-	-	-	-	-	-
19	Metallization	-	-	-	-	-	-	-	-	5.17	1.18	-	-	-	-	-	-
19	Metallization - Electroplating	2.43E-03	5.55E-04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Thin Film	0.75	3.26	-	-	-	-	-	-	2.07	0.47	-	-	-	-	-	-
21	Misc Support - APTC (Insig)	-	-	-	-	-	-	-	-	0.98	0.22	-	-	-	-	-	-
21	Misc Support - Boiler	0.54	0.12	0.04	0.01	7.04	1.61	5.92	1.35	0.39	0.09	8.45	2.40	0.15	0.04	0.16	0.05
21	Misc Support - Emergency Gens.	0.43	1.70	0.40	1.59	6.05	24.19	1.30	5.21	0.48	1.92	224.89	81.88	-	-	-	-
21	Misc Support - Soldering	0.01	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Misc Support - Stripping Tower (Insig)	-	-	-	-	-	-	-	-	2.19	0.50	-	-	-	-	-	-
TOTALS		18.68	8.96	0.44	1.60	13.53	25.90	7.59	6.65	171.91	41.06	233.87	84.41	0.15	0.04	0.16	0.05

Emission Unit ID No.	Department	Controlled Emissions															
		PM (tpy)	PM (lb/hr)	SO ₂ (tpy)	SO ₂ (lb/hr)	NOx (tpy)	NOx (lb/hr)	CO (tpy)	CO (lb/hr)	VOC (tpy)	VOC (lb/hr)	CO ₂ (tpy)	CO ₂ (lb/hr)	N ₂ O (tpy)	N ₂ O (lb/hr)	Methane (tpy)	Methane (lb/hr)
14	RMM	1.49E-04	3.39E-05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Slip Mfg	-	-	-	-	-	-	-	-	24.46	5.58	-	-	-	-	-	-
16	Metals	1.17	0.27	-	-	-	-	-	-	6.16	1.41	-	-	-	-	-	-
17	CMAQ Buildup (perm & temp)	0.03	0.01	0.003	0.001	0.44	0.10	0.37	0.09	17.85	4.08	0.53	0.12	-	-	-	-
18	CMAQ Support	0.23	0.05	-	-	-	-	-	-	1.19	0.27	-	-	-	-	-	-
19	Metallization	-	-	-	-	-	-	-	-	5.17	1.18	-	-	-	-	-	-
19	Metallization - Electroplating	2.43E-03	5.55E-04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Thin Film	0.01	0.03	-	-	-	-	-	-	1.05	0.24	-	-	-	-	-	-
21	Misc Support - APTC (Insig)	-	-	-	-	-	-	-	-	0.98	0.22	-	-	-	-	-	-
21	Misc Support - Boiler	0.54	0.12	0.04	0.01	7.04	1.61	5.92	1.35	0.39	0.09	8.45	2.40	0.15	0.04	0.16	0.05
21	Misc Support - Emergency Gens. (Insig)	0.43	1.70	0.40	1.59	6.05	24.19	1.30	5.21	0.48	1.92	224.89	81.88	-	-	-	-
21	Misc Support - Soldering	0.01	1.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Misc Support - Stripping Tower	-	-	-	-	-	-	-	-	2.19	0.50	-	-	-	-	-	-
TOTALS		2.42	3.88	0.44	1.60	13.53	25.90	7.59	6.65	59.91	15.49	233.87	84.41	0.15	0.04	0.16	0.05

TABLE 11
 Potential HAP/TAP Emission Summary - Non-Exempt Sources Manufacturing Emissions
 AVX Corporation, Myrtle Beach, SC

HAP/TAP	Emission Unit							Individual Totals	Aggregate Total
	15 Slip Mfg	16 Metals	17 CMAP Buildup	19 Metallization	20 Thin Film	21 Strip. Twy/Solder	21 Boiler		
	Emissions (ton/yr)								
2-Ethanolamine	-	-	-	-	2.27E-01	-	-	2.27E-01	
Bis (2-ethylehexyl) Phthalate	1.30E-01	4.88E-03	0.03	-	-	-	-	1.65E-01	
Benzene	-	-	-	-	-	-	1.48E-04	1.48E-04	
Ethyl Benzene	-	2.88E-04	0.03	-	-	-	-	3.04E-02	
Ethylidene Dichloride	-	-	-	-	-	0.48	-	4.82E-01	
Formaldehyde	-	-	-	-	-	-	5.28E-03	5.28E-03	
Hexane	-	-	-	-	-	-	1.27E-01	1.27E-01	
Hydrochloric Acid	-	-	-	-	4.02E-03	-	-	4.02E-03	
Hydrofluoric Acid	-	-	-	-	7.67E-04	-	-	7.67E-04	
Lead	-	-	-	5.42E-05	2.92E-04	9.32E-05	-	4.39E-04	
Methyl Alcohol	7.70E-03	1.42E-03	0.24	0.07	-	-	-	3.21E-01	
Methyl Isobutyl Ketone	4.06E-03	7.49E-04	0.12	0.04	-	-	-	1.59E-01	
Naphthalene	-	-	-	-	-	-	4.30E-05	4.30E-05	
Nickel	-	-	-	1.95E-03	-	-	-	1.95E-03	
Nitric Acid	-	-	-	-	1.70E-02	-	-	1.70E-02	
Phosphoric Acid	-	-	-	-	6.98E-03	-	-	6.98E-03	
Polycyclic Organic Matter	-	-	-	-	-	-	6.21E-06	6.21E-06	
Sulfuric Acid	-	-	-	-	3.16E-03	-	-	3.16E-03	
Toluene	-	5.76E-04	0.03	-	-	-	2.39E-04	3.09E-02	
Trichloroethylene (TCE)	-	-	-	-	-	1.32	-	1.32E+00	
Vinyl Chloride (Chloroethylene)	-	-	-	-	-	0.39	-	3.95E-01	
Xylene	-	0.05	0.03	-	-	-	-	7.68E-02	

3.37

Note: The highest emitted single HAP is xylene.

TABLE 12
Emission Unit 14
Raw Materials Manufacturing Emissions
AVX Corporation, Myrtle Beach, SC

UNIT 14 - Particulate Matter Emissions from RMM Processing
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Process	Amount Processed 2006 (tpy)	Potential Usage (tpy)	Emission Factor (lb/ton) ¹	Uncontrolled Emissions		Controlled Emissions ²		Std. 4 Process Weight Rule (lb/hr)
				(lb/yr)	(tpy)	(lb/hr)	(tpy)	
Grinders, Mills, and Prillers	277	318	0.72	199.3	0.10	6.83E-06	2.99E-05	8.86
Mixers	1,100	1,265	0.72	792.0	0.40	2.71E-05	1.19E-04	15.90

Notes:

¹ Use AP-42 Emission Factor from cement bin loading Section 11.12

² Three baghouses control emissions from RMM, the lowest efficiency is 99.97%.

³ All PM emissions from the Vat loading are accounted for in the Grinders, Mills and Mixers.

TABLE 13

Unit 15

Slip Manufacturing Emissions
AVX Corporation, Myrtle Beach, SC

UNIT 15 - VOC Emission from Slip Manufacturing (Slip Manufacturing Mills and Slip Manufacturing Mixers)

Solvents Used in Slip Dept.	Use Type	Actual Slip Department Use (2006) ¹ (gal)	Potential Slip Department Use (gal) ²	% of Usage Emitted ³	lb/gal (VOC)	Total VOC Emissions (lb/yr)	Total VOC Emissions (tpy)
PGME	Process	55	63,25	10%	7.7	49	0.02
Butyl Cellusolve	Process	770	886	10%	7.5	664	0.33
BC/PM	Process	43,010	49,462	10%	7.57	37,442	18.72
DiOctylPhthalate	Process	275	316	10%	8.22	260	0.13
Iso Spirits ⁴	Cleaning	55	63.25	20%	6.23	78,8095	0.04
Bio-Act113	Cleaning	1210	1,392	100%	7.18	9,991	5.00
Denatured Alcohol	Cleaning	275	316	20%	6.76	428	0.21
Totals						48,912	24.46

Notes:

1. Based on actual 2006 usage data from AVX.
2. Potential emissions based on 2006 usage + 15%
3. 10% or 20% losses are primarily fugitive and are conservative estimates established from communications between AVX and DHEC. The balance remains in the electrode ink, termination paste, or waste.
4. Iso Spirits was not used in Slip in 2006. 55 gallons used in each of 2004 and 2005 and is included to capture the potential material use.

UNIT 15 - HAP/TAP Emissions From Slip Department

Constituent	HAP / TAP	Maximum % wt in Solvents Used (Worst Case)	lbs of HAP (Worst Case)	tpy of HAP (Worst Case)
Bis (2-ethylehexyl) Phthalate ¹	HAP/TAP	100	260.0	1.30E-01
Methyl Alcohol ²	HAP/TAP	3.6	15.4	7.70E-03
Methyl Isobutyl Ketone ²	HAP/TAP	1.9	8.12	4.06E-03

Notes:

1. Contained in DiOctylPhthalate
2. Contained in Denatured Alcohol

TABLE 14
Unit 16
Metals Manufacturing Emissions - VOC/HAP
 AVX Corporation, Myrtle Beach, SC

UNIT 16 - VOC Emissions from Metals Department (Metal Mills and Metal Mixers)

Solvents Used in Metals	Use Type	Actual Metal Department Use (2006) ¹ (gal)	Potential Metal Department Use (gal) ²	% of Usage Emitted ³	lb/gal (VOC)	Total VOC Emissions (lb/yr)	Total VOC Emissions (tpy)
Terpineol	Process	8,690	9,994	10%	7.79	7,785	3.89
Dipentene	Process	55	63	100%	7.21	456	0.23
Iso Spirits	Cleaning	2,365	2,720	20%	6.23	3,389	1.69
Denatured Alcohol	Cleaning	55	63	20%	6.23	79	0.04
Xylene	Process	110	127	10%	7.26	92	0.05
Butyl Cellusolve	Process	0	15	10%	7.5	11	0.006
Southpart K Solvent	Process	0	15	100%	6.5	98	0.05
Diethylene Glycol Dibutyl Ether	Process	0	15	100%	7.38	111	0.06
DiOctylPhthalate	Process	0	15	10%	6.5	10	0.005
Mineral Spirits Type 66	Process	385	443	10%	6.51	288	0.14
Total		11,660.00	13,469		69.11	12,318	6.16

Notes:

1. Based on actual peak usage in 2006 data from AVX.
2. Potential emissions based on 2006 usage + 15%. Butyl cellusolve, Southpart K, DGDE, and DOP were not used in 2006. Since they were used in the past, 15 gal future usage was assumed.
3. 10% or 20% losses are primarily fugitive and are conservative estimates established from communications between AVX and DHEC. The balance remains in the electrode ink, termination paste, or waste.

UNIT 16 - HAP/TAP Emissions From Metals Department

Constituent	HAP/TAP	Maximum % wt in Solvents Used (Worst Case)	lbs of HAP (Worst Case)	tpy of HAP (Worst Case)
Xylene, Mixed Isomers ¹	HAP/TAP	100	91.8	0.05
Xylene, Mixed Isomers ²	HAP/TAP	0.5	1.44	7.21E-04
Total Xylene			93.28	0.05
Toluene ²	HAP/TAP	0.4	1.15	5.76E-04
Ethyl Benzene ²	HAP/TAP	0.2	0.58	2.88E-04
Bis (2-ethylehexyl) Phthalate ³	HAP/TAP	100	9.75	0.005
Methyl Alcohol ⁴	HAP/TAP	3.6	2.84	0.001
Methyl Isobutyl Ketone ⁴	HAP/TAP	1.9	1.50	0.001
Total				0.05

Notes:

1. Used as process solvent and contained in Mineral Spirits Type 66
2. Contained in Mineral Spirits Type 66
3. Contained in DiOctylPhthalate
4. Contained in Denatured Alcohol

June 25, 2009 Metals Source Test Results

Ink Milling

Consolidated Process Ink Formulation	% by wt.
Ni Powder	43.21
Barium Titanate Powder	9.79
Ethyl Cellulose Binder	2.30
Terpineol	44.47
DOP	0.23

Total Ink processed (g)	49240.5
Total Solvent processed in ink (g)	21894.9
Total Solvent processed in ink (lb)	48.3
Source test time (minutes)	90 (Three 30 minute runs)
Solvent processed during test (lb/hr)	32.2
Ave. Measured Emission Rate (lb/hr as carbon)	0.036
Milled ink emission factor (lb VOC/lb solvent)	0.0011

Note: Percentage loss factors are more conservative than source test results.

Percentage loss factors are used in the facility emission estimates.

TABLE 15
Unit 16
Metals Manufacturing Emissions - PM
 AVX Corporation, Myrtle Beach, SC

UNIT 16 - PM Emissions from Metals Department (Metal Mills and Metal Mixers)
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Process	Material Processed (tpy)	Loss Rate ¹ (lb/ton)	Uncontrolled Emissions ² (lb/hr)	Emissions (tpy)	Process Weight Rule (lb/hr)
Mills/Mixers	3,257.00	0.72	0.27	1.17	1.53

Notes:

1. Loss rate for mixers is based on AP-42 5th edition 11.12-1 for loading of cement into bins of 0.72 lb/ton. PM emissions only occur during loading. Solvent is added during mixing so no PM is produced.
2. There is no PM control in Metals

TABLE 16
UNIT 17
CMAP Emissions
AVX, Myrtle Beach, SC

UNIT 17 - VOC Emissions from CMAP Manufacturing

Mass balance and control information:

- 0.85 Fraction slip actually applied to chip (the remaining 15% is collected for reclaim)
- 0.3032 Fraction of VOC in slip (from the MSDS sheets)
- 0.01 Fraction of VOC emitted as room fugitives (engineering estimate)
- 0.005 Fraction of VOC emitted as fugitive post chip manufacturing (engineering estimate)
- 0.985 Adsorber/Desorber/Thermal oxidizer System destruction efficiency (February 26, 2009 Source Test)¹
- 70 Slip usage rate (kg slip/machine/day)
- 24 Number of CMAP machines²
- 0.67 Potential operating hours factor (32 hrs/48 hrs)³

Total VOC prior to thermal oxidizer in the CMAP process:	116.15 TPY
Manufacturing fugitive VOC emissions:	1.16 TPY
Post manufacturing fugitive VOC emissions ⁴ :	0.58 TPY
Total VOC evolved during the CMAP process (after Thermal Oxidizer, less fugitives):	1.72 TPY
Total Process VOC Emissions from CMAP process	3.46 TPY

Note:

1. The February 2006 source test resulted in an overall 99.5% control efficiency. AVX will use 98.5% in emission rate calculations for conservatism.
2. 24 machines includes two medical machines that will remain in the original MB1 location through the majority of 2010 for qualification product purposes (See Table 16).
3. AVX/DHEC communications. CMAP equipment cannot operate 24/7.
4. An estimate of residual VOC emissions after chip manufacturing emitted in green chip step prior to the kiln room.

UNIT 17 - HAP/TAP Emissions from CMAP Manufacturing

HAP/TAP	Max % HAP by wt. in Slip/Ink	CMAP Fugitive Uncontrolled Emissions (TPY)	CMAP Controlled Point Source Emissions (TPY)	CMAP Total Emissions
Toluene	0.5	0.01	0.01	0.02
Ethyl Benzene	0.5	0.01	0.01	0.02
Bis (2-ethylehexyl) Phthalate	0.5	0.01	0.01	0.02
Xylene	0.5	0.01	0.01	0.02
Methyl Alcohol	3.60	0.10	0.06	0.17
Methyl Isobutyl Ketone	1.90	0.05	0.02	0.08
Total		0.22	0.12	0.33

UNIT 17 - Fugitive VOC Emissions from CMAP Manufacturing Cleaning

Cleaning Materials Used	Actual 2006 Department Use (gal)	Potential Department Use (gal) ²	% of Usage Emitted	lb/gal (VOC)	Total VOC Emissions (lb/yr)	Total VOC Emissions (tpy)
Iso Spirits	11,220	12,903	20%	6.23	16,077	8.0
n-Butyl Acetate ¹	165	190	20%	7.34	279	0.1
BC/PM	2,695	3,099	20%	7.57	4,692	2.3
Denatured Ethyl Alcohol	770	886	20%	6.59	1,167	0.6
Total	14,850.00	17,078		27.73	22,215	11.1

Notes:

1. N-butyl acetate recently replaced xylene as a CMAP cleaning solvent. Since xylene was not used in 2006, an average of previous year usages was assumed.

UNIT 17 - HAP/TAP Emissions from CMAP Manufacturing Cleaning

Constituent	HAP / TAP	Maximum % wt in Solvents Used (Worst Case)	lbs of HAP (Worst Case)	tpy of HAP (Worst Case)
Methyl Alcohol ¹	HAP/TAP	3.6	42.02	0.02
Methyl Isobutyl Ketone ¹	HAP/TAP	1.9	22.17	0.01
Total				0.03

Notes:

1. Contained in Denatured Alcohol

TABLE 17
UNIT 17
Temporary CMAP Emissions
AVX, Myrtle Beach, SC

UNIT 17 - VOC Emissions from Temporary CMAP Manufacturing

Mass balance and control information:

- 0.85 Fraction slip actually applied to chip (the remaining 15% is collected for reclaim)
- 0.3032 Fraction of VOC in slip (from the MSDS sheets)
- 70 Slip usage rate (kg slip/machine/day)
- 2 Number of CMAP machines¹
- 0.10 Potential operating hours factor (864 hr/yr limit)

Total VOC emitted from temporary medical CMAP process:

1.43 TPY

Note:

1. Two CMAP machines will remain at the original MBI location through the majority of 2010 for qualification purposes. Sufficient product inventory was produced prior to the submittal of this application. These machines should remain idle during this qualification. The machines will be needed in their present location in event the inventory is depleted prior to qualification approval to relocate them.

UNIT 17 - Fugitive VOC Emissions from CMAP Manufacturing Cleaning

Cleaning Materials Used	Potential Department Use (gal) ¹	% of Usage Emitted	lb/gal (VOC)	Total VOC Emissions (lb/yr)	Total VOC Emissions (tpy)
Iso Spirits	129	20%	6.23	161	0.1
n-Butyl Acetate	2	20%	7.34	3	0.001
BC/PM	31	20%	7.57	47	0.02
Denatured Ethyl Alcohol	9	20%	6.59	12	0.01
Total	171		27.73	222	0.11

Notes:

- 1. Assumed 1% of main CMAP manufacturing potential material usage.

UNIT 17 - HAP/TAP Emissions from CMAP Manufacturing

HAP/TAP	Max % HAP by wt. in Slip/Ink	CMAP Fugitive Uncontrolled Emissions (TPY)
Toluene	0.5	7.16E-03
Ethyl Benzene	0.5	7.16E-03
Bis (2-ethylehexyl) Phthalate	0.5	7.16E-03
Xylene	0.5	7.16E-03
Methyl Alcohol	3.60	5.16E-02
Methyl Isobutyl Ketone	1.90	2.72E-02
Total		0.11

UNIT 17 - HAP/TAP Emissions from CMAP Manufacturing Cleaning

Constituent	HAP/TAP	Maximum % wt in Solvents Used (Worst Case)	lbs of HAP (Worst Case)	tpy of HAP (Worst Case)
Methyl Alcohol ¹	HAP/TAP	3.6	0.42	2.10E-04
Methyl Isobutyl Ketone ¹	HAP/TAP	1.9	0.22	1.11E-04
Total				3.21E-04

Notes:

- 1. Contained in Denatured Alcohol

TABLE 18
UNIT 17
CMAP Emissions
AVX, Myrtle Beach, SC

UNIT 17 - Emission from Ancillary VOC Control Startup Burner
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Fuel Combustion: FluiSorb Startup Burner
Unit Designation: NMF-FB1

Burner Information:

Average Firing Rate:	1	MMBtu/hr	
Maximum Firing Rate:	1	MMBtu/hr	
Fuel Heat Content:	1,020	Btu/scf	
Maximum Fuel Usage:	1,020	scf/hour	
Maximum Fuel Usage:	8.8	MMscf/yr	
Maximum Operating Schedule:	Assumed continuous		
	Not supplemented by process VOC		

Pollutant	Emission Factors ¹ (lb/MMscf)	Potential Emissions (Unc.)	
		(lb/hr)	(tpy)
PM	7.6	0.01	0.03
SO ₂	0.6	0.00	0.003
NO _x	100	0.10	0.44
CO	84	0.09	0.37
VOC	5.5	0.01	0.02
CO ₂	120	0.12	0.53
N ₂ O	2.2	0.002	0.01
Methane	2.3	0.002	0.01

Note:

1. AP-42, Section 1.4, Tables 1.4-1 and 1.4-2

TABLE 19
UNIT 18
CMAP Support Emissions
 AVX, Myrtle Beach, SC

UNIT 18 - Particulate Matter Emission from Dry Dicing

Assumed mass balance and control information:

Dust Recovered:	575.0	kg/month/dicer	Estimated baghouse material recovery + 15%
Control efficiency:	99.5%		April 1, 1998 Title V permit application
PM generated:	577.9	kg PM/month/dicer	
PM Uncontrolled	15.26	TPY	
Controlled PM Emissions:	2.89	kg PM/month/dicer	
Number of Dry Dicers:	6		
Processing Rate:	106	lbs/day/machine (48 kg/day/machine)	
Total Processing Rate:	0.0133	tons per hour	

Summary of Potential Process Emissions

Emission Source	PM Emissions (lb/hr)	PM Emissions (tpy)
Dicing Baghouse	0.05	0.23

Process Weight Rule Computation

Parameter	Value	Units
Material per Hour (P)	0.002	tons/hour
Process Weight Rate, $4.10(P)^{0.67}$	0.07	lb PM/hr
Potential PM Emissions ^a	0.05	lb PM/hr

TABLE 20
UNIT 18
CMAP Support Emissions Continued
AVX, Myrtle Beach, SC

UNIT 18 - VOC Emissions from Kiln Room
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Burnout oven emissions based on source testing

Source Test Date:	June 25, 2009
Burnout Oven:	GB201
No. of pans in charge:	19
No. of chips in pans:	1,010,960
Chips/pan:	53,208
Oven pan capacity:	30
Max. No. of chips.:	1,596,253
Actual to Potential Linear Factor:	1.58

Test Results Summary

	Test 1	Test 2
	lb/hr (as carbon)	lb/hr (as carbon)
Run 1	0.0009	0.016
Run 2	0.0009	0.013
Run 3	0.0011	0.013
Test Average	0.0010	0.0140
Linear Adj. (Potential)	0.0015	0.0221

Burnout Batch Cycle Emissions

Temperature Curve Points	Oven Cycle Temp. (°F)	Emission Rate (lb/hr)
Point 1 (start)	230	0
Point 2 (Test 1)	409 ¹	0.0015
Point 3 (Test 2)	496 ¹	0.0221
Point 4 (end)	100	0
Cycle Average		0.006

Note:

1. Averages of oven temperatures during Test 1 and Test 2 testing times.

Worse Case Cycle Emissions

Cycle Average lb/hr per oven	0.006
Total No. of Burnout Ovens	46
Potential Department (lb/hr)	0.27
Potential Department (lb/yr)	2,381
Potential Department (ton/yr)	1.19

Table 21
UNIT 19
Termination Department Emissions
AVX, Myrtle Beach, SC

Unit 19 - VOC Emissions from Termination Paste

Data	2006 Usage¹ (lb/yr)	Potential Usage² (lb/yr)
Termination Department Paste Delivered (lb/yr)	34,149	39,271
VOC Content Silver Paste (percent)	22%	22%
Termination Reclaim & Waste (lb/year) ³	18,444	18,444
VOC (Terpineol) Emissions (tpy)	1.73	2.29

Notes:

1. 2006 Production data provided by AVX
2. 2006 data plus 15%
3. The potential reclaim amount was not increased by 15% as a conservative approach.

Unit 19 - VOC Emissions From Termination Department Cleaning

Cleaning Solvents Used in Termination	2006 Department Use¹ (gal)	Potential Department Use² (gal)	% of Usage Emitted³	lb/gal (VOC)	Total VOC Emissions (lb/yr)	Total VOC Emissions (tpy)
Propyl Propionate	3,685	4,238	20%	7.35	6,229	3.1
Denatured Alcohol	2,640	3,036	20%	6.76	4,105	2.1
Total					10,334	5.2

Notes:

1. Production data provided by AVX
2. 2006 data plus 15%
3. 20% loss factor is fugitive emissions based on conservative estimates from knowledge of material use. The balance is waste.
4. Propyl propionate recently replaced xylene as a Termination cleaning solvent. The amount of xylene used in 2006 was assumed equal to propyl propionate usage.

Unit 19 - HAP/TAP Emissions From Termination Department Cleaning

Constituent	HAP/TAP	Maximum % wt in Solvents Used (Worst Case)	lbs of HAP (Worst Case)	tpy of HAP (Worst Case)
Methyl Alcohol ¹	HAP/TAP	3.6	147.8	0.07
Methyl Isobutyl Ketone ¹	HAP/TAP	1.9	77.99	0.04

Notes:

1. Contained in Denatured Alcohol

TABLE 22
UNIT 19
Termination Emissions - Electroplating
AVX, Myrtle Beach, SC

Unit 19 - Miscellaneous Emissions From Electroplating Operations

	AUTOLINE				SBE			
	Target Metal Concentration ² (oz/gal)	Cr Emission Factor (Con.) (gr/dscf)	Original Control Eff.	Other Metal Factor (Unc.) ³ (gr/dscf)	Target Metal Concentration ² (oz/gal)	Cr Emission Factor (Con.) (gr/dscf)	Original Control Eff.	Other Metal Factor (Unc.) ³ (gr/dscf)
Nickel Electroplating ¹	11.2	2.62E-06	98.0%	4.11E-05	12.7	2.62E-06	98.0%	4.66E-05
Lead Electroplating ¹	0.60	2.62E-06	98.0%	2.20E-06	0.16	2.62E-06	98.0%	5.87E-07
Gold Electroplating ¹	-	-	-	-	1.00	2.62E-06	98.0%	3.67E-06
Tin Electroplating ¹	1.7	2.62E-06	98.0%	6.24E-06	2.4	2.62E-06	98.0%	8.80E-06

- Notes:
- Emission factors for all metals are calculated using AP-42, Section 12.20 (7/96).
AVX removed their scrubber in 2002, therefore the emission rates are back calculated using the original control efficiency.
 - Target bath concentrations provided by AVX.
 - Other metal emission factor = 0.028*Metal concentration (oz/gal)*Cr Emission Factor

Flow Rate Information:¹

	95 liter SBE	95 & 130 liter SBEs	1 Autoline
Stack Diameter (ft)	0.5	0.5	36
Velocity (fps)	5.44	18.43	39.4
Temperature (F)	68	68	68
Flow Rate (acfm)	64.0	217.0	575.00
Flow Rate (scfm)	63.7	212.6	563.30

SBE Line Information:

Lines	Size (liter)	Metals
SBE-1 and 5	95	Ni/Sn/Pb
SBE-4	95	Ni/Sn
SBE-2 and 3	130	Ni/Sn

- Note:
- Until all qualification processes are completed, the last Autoline will remain in operation through 2010 before it also will be decommissioned.
The Autoline and SBE flow rates based on February 2, 2010 measurement by AVX.

Electroplating Emissions

Pollutant	Emission Factor ¹ (mg/dscm)	Autoline ²	
		(lb/hr)	(tpy)
PM	1.13E-01	2.39E-04	1.05E-03
Nickel	9.41E-02	1.99E-04	8.70E-04
Lead	5.05E-03	1.07E-05	4.67E-05
Tin	1.43E-02	3.01E-05	1.32E-04

Pollutant	Emission Factor ¹ (mg/dscm)	Total Process Emissions		95 l SBE ²		130 l SBE ²	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
PM	1.37E-01	3.15E-04	1.38E-03	9.78E-05	4.28E-04	2.18E-04	9.53E-04
Nickel	1.07E-01	2.46E-04	1.08E-03	7.64E-05	3.34E-04	1.70E-04	7.44E-04
Lead	1.34E-03	1.71E-06	7.50E-06	6.41E-07	2.81E-06	1.07E-06	4.69E-06
Gold	8.40E-03	2.00E-06	8.78E-06	2.00E-06	8.78E-06	-	-
Tin	2.02E-02	4.65E-05	2.04E-04	1.44E-05	6.32E-05	3.21E-05	1.41E-04

Pollutant	Total Emissions	
	(lb/hr)	(tpy)
PM	5.55E-04	2.43E-03
Nickel	4.45E-04	1.95E-03
Lead	1.24E-05	5.42E-05
Gold	3.21E-05	1.41E-04
Tin	4.65E-05	2.04E-04

- Notes:
- Emission factor conversion from grains/dscf to mg/dscm from AP-42, Section 12.20.
 - Emission calculated from emission factor times air flow rate multiplied by the number of respective line sizes.

TABLE 23
UNIT 20
Thin Film Emissions
AVX, Myrtle Beach, SC

Unit 20 - VOC Emissions from Thin Film Process

Chemical	Uncontrolled Emissions ¹		Controlled Emissions ²	
	lb/hr	tpy	lb/hr	tpy
Acetic Acid	4.17E-02	1.83E-01	2.08E-02	9.13E-02
Tetramethylammonium hydroxide	5.21E-03	2.28E-02	2.60E-03	1.14E-02
2-ethanolamine	1.04E-01	4.54E-01	5.19E-02	2.27E-01
N-methylpyrrolidone	2.03E-01	8.91E-01	1.02E-01	4.45E-01
1,2-Propenediol	6.71E-02	2.94E-01	3.35E-02	1.47E-01
2,4 Pentandione	1.00E-03	4.38E-03	5.00E-04	2.19E-03
Hexamethyldislazane	1.67E-03	7.30E-03	8.33E-04	3.65E-03
Isopropyl alcohol	2.00E-02	8.76E-02	1.00E-02	4.38E-02
Mesitylene	2.83E-03	1.24E-02	2.83E-03	1.24E-02
Dipropylene glycol dimethyl ether	2.17E-03	9.49E-03	1.08E-03	4.75E-03
Naphtha	4.42E-03	1.93E-02	4.42E-03	1.93E-02
1-Methoxy-2-propanol acetate	1.60E-02	7.01E-02	8.00E-03	3.50E-02
1-Methoxy-2-propanol	2.38E-03	1.04E-02	1.19E-03	5.29E-03
Total VOCs	0.47	2.07	0.24	1.05

Notes:

1. Uncontrolled emissions are assumed to be a 10% loss from the daily material usage.
2. Controlled emission for VOC are based on a control efficiency of 50% based on conservative industry standards for soluble compounds. No control is assumed for mesitylene and naphtha since they are insoluble.

Unit 20 - HAP/TAP Emissions from Thin Film Process

Chemical	Uncontrolled Emissions ¹		Controlled Emissions ²		
	lb/hr	tpy	lb/hr	tpy	lb/day
Sulfuric Acid	0.07	0.32	7.21E-04	3.16E-03	0.017
Nitric Acid	0.39	1.70	3.88E-03	1.70E-02	0.093
2-ethanolamine	0.10	0.45	5.19E-02	2.27E-01	1.245
Hydrochloric Acid	0.09	0.40	9.18E-04	4.02E-03	0.022
Phosphoric Acid	0.16	0.70	1.59E-03	6.98E-03	0.038
Total TAPs	0.81	3.57	0.06	0.26	1.42

Notes:

1. Uncontrolled emissions are assumed to be a 10% loss from the daily material usage.
2. Conservative control efficiency of 99% based on system design for acids. 50% for soluble VOC 2-ethanolamine.

Unit 20 - Fluorine and Lead Emissions from Thin Film Process

Chemical	Uncontrolled Emissions ¹		Controlled Emissions ²	
	lb/hr	tpy	lb/hr	tpy
Hydrofluoric Acid	0.02	0.08	1.75E-04	7.67E-04
Lead	0.01	0.03	6.67E-05	2.92E-04
Lead zirconate titanate	0.01	0.03	6.04E-05	2.65E-04

Notes:

1. Uncontrolled emissions are assumed to be a 10% loss from the daily material usage.
2. Conservative control efficiency of 99% based on system design for hydrofluoric acids. Industry standard, conservative 99% efficiency for particulate matter.

TABLE 24
UNIT 21
 Miscellaneous Support Emissions - APTC
 AVX, Myrtle Beach, SC

Unit 21 - APTC (Product Testing Process)

Material	HAP Constituents	HAP/TAP/VOC	2006 Cleaning Solvent Use ¹ (gal)	Potential Cleaning Solvent Use ² (gal)	VOC Content (lb/gal)	HAP Content (lb/gal)	Amount Reclaimed ³ (%)	VOC Emissions (tpy)	HAP Emissions (tpy)
Iso Sprints	-	VOC	1,028	1182	6.23	0	93	0.26	-
Isopropyl Alcohol	-	VOC	343	394	6.51	0	93	0.09	-
BC-PM	-	VOC	2082	2394	7.57	0	93	0.63	-
Denatured Alcohol	MeOH, MIBK	HAP/TAP/VOC	0	0	6.59	0.21	93	0.00	0.00E+00
TOTAL			3,453	3,971				0.98	0.00E+00

¹Per 2006 facility provided data.

²Potential is estimated using the 2006 data plus 15%

³Reclaim of cleaning solvent based on volume used and volume collected in waste bins.

TABLE 25
UNIT 21
Miscellaneous Support Boiler Emissions
AVX, Myrtle Beach, SC

Unit 21 - Emissions from Boilers (Miscellaneous Support)

Boiler Information

Fuel Combustion Unit:	Boiler B201
Fuel Fired:	Natural Gas
Process Designation:	MB2 Boiler
Stack Designation:	NMFS-B1
Maximum Rated Capacity:	16.4 MMBtu/hr
Average Fuel Heat Content:	1,020 Btu/scf
Maximum Annual Operation:	8760 hours/year
Hourly Fuel Usage:	0.02 10 ⁶ scf/hr
Potential Annual Fuel Usage:	175.2 10 ⁶ scf/hr

Unit 21 - Criteria Pollutant Emissions

Pollutant	Emission Factors ¹	Potential to Emit	
	(lb/10 ⁶ scf)	(lbs/hr)	(tpy)
PM, PM ₁₀ , PM _{2.5}	7.6	0.15	0.54
SOx	0.6	0.01	0.04
NOx	100	2.00	7.04
CO	84	1.68	5.92
VOC	5.5	0.11	0.39
Lead	0.0005	1.00E-05	3.52E-05

¹Source: EPA AP-42, Section 1.4, Tables 1.4-1 and 1.4-2.

Unit 21 - HAP/TAP Emissions

Pollutant	Emission Factors ¹	Potential to Emit	
	(lb/10 ⁶ scf)	(lbs/hr)	(tpy)
Benzene	2.10E-03	4.20E-05	1.48E-04
Formaldehyde	7.50E-02	1.50E-03	5.28E-03
Hexane	1.8	3.60E-02	1.27E-01
Naphthalene	6.10E-04	1.22E-05	4.30E-05
Polycyclic Organic Matter	8.82E-05	1.76E-06	6.21E-06
Toluene	3.40E-03	6.80E-05	2.39E-04

¹Source: EPA AP-42, Section 1.4, Table 1.4-3.

Unit 21 - GHG Emissions

Pollutant	Emission Factors ¹	Potential to Emit	
	(lb/10 ⁶ scf)	(lbs/hr)	(tpy)
CO ₂	120	2.40	8.45
N ₂ O	2.2	0.04	0.15
Methane	2.3	0.05	0.16

TABLE 26
UNIT 21
Miscellaneous Support Emissions - New Stripper Tower
 AVX, Myrtle Beach, SC

Unit 21 - New Stripping Tower Emissions (Miscellaneous Support)

Contaminant	CAS No.	HAP/TAP	QED Model (6-tray)			
			(lb/hr)	(lb/day)	(lb/yr)	(ton/yr)
Trichloroethylene (TCE)	79-01-6	H,T	0.300	7.21	2631.6	1.32
Vinyl chloride (chloroethylene)	75-01-4	H,T	0.090	2.16	789.5	0.39
Ethylidene dichloride	75-34-3	H,T	0.110	2.64	963.6	0.48
Total HAP/VOC			0.50	12.01	4384.73	2.19

Notes:

TABLE 27
UNIT 21
 Miscellaneous Support Emissions - Soldering
 AVX, Myrtle Beach, SC

Unit 21 - Soldering Emissions (Miscellaneous Support)

Assumptions:

Number of machines (1 wave solder, 3 solder pots with hoods)	4
Potential soldering usage	1,000 lbs/yr

HAPs	Manufacturers Product ID Number	Emission Factor (lb)	Potential Quantity Used (lb/yr) ¹	Potential Emissions	
				(lb/yr)	(ton/yr)
Lead (Pb) ³	SN/60 Electrolytic Grade Solder	0.000162	1150	0.19	9.32E-05
Cr (HAP)	SN/60 Electrolytic Grade Solder	0.000013	1150	0.01	7.48E-06
Mn (HAP)	SN/60 Electrolytic Grade Solder	0.000846	1150	0.97	4.86E-04

Criteria Pollutants	Manufacturers Product ID Number	Emission Factor (lb)	Potential Quantity Used (lb/yr) ¹	Potential Emissions	
				(lb/yr)	(ton/yr)
PM	SN/60 Electrolytic Grade Solder	0.018	1150	20.70	0.010
PM-10	SN/60 Electrolytic Grade Solder	0.018	1150	20.70	0.010

¹Potential is estimated using the 2006 data plus 15%. 2006 was the most recent, maximum year data was available.

²Per the MSDS, the emissions using the MSDS were more conservative for Pb there that number was used in the facility summary.

³Using AP-42 12.19 Emission Factors for SMAW Welding Process

TABLE 28
UNIT 21
Miscellaneous Support Emissions (Insignificant Emergency Generators)
 AVX, Myrtle Beach, SC

Unit 21 - Emissions from Emergency Generators E1, E4 -E7 (Miscellaneous Support)

Data	E1	E5	E6	E7
	Kiln Room ¹	MIS	RMM	Sol Gel
Fuel Fired:	Diesel	Diesel	Diesel	Diesel
Power Output (kW):	100	260	600	565
Max. Firing Rate (MMBtu/hr):	0.5	0.89	2.05	2.05
Ave. Fuel Heat Content (Btu/gal):	140,000	140,000	140,000	140,000
Fuel Sulfur Content (%):	0.05	0.05	0.05	0.05
Hourly Fuel Usage (gal/hr):	3.56	6.34	14.64	14.64
Annual Fuel Usage (gal/yr based on 500 hrs):	1780	3170	7320	7320

Note:

1. Formerly located at CMAP. Moved to Kiln Room.
2. E3 has been decommissioned and E4 has been moved off site.

Pollutant	Emission Factors ¹ (lb/MMBtu)
PM	0.31
SO ₂	0.29
NOx	4.41
CO	0.95
CO ₂	164
VOC	0.35
Benzene	9.33E-04
Toluene	4.09E-04
Xylene	2.85E-04
1,3 Butadiene	3.91E-04
Formaldehyde	1.18E-03
Acetaldehyde	7.67E-04
Acrolein	9.25E-05

Note:

1. Source: AP-42, Tables 3.3-1 and 3.3-2, October 1996.

Pollutant	Potential Emissions							
	E1		E5		E6		E7	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
PM	0.15	0.04	0.28	0.07	0.64	0.16	0.64	0.16
SO ₂	0.14	0.04	0.26	0.06	0.59	0.15	0.59	0.15
NOx	2.20	0.55	3.91	0.98	9.04	2.26	9.04	2.26
CO	0.47	0.12	0.84	0.21	1.95	0.49	1.95	0.49
CO ₂	81.74	20.43	0.03	36.39	0.06	84.03	0.06	84.03
VOC	0.17	0.04	0.31	0.08	0.72	0.18	0.72	0.18
Benzene	4.65E-04	1.16E-04	1.48E-07	2.07E-04	3.41E-07	4.78E-04	3.41E-07	4.78E-04
Toluene	2.04E-04	5.10E-05	6.48E-08	9.08E-05	1.50E-07	2.10E-04	1.50E-07	2.10E-04
Xylene	1.42E-04	3.55E-05	4.52E-08	6.32E-05	1.04E-07	1.46E-04	1.04E-07	1.46E-04
1,3 Butadiene	1.95E-04	4.87E-05	6.20E-08	8.68E-05	1.43E-07	2.00E-04	1.43E-07	2.00E-04
Formaldehyde	5.88E-04	1.47E-04	1.87E-07	2.62E-04	4.32E-07	6.05E-04	4.32E-07	6.05E-04
Acetaldehyde	3.82E-04	9.56E-05	1.22E-07	1.70E-04	2.81E-07	3.93E-04	2.81E-07	3.93E-04
Acrolein	4.61E-05	1.15E-05	1.47E-08	2.05E-05	3.39E-08	4.74E-05	3.39E-08	4.74E-05

Summary of Generator Potential Emissions

Pollutant	Potential Emissions	
	(lb/hr)	(tpy)
PM	1.70	0.43
SO ₂	1.59	0.40
NOx	24.19	6.05
CO	5.21	1.30
CO ₂	81.88	224.89
VOC	1.92	0.48
Benzene	4.66E-04	1.28E-03
Toluene	2.04E-04	5.61E-04
Xylene	1.42E-04	3.91E-04
1,3 Butadiene	1.95E-04	5.36E-04
Formaldehyde	5.89E-04	1.62E-03
Acetaldehyde	3.83E-04	1.05E-03
Acrolein	4.62E-05	1.27E-04